INTEGRATED NATURAL RESOURCES MANAGEMENT OF COASTAL FISHERIES

- The Case of Nha Phu Lagoon, Vietnam -

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Abstract

The selected study site, Nha Phu Lagoon is characterized by massive degradation of coastal fishery resources. As a result rural livelihoods in coastal communities are threatened. Since household decisions concerning resource use are influenced by several factors, a multi-sectoral approach is necessary. A multi-sectoral approach enables to comprehend the complexity and diversity of the resource system and its users.

Integrated natural resource management (INRM) is one multi-sectoral research approach that aims to develop innovative and flexible management forms to manage natural resources in a more sustainable way. The applied INRM-approach is characterized through strong interdisciplinarity and participation. Interdisciplinary means that socioeconomic and institutional aspects, e.g. resource-user groups and existing legal arrangements, are combined with biological as well as production system aspects, e.g. mangrove reforestation as well as aquaculture or gear-fishing techniques. For a period of six months participatory action research following an integrated natural resource management approach was carried out visiting 12 fishing villages around Nha Phu Lagoon. The inherent 'learning cycle' in participatory action research generates knowledge in a process of reflecting on the collected data that is continuously fed back to the participants. During questionnaires, semi-structured interviews, group discussions, observations, resource mappings, and Venn diagrams reasons for the destruction of fishery resources were gathered, e.g. trawling, population increase and pollution from shrimp ponds. This information was then shared with participants, which led to new insights as well as alternative resource management strategies.

The integration of biological and socioeconomic aspects identified the complexity of the coastal fishery resource system Nha Phu Lagoon and its users. This includes a multitude of different resources, actors, levels, institutions, decision-making structures, livelihood strategies, trends, and associated problems in the sustainable management of the natural resources. Illegal trawl-fishermen for example were said to be extremely poor and therefore needed to be treated with great tolerance despite their negative impacts on coastal fishery resources. But during follow-up visits it was discovered that illegal fishermen often belonged to middle-class households around Nha Phu Lagoon and that lax enforcement rather encouraged illegal fishing and punished those fishermen using traditional fishing methods. The participatory approach induced awareness-building and strengthened local decision-making structures. Exemplary for this process stakeholders of the fishery sector in Nha Phu Lagoon envisioned new management forms and ideas as well as guidelines and recommendations for the reorganization of institutions and organizations within the fishery sector. Meetings and gatherings in the course of applied integrated natural resources management prove to be effective forums for resource user groups to organize themselves and engage in decision-making. Considering socioeconomic, political and biological elements in a coastal fishery resource system through integrated natural resources management is a possibility to manage resources more effectively and with greater participation of the associated communities.

Zusammenfassung

Das Untersuchungsgebiet, die Nha Phu Lagune, weist eine massive Degradation der fischereilichen Ressourcen auf. Die „Rural Livelihoods“ in den Gemeinden dieser Küstenregionen sind durch diese Degradation gefährdet. Da, die Ressourcennutzungsentscheidungen einzelner Haushalte von vielen Faktoren abhängen, bedarf es eines multi-sektoralen Forschungsansatzes. Dieser ermöglicht, die Komplexität und die Diversität des Ressourcennutzungssystems und seine Nutzer, zu erfassen.
Das Integrated Natural Resource Management (INRM) ist ein multi-sektoraler Forschungsansatz, der innovative und flexible Managementformen zu entwickeln versucht, um natürliche Ressourcen nachhaltig zu nutzen. Interdisziplinarität und die Betonung von Partizipation sind zentrale Kennzeichen des angewandten INRM-Forschungsansatzes. Diese interdisziplinäre Vorgehensweise berücksichtigt sowohl sozio-ökonomische und institutionelle Einflussfaktoren, z.B. Ressourcennutzer-Gruppen und bestehende Regulierungen und Gesetze, als auch biologische und produktionstechnische Einflussfaktoren, z.B. Aquakultur und Fischfangtechniken. Während eines sechs monatigen Untersuchungszeitraums unter Anwendung Partizipativer Aktionsforschung und des INRM-Ansatzes wurden 12 Dörfer im Umkreis der Nha Phu Lagune besucht. Der innerhalb der Partizipativen Aktionsforschung angesiedelte Lernzyklus generiert Wissen durch die Reflektion von gesammelten Daten, die kontinuierlich an die Beteiligten zurückgeführt werden. Die Erhebung mittels Fragebögen, halbstrukturierter Interviews, Gruppendiskussionen, Observierung, „Resource Mapping“ und Venn Diagrammen identifizierte Ursachen für die Degradation fischereilicher Ressourcen, z.B. Schleppnetzfischerei, Bevölkerungswachstum und Verschmutzungen durch Schrimpteiche. Diese Informationen wurden dann an die Beteiligten weitergereicht, was zu neuen Erkenntnissen über alternativen Ressourcenmanagementstrategien führte.
Die Integration biologischer und sozio-ökonomischer Aspekte erfasste die Komplexität des Ressourcensystems Nha Phu Lagune und seiner Nutzer. Dies beinhaltet eine Vielzahl von verschiedenen Ressourcen, Akteuren, Ebenen, Institutionen, Entscheidungsstrukturen, Livelihood Strategien, Trends und assoziierte Probleme des nachhaltigen Managements natürlicher Ressourcen. Zum Beispiel wurden illegale Schleppnetzfischer – trotz ihres negativen Einflusses auf die fischereilichen Ressourcen – als sehr arm angesehen und deshalb mit größter Toleranz behandelt. Bei weiteren Versammlungen wurde jedoch aufgedeckt, dass illegale Schleppnetzfischer häufig aus weniger armen Haushalten stammten und dass die mangelnde Umsetzung bestehender Gesetze illegale Fangmethoden fördert und Fischer mit traditionellen Fangmethoden benachteiligt. Der partizipative Ansatz induzierte Bewusstseinsbildung und stärkte lokale Entscheidungsstrukturen. Beispielhaft hierfür sind Vorschläge der Interessensgruppen zu neuen Managementformen und Ideen sowie Richtlinien und Vorschläge zur Umstrukturierung von Institutionen und Organisationen des Fischereisektors zu nennen. Versammlungen und Treffen im Rahmen des angewandten Integrated Natural Resource Management erwiesen sich als effektive Foren für Ressourcennutzer-Gruppen zur Selbstorganisation und Teilnahme an Entscheidungen. Die Berücksichtigung sozioökonomischer, politischer und biologischer Elemente eines Küstenfischerei Ressourcensystems durch Integrated Natural Resource Management ist eine Möglichkeit, Ressourcen effektiver und mit größerer Beteiligung der zugehörigen Gemeinden zu bewirtschaften.

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Glossary

ASEAN	Association of Southeast Asian Nations
BEAF	Advisory Service on Agricultural Research for Development
BIDV	Bank of Investment and Development in Vietnam
BKC	Benzalkonium Chloride Ethanol
BMZ	Federal Ministry for Economic Cooperation and Development
CBNRM	Community-Based Natural Resource Management
CBO	Community-based organization
CBRM	Community-Based Resource Management
CGIAR	Consultative Group on International Agricultural Research
CIA	Central Intelligence Agency
CPRGS	Comprehensive Poverty Reduction and Growth Strategy
CPUE	Catch per unit of effort
DFID	Department for International Development
EEZ	Exclusive Economic Zone
EJF	Environmental Justice Foundation
FAO	Food and Agriculture Organization
FCR	Food Conversion Ratio
FICen	Fisheries Information Centre
GDP	Gross Domestic Product
GNI	Gross National Income
GRT	Gross Registered Tonnage
GT	Gross Tonnage
GTZ	German Technical Cooperation
HCMC	Ho Chi Minh City
HDI	Human Development Index
HEPR	Hunger Eradication and Poverty Reduction
Hp	Horsepower
IBRD	International Bank for Reconstruction and Development
ICES	International Council for the Exploration of the Sea
ID	Identification
IFEP	Institute of Fisheries Economics and Planning
IIRR	International Institute for Rural Reconstruction
ILO	International Labor Organization
IMA	International Marinelife Alliance
IMF	International Monetary Fund
INRM	Integrated Natural Resources Management
IRD	Integrated Rural Development
Kg	Kilogram

L_{opt}	Optimum length
ME	Memo
MEY	Maximum Economic Yield
MKC	Myristalkonium Chloride
MOFI	Ministry of Fisheries
MOLISA	Ministry of Labor, Invalids and Social Affairs
MPA	Marine Protected Area
MRC	Mekong River Commission
MSY	Maximum Sustainable Yield
NADAREP	National Directorate of Aquatic Resources Exploitation and Protection
NAFIQACEN	National Fisheries Inspection and Quality Assurance Centre
NAFIQAVED	National Fisheries Quality Assurance and Veterinary Directorate
NARES	National Agricultural Research and Extension System
NARS	National Agricultural Research System
NGO	Non Governmental Organization
NORAD	Norwegian Agency for Development Cooperation
NRM	Natural Resources Management
PAR	Participatory Action Research
PCF	People's Credit Funds
PDF	Portable Document Format
PRA	Participatory Rural Appraisal
R&D	Research for Development
RIA	Research Institute for Aquaculture
RIMP	Research Institute of Marine Products
RRA	Rapid Rural Appraisal
SAPA	Sustainable Aquaculture for Poverty Alleviation
STREAM	Support to Regional Aquatic Resources Management
T	Ton
TAC	Technical Advisory Committee
TAC	Total Allowable Catch
TOT	Transfer of Technology
U.S.	United States
UNDP	United Nations Development Programme
USA	United States of America
USD	United States Dollar
VASEP	Vietnam's Association of Seafood Exporters and Producers
VINAFIS	Vietnam's Fisheries Association
VND	Vietnamese Dong
WTO	World Trade Organization

1 General Introduction and Overview

1.1 Natural Resources and the Need for Management

Ever since mankind has been utilizing natural resources there has been a need for managing them. Natural resources like water, soil, forests and fish can be managed sustainable, unlike unrenewable resources like oil or gold, which once extracted are exhausted. The evidence for the role natural resources management plays lies in the history of mankind itself. In his book: *"Cannibals and Kings: Origins of Cultures"* HARRIS (1991) describes how the most advanced civilizations collapsed due to a mismanagement of the natural resources they depended on. Today, nothing has changed and although not apparent for most people in everyday life, we still all depend on the natural resources our societies and economies are built on. This point cannot be stressed enough, because it is not only the rural and poor communities in developing countries that encounter problems with the sustainable management of natural resources but also and to the same extent the citizens in the developed world.

Management of natural resources has always occurred in one way or the other. The traditional hunting system of the Cree people in the western James Bay area in Quebec is one such example. Hunting areas are 'rested' by rotation, so that beaver populations may recover in the years they are not hunted, to ensure long-term sustainable beaver harvest (BERKES, GEORGE and PRESTON 1991,15). But only through increasing news coverage about desertification, global warming, or the extinction of species will natural resources management and its relevance, normally reserved to scientists, researchers, and government officials, become generally known to the public.

Fish, just like beavers, are resources that are hunted. And just as in the traditional hunting system of the Cree people **global fisheries** depend on a 'management-system' to ensure sustainable catches. In the 1970s the FAO valued the global potential of marine fish stocks at 100 million tons, of which approximately 80 million tons could be harvested each year (FAO, 2001,3; FAO 2002,6). Fishery data from the last three decades and the fact that reported world catches have been oscillating around 85 million tons since 1985 confirm this information (FAO, 2001,3; FAO 2002,7). In recent time capture fisheries worldwide are receiving more and more attention. Between 1971 and 1972, for example, the Peruvian anchoveta fishery collapsed (PAULY et al. 2002,690). Or another example is the collapse of the Atlantic cod fishery at the Grand Banks in Newfoundland, Canada, that caused more than 50 000 people to lose their jobs and annual losses, which amounted to 50 million USD (HARRIS 1998; cf. MYERS, HUTCHINGS and BARROWMAN 1997). And last but not least the more dramatic, and exemplary for West Africa, decline of Ghana's fishery leading to a decline in fish supply per caput (ATTA-MILLS, ALDER and SUMAILA 2004,16).

The rise of production from capture fisheries coincided with the development of fishing fleets worldwide. A comprehensive study from LINDEBO (1999) revealed that estimates of global overcapacity of fishing fleets varied from 25 percent to 155 percent with the most part of figures fluctuating around 50 percent, depending on the various models and underlying assumptions. FAO (1993, cited in LINDEBO 1999) estimate a global deficit of 54 billion USD, using cost and revenue data for the world fisheries in the late 1980's, with capital costs at 124 billion USD and revenues at 70 billion USD. The analysis of

global fisheries revealed that 50 to 60 per cent of stocks, depending on the fishing region and particularly in the Northeast Atlantic and the North Sea, are overfished or have collapsed (FROESE and PAULY 2003,250; GRAINGER 1999,23). Several studies come to the conclusion, that fisheries management has generally failed to manage fishery resources sustainable and attribute this to the institutions (FROESE and PAULY 2003,251; GRAINGER 1999,23). Ironically the fish stocks studied best, i.e. in the Northeast Atlantic and the North Sea are the ones most heavily overfished, compared to the world average (FROESE AND PAULY 2003,252). Many fisheries have undergone substantial changes regarding their catch composition and this trend is also reflected in a shift in the balance of the ocean's ecosystems, e.g. in the North Sea from demersal fish like herring to lower organisms like jellyfish and crabs (FROESE and PAULY 2003,253). Aquaculture has certainly flourished from this development and has been *"the world's fastest growing food production system for over a decade"*, supplying the world with food fish (GRAINGER 1999,24). Consequently the number of people employed in fisheries and aquaculture has increased from 13 million in 1970 to 38 million in 2002 (GRAINGER 1999,24; FAO 2004,6). The number of people, whose livelihoods depend on fisheries and aquaculture, is estimated at 200 million worldwide (GRAINGER 1999,21).

Vietnam's coastal waters feature rich fishery resources comprising over 2,000 species of fish, amongst which are about 130 species with economical value (DANG NGOC THANH 1995,77; DUONG LONG TRI 2002,2; RUANGSIVAKUL and SIRIRAKSOPHON 2002,2). With 3260 km of coastline many livelihoods in coastal communities depend directly or indirectly on fishing or aquaculture. In the year 2000, 70 percent of jobholders in Vietnam were working in agriculture, forestry, aquaculture and fisheries of which 3,4 million employees were working in the fishery sector (DUONG LONG TRI 2002,2). Seafood products also supply nearly half of animal protein in the Vietnamese diet (TENENBAUM 1996,1282; FAO 2005). In recent years the pressure on fishery stocks has increased dramatically (RUANGSIVAKUL and SIRIRAKSOPHON 2002,2) (emphasis added). In the years from 1990 to 2001 the catch per unit effort (CPUE)[1] in coastal waters decreased from 0.92 t/Hp/year to 0.48 t/Hp/year, which is a sign of overfishing[2] (NGUYEN CHU HOI 2003,7). The exploitation of the coastal fishing grounds has reached a critical level and various species face extinction. In 1995, for instance, DANG NGOC THANH (79) reported:

> *"It must be to remind that 80-90% of the total fisheries yield is exploited in the coastal fishing grounds with the depth less than 30m occupying only 10% of total sea area of Vietnam. This excessive exploitation has been occurring in a narrow zone for a long time, resulted to serious decrease of the fish resource reserve. The using of backward fishing technics sometimes even use of explosive substance in exploitation caused to mass extermination all living organisms including juvenile, economical fishes and shrimps. For that reason, some fishes of great economical value as Clupanodon thrissa, C. chacunda, Ilisha reevesii as well as some mollusks having a great ornamental value as Cymbium melo, Charonia tritonis,*

[1] Catch per unit of effort (CPUE): The quantity of fish caught (weight) by a certain amount of effort (e.g. fishing time, gear type). CPUE can be compared between different types of gear and used as a measurement for the abundance of fish.

[2] RUANGSIVAKUL and SIRIRAKSOPHON (2002,2) estimated that 91.8% of total fishing boats in Vietnam have less than 75 Hp and therefore operate only in coastal areas.

Cassis cornuta etc.. are at present time decreasing in quantitative or on the threshold to extinct."

The same author estimated the potential fishery stocks in coastal waters with about 1,500,000 tons and a total allowable catch (TAC)[3] of 600,000 tons per year (DANG NGOC THANH 1995,79). De facto 830,000[4] tons were extracted in the year 2000, representing 65 percent of Vietnam's total fishery production (DUONG LONG TRI 2002,4). Coastal fishery resources are not only important to supplement human diets; broodstock from wild stocks fuels the growing importance of Vietnams shrimp and lobster industry and *"aquatic resources extracted from coastal waters provide income-strategies for rural households"* (TOWNSLEY 1998,139). For this reason recent developments, namely the degradation of coastal fishery resources through overfishing, gain significant importance for Vietnam's future fishery sector (see RUANGSIVAKUL and SIRIRAKSOPHON 2002,5; NGUYEN CHU HOI 2003,7 for further discussion on this point). A large share of rural poverty is spread amongst coastal communities highlighting the importance of addressing the issue of degrading coastal fishery resources (NGUYEN CHU HOI 2003,8). Since households in these communities not only depend on fishing or aquaculture but additionally on agriculture or trading for example, a multi-sectoral approach is necessary. A multi-sectoral approach not only addresses this situation but also the fact that pollution from agriculture or aquaculture impacts negatively on coastal waters. This example shows the interdependency between the sectors and explains why the complexity and diversity of the resource system and its users can only be addressed through an integrative, multi-sectoral approach such as the integrated natural resources management (INRM) approach.

1.2 Scope of the Study

The overall research objective is to develop a framework and identify starting points for the successful introduction of integrated natural resources management and to improve rural livelihoods in a coastal fishery environment facing environmental degradation. The intention of the present study is to contribute to a new approach in research for development for a more participative, adaptive and poverty reducing integrative management of natural resources. The objective is to provide concepts, methods, tools and examples that can be used by scientists and decision-makers in development organizations, e.g. the CGIAR and national agricultural research systems (NARS) who plan and conduct research on living aquatic resources. Effective resources management depends on several factors, the consideration of the complexity of a natural resources management system and its specific local conditions as well as participation and facilitation to develop solutions for existing problems.

The presented methods and tools are applied to the conditions of an exemplary coastal fishery system facing degradation in Vietnam. The case study of Nha Phu Lagoon

[3] Total allowable catch (TAC): The quantity of fish allowed to be caught from a fishery resource in a specified period (usually a year) ensuring a sustainable fisheries production.

[4] This figure derived from 1,280,590 tons of the total fish production in the year 2000 (DUONG LONG TRI 2002,4). This figure is similar to the 870,000 tons total catch in coastal areas, estimated by RUANGSIVAKUL and SIRIRAKSOPHON (2002,5).

provides a comprehensive documentation of planning and implementing integrated natural resources management research in practice. Furthermore, it demonstrates the complexity of a natural resources management system composed of multiple stakeholders, sectors, interests, resources, management strategies, and problems to exemplify the potential of applied integrated natural resources management methods and tools with regard to its pursued objectives.

The means by which this complex multi-stakeholder system is addressed is one of integrated natural resources management. One of the key characteristics of this approach is participatory action research, which builds on a learning cycle, and may be described as a cycle *"consisting of phases of planning, acting, observing and reflecting"* (ALLEN 2001,2). Participatory action research aims to formulate public knowledge, develop a shared understanding of resource management issues, and help people to help themselves.

Former research and development initiatives associated with natural resources management were limited in achieving their objectives, namely sustainable natural resources management and poverty reduction (CAMPBELL and HAGMANN 2003,1). These limits were set by the clash of two paradigms: positivism versus constructivism. Moreover, a large variety of theoretical models exist for achieving adaptive management thus sustainable development, like the transfer of technology (TOT) model, integrated rural development (IRD) and the sustainable livelihoods approach.

The development and application of integrated natural resources management as a research approach to cope with the complexity of a natural resources management system constitute the central part of this study. The complexity of a multi-stakeholder system is dealt with in theory, expressed in a conceptual framework and applied through various participatory methods.

This is dealt with in describing the genesis of integrated natural resources management , the research design and applied methods, the implementation of integrated natural resources management in the case study and the development of alternative management strategies.

The contribution to integrated natural resources management, leading to sustainable management of fishery resources and thus reduction of rural poverty, is accomplished through several tasks:

1. The coastal fishery sector is depicted and evaluated regarding:
    - The multi-stakeholders system;
    - The natural resources and existing management forms;
    - The prevailing institutions and decision-making processes.
2. The identification of starting points for the successful introduction of integrated natural resources management in a coastal fishery sector:
    - Specify arenas for resource user groups and policy makers;
    - Participate in developing options and scenarios for alternative resource management.

The study of integrated natural resources management rather concentrates on planning and implementing integrated natural resources management research in practice and the

adjustment of applied methods to the conditions of a coastal fishery environment. Further steps need to be taken towards the comparison and establishment of integrated natural resources management to other NRM research to develop sustainable natural resources management.

Scientists, practitioners in the national agricultural research systems (NARS) and the Consultative Group on International Agricultural Research (CGIAR) for example, who might be inspired by some of the methods and findings and would like to integrate them into their own work, are provided with concepts, methods and recommendations in this study.

1.3 Thesis Structure

The study is organized around six chapters. In Chapter 1 the motivation to engage in INRM within a coastal fishery environment is depicted. Following the introduction, the next section mentions the problems and objectives of this work and provides a context for this study.

Chapter 2 provides a descriptive overview of the genesis of integrated natural resources management. Thereby the focus lies on the paradigm shift in research and development (R&D) and the shortcomings of conventional research approaches. Chapter 2 continues with a review of definitions, terms, and concepts that are commonly used in integrated natural resources management.

Chapter 3 describes the applied methods and the role of the researcher. It begins with an overview of the research design from ´concept to practice` and the process that the researcher uses to guide those involved. Then the applied participatory methods are discussed and listed in order to make later applications more transparent and replicable for the interested reader. Subsequently my own role in the research process and its design is reflected and an outlook provided how to reduce limitations when implementing integrated natural resources management.

Chapter 4 provides the background to the start of the wider case study reported in this thesis, which can be seen as a platform to apply and test the integrated natural resources management research approach. This involved an integrated natural resources management research initiative, conducted in 2003/2004, to address the issues of coastal fishery resources degradation and rural livelihoods in Nha Phu Lagoon, Vietnam. After a brief introduction, Chapter 4 continues with background information on the coastal fishery sector in Vietnam. Empirical findings of the natural resources management system are differentiated into institutional and organizational structures, natural resources and their management, resource users, trends, problems in the implementation of institutions within the various production systems, and devolution of natural resources management.

Chapter 5 begins with an excursion into global fisheries and a critical assessment of fishery management. Next, the discussion about the shortcomings of conventional research approaches is deepened, by evaluating their impacts in regards to poverty eradication. Some more practical details of practicing integrated natural resources management research are then discussed. The following section opens with a discussion of the case study, concerning the evaluation of the fishery sector, state- and local-led

management, decision-making processes, environmental degradation, and livelihood strategies. A further analysis describes and complements the production systems in fishery and aquaculture and their institutions. Finally, the participatory development of new management forms and ideas is highlighted, and an illustration given of how it can help in getting people to think more deeply about natural resources management.

Chapter 6 presents the general conclusion and outlines some implications for future integrated natural resources management research within a coastal fishery environment.

Although the individual chapters of this study partly overlap in their topics and methodology, they can be read independently from each other. Having more or less independent chapters also implies that certain repetitions are unavoidable.

2. New Paradigms in Research for Development: Towards Integrated Natural Resources Management

2.1 Addressing Poverty and Environmental Sustainability

2.1.1 Introduction

Since the Millennium Development Goals[1] were formulated several authors have contributed to the discussion about how to bear on the ever-widening gap between rich and poor countries. LAWTON (2001,1965) and LESHNER (2002,897) comply that *"effective solutions require multidisciplinary, multidimensional strategies (…) to tackle the complexities of sustainable development"*. GORDON CONWAY (2003,2), president of the Rockefeller Foundation, refers to the Green Revolution[2] criticizing its long-term sustainability, e.g. soil erosion, nutrient depletion, salinization and social inequity, i.e. only rich farmers can afford expensive inputs *(…)* "*driving the poor off the land"*, in an approach to explain what needs to be done to create the 'next' equitable and sustainable Green Revolution (see RASMUSSEN and MEINZEN-DICK 1995; VAN KEER et al. 1998 for further discussion on this point). In the annual meeting of the American Association for the Advancement of Science, PETER RAVEN (2002,954) discusses an integrated multidimensional approach as a new way of thinking to achieve a sustainable world.

Contrary to the perception above, an analysis of rural development projects by the World Bank concluded that multi-sectoral approaches were not in line with the countries institutional framework, i.e. sectoral and vertical organization (IBRD 1987 cited in ENGEL 1997; BIRGEGARD 1987,6). Thus projects often *"by-passed"* institutions and yielded only short-term success. On the other hand RAUCH (1996,154), compared the World Bank analysis with an analysis of the German Federal Ministry for Cooperation and Development (BMZ) on their rural development projects concluding, that the aspect of highly complex multi-sectoral projects was no issue anymore, because projects had assembled themselves through shrinking to few key sectors.

Science has recognized that complex real-world problems such as natural resource systems cannot be dealt with discipline-led research approaches (PARKES and PANELLI 2001,86; RAVEN 2002,954; LESHNER 2002,897). However, most research products *("publications, GIS databases, decision-support tools, manuals and guidelines"*) do not match the often highly aggregated development goals and therefore have a small impact on the poor (PROBST and HAGMANN 2003,1). In their research findings PROBST and HAGMANN (2003,1) quote, that "*the research focus is often derived from a supply-led and discipline-led perspective, and it is widely assumed that research outputs can be fed into an existing and functioning research-development continuum.*" This view brings a

[1] The Millennium Development Goals were declared by the United Nations in September 2000 as part of a road map to focus on sustainable development through poverty eradication (see www.developmentgoals.org for further reading).

[2] The Green Revolution refers to the introduction of high-yielding cereal varieties requiring large quantities of fertilizer, pesticides and better management during the 1960s and 1970s which greatly increased agricultural productivity.

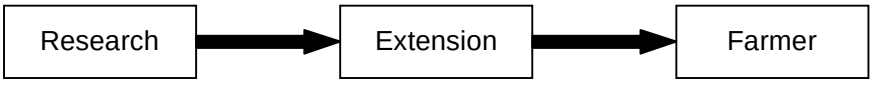
dramatic change in the way research efforts for development is perceived. Previously seen as a failure in common research approaches adopting market-led and demand-oriented participatory learning and action research is now seen as the way to achieve successful natural resource management. Although local resource users stand in the centre of today's modern research efforts (see for instance the rural livelihood framework), participatory research merely acts as a means to improve conventional technology development and achieve local impact instead of being recognized as strategic research developing knowledge. Behind this stands the underlying paradigm that implies, if scientists will investigate *"on"* or *"with"* their clients. (PROBST and HAGMANN 2003,1-16)

The following section reviews the various positions in the ongoing debate on research for development. To understand the genesis of integrated natural resources management and the associated paradigm change one need to differentiate between the research approaches. Several authors have defined research approaches to development (PROBST and HAGMANN 2003,11; CHAMBERS, PACEY and THRUPP 1989,182; ALLEN 2001a,4). In this respect PROBST and HAGMANN'S (2003,11) framework is representative offering three prototypical approaches.

2.1.2 The Transfer of Technology Model

The transfer of technology (TOT) model was developed in the 1960s and is based on the positivist paradigm[3] (PROBST and HAGMANN 2003,8). Thereby scientists develop technologies that benefit farmers that in turn are 'transferred' to the farmers. The scientist is solely responsible for developing scientifically valid and replicable research results in off-farm conditions. The extension worker packages the information for dissemination to the farmers. Then the farmer either adopts or rejects the innovations. The role of communication in the TOT model is to transfer information of knowledge from the researchers to the farmers through the extension system in a unidirectional way (Figure 1).

Figure 1: The Transfer of Technology model.



During the Green Revolution in the 1960s and 1970s the provision of technology packages consisting of improved seed, fertilizers and pesticides followed the path of the TOT model. In terms of increasing food efficiency and avoiding a massive famine

[3] Positivism or positivist-realism is associated with „hard" science (DOUTHWAITE et al. 2001b,4) and grounded in direct empirical evidence (PROBST and HAGMANN 2003,5), i.e. something that can be observed or recorded with scientific methods. Thereby the researcher is placed outside and separate from the research subject or reality, which is seen to pre-exist without anyone taking action to create it, seeking *"to discover and generate objective 'true' knowledge"* (PROBST and HAGMANN 2003,6). Physical objects or systems are studied in a closed experimental situation and components reduced to one level according to cause-effect relations (reductionism). *"Systems are considered to be predictable and controllable once the parts are known"* (PROBST and HAGMANN 2003,5).

predicted for India during that time TOT has been successful (CONWAY 2003,1-2). The success in adoption of techniques depends on the homogeneity of *"natural and social environments, where farmers live under similar conditions, perceive the same kinds of challenges and share a common set of beliefs and values"* (PROBST and HAGMANN 2003,8).

2.1.3 Farmer First

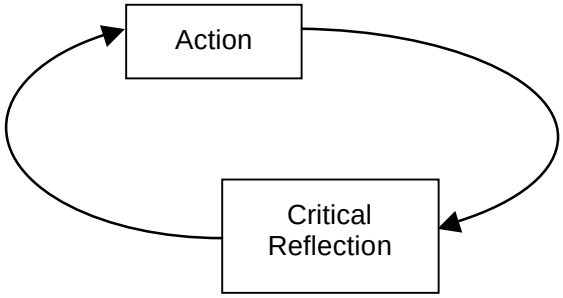
In the 1980s a shift in thinking questioned agricultural research, the transfer of technology approach and its effects under unfavorable conditions, e.g. in sub-Saharan Africa (PROBST and HAGMANN 2003,8; CHAMBERS, PACEY and THRUPP 1989,xvii; CONWAY 2003,1-4). Until then non-adoption of technologies was often attributed to ignorance of the farmers but now researchers went out to farmers to understand the reasons for non-adoption (CHAMBERS, PACEY and THRUPP 1989,xix). The scientists learned, that the reason was often the technology itself and the way it was generated, i.e. priority setting by scientists and generation of technology in off-farm conditions. By acknowledging local knowledge and the complexity of farming systems a new complementary paradigm constitutes meaning that the conventional transfer of technology approach is reversed (CHAMBERS, PACEY and THRUPP 1989,xix). The farmers come 'first', it is they who identify their own priorities, their farms that act as a research station, and themselves as the central experimenter (CHAMBERS, PACEY and THRUPP 1989,xix). Under the umbrella term Farmer First many familiar approaches are housed, e.g. Farmer-back-to-Farmer (RHOADES and BOOTH 1982), Farmer First and Last (CHAMBERS and GHILDYAL 1985), Farmer Participatory Research (FARRINGTON and MARTIN 1987) and Participatory Technology Development (ILEIA 1989). They all have in common that participation of farmers is central to the implementation of the complementary paradigm mentioned above. *"The positivist paradigm is still prevalent in these approaches"* (PROBST and HAGMANN 2003,8) which becomes apparent in needs and priorities analysis, whereby farmers are assisted by 'outside' scientists and local knowledge is seen as a homogenous, research compatible and readily formatted product that can be taped into. Lastly it is assumed, that gathered information is fed into an existing research and development continuum (PROBST and HAGMANN 2003,4). That means, knowledge is fed into effective and organized national agricultural research systems and from there, developed technologies are distributed through a widely organized and functioning extension system to well educated farmers with access to resources, credits, inputs and markets.

2.1.4 Participatory Learning and Action Research

Just like Farmer First, Participatory Learning and Action Research is an umbrella term that houses research approaches like the Integrated Systems for Knowledge Management (ALLEN 1998), Experiential Learning (KOLB 1984), and Action Research (ARGYRIS 1983), only to name a few. In Participatory Learning and Action Research knowledge is generated *"through critical reflection and experiential learning in an ongoing process of action in a real life context"* (PROBST and HAGMANN 2003,9) or as CORNWALL, GUIJT

and WELBOURN (1994,115) put it, *"in a process of mutual learning between people with different experiences, knowledges and skills"* (Figure 2).

Figure 2: A simple action research spiral.



Source: DICK (2002,3)

Underlying this research approach is a famous citation from Kurt Lewis (LEWIS 1946, cited in HAGMANN et al. 2000,12)*: "If you want to know how things really work, just try to change them"*, i.e. scientists need to abandon objectivity and instead interact directly with complex real-world systems in order to understand them and deliver relevant research results. This implies that a constructivist perspective[4] is applied arguing, that if the complex real-world system does not reveal itself from 'outside' assuming there is only one reality, and then it is the internal constructed realities of the actors that reveal the true nature of the research issue. Therefore, facilitation is the core attribute scientists need to possess, because in their interaction with actors they will influence the reality construction of people (HAGMANN et al. 2000,9). GAVENTA and BLAUERT (2000) perfectly summarize this perception, when they choose the heading *"Learning to Change by Learning from Change"*.

2.2 Shortcomings of Conventional Research Approaches

The following section describes what is meant with the term 'conventional research approaches' and attempts to answer the question, why they have failed in terms of sustainable use of natural resources. In a next step, the need for more integrated, multidimensional approaches is demonstrated ultimately leading to the development of integrated natural resource management.

2.2.1 Linear Research and One-way Thinking

The transfer of technology model is a good example for linear research, whereby research outputs are fed into an assumingly existing and functioning 'research-development

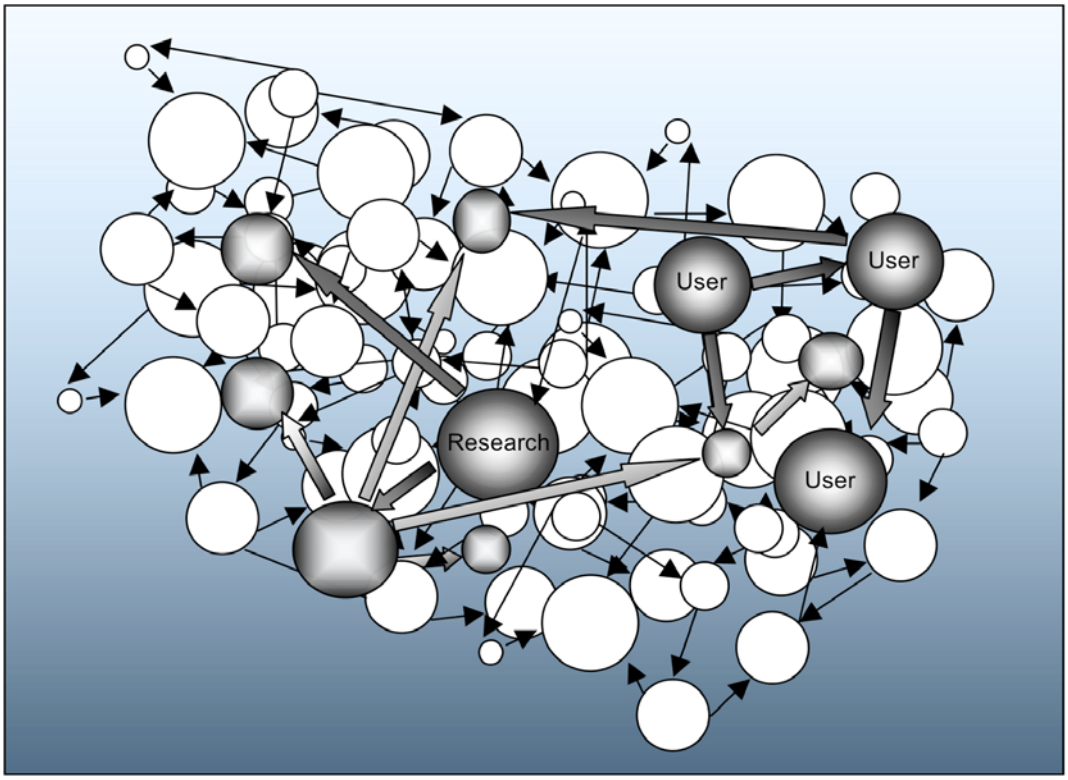
[4] Constructivists assume that there are multiple 'constructed' realities that are products of human intellects and that the researcher has to be a *"passionate participant"* to investigate the perception of respondents (GUBA and LINCOLN 1994,112).

continuum' as mentioned above. In reality, parts of the transfer of technology model are often missing or underdeveloped; e.g. in their comprehensive review of research on soil fertility in West Africa BATIONO, LOMPO and KOALA (1998,33) come to the conclusion, that

> *"Over the past years a considerable amount of technologies to improve the productive capacity of African soils has been generated. These technologies have not been transferred to or implemented by the intended beneficiaries. Future research needs to focus more on reasons for adoption and non-adoption of presently available technologies (…), use more participatory technology generation (…), and take more into account the farmer's view, social and economic realities".*

Based on 10 years practical experience in integrated and participatory natural resource management in Zimbabwe HAGMANN et al. (2000,7) takes up the matter of linearity of research – extension – farmer as a pathway for innovation that disproves itself even if improved through feedback loops from farmers to researchers. Experience from their work shows that *"innovation involves a whole innovation system with many actors and sources of inspiration, creativity, and motivation (…) in which the direct cause and effect of a certain activity is almost impossible to assess"* (HAGMANN et al. 2000,7). KUBY (1999, cited in HAGMANN et al. 2000,7) expresses this innovation system in a diagram to show its complexity and the unpredictable influence of research (Figure 3).

Figure 3: Innovation as a social process where the influence of research on the users is highly complex and unpredictable.



Source: KUBY (1999, cited in HAGMANN et al. 2000,24)

Bearing this in mind there is a general need that our scientific culture has to change its view and perception of research for development (cf. CAMPBELL and HAGMANN 2003,2). There will always be a need for conventional linear research, especially in the western highly specialized and well-organized world. But non-adoption of technologies and innovation here and there will have to lead to a critical self-evaluation, not focusing on the technologies itself and their suitability but on the social environment, i.e. the societies exposure to innovations and technologies, awareness, learning processes, participation in change, only to name a few (see PROBST and HAGMANN 2003,10-12; HAGMANN et al. 2000,8; CAMPBELL and HAGMANN 2003,6 for further discussion on this point).

2.2.2 Rhetoric Research Development

Especially in research and development the call for adopting new research approaches according to newest insights and publications has led to an inflationary use of words like "participation", "capacity building", "devolution", "self-empowerment" or "community based". Words that CORNWALL and BROCK (2005,iii) term *"buzzwords"* and that suggest a sense of purposefulness and optimism in development policies and feign a world where everybody gets a chance to take part in making the decisions concerning their own lives. The development of new research approaches and methodologies certainly justifies the introduction of a new vocabulary. Unfortunately at the same time and up to now, the thinking and perception of scientists barely changed, although they were willing to apply these new research approaches and methodologies (cf. DOUTHWAITE et al. 2001a; DOUTHWAITE et al. 2001b,2). The necessary paradigm change associated with the new methods failed to appear and is the main reason the scientific community as well as beneficiaries did not prosper much from this methodological development (PROBST and HAGMANN 2003,12). DOUTHWAITE et al. (2001a) point out, *"(…) that positivist-realism, rather than constructivism, is still the dominant paradigm in many CGIAR centers and in most national research systems"* and *"that scientists will go to great lengths to defend their belief structures (…)"*. KUHN (1970, cited in DOUTHWAITE et al. 2001a) adds to this perception *"(…) a strenuous and devoted attempt to force nature into the conceptual boxes supplied by professional education"*. In addition, the scientific community promoted methodological development to learn more about the applied methods which to a certain extent led to research focusing solely on the research process rather than on research results and their proper implementation and continuation (cf. SUSMAN and EVERED 1978,582; CAMPBELL and HAGMANN 2003,1). SWEPSON (1998,1-2) writes about another danger in research, the *"idealist trap"*. Thereby she emphasizes the need to separate the ideals of research from the methodology of research with the underlying assumption that action research theorists fail to incorporate their ideals into the methodology.

2.2.3 Neglecting the Diversity of Agro-ecosystems and its Socioeconomic Environment

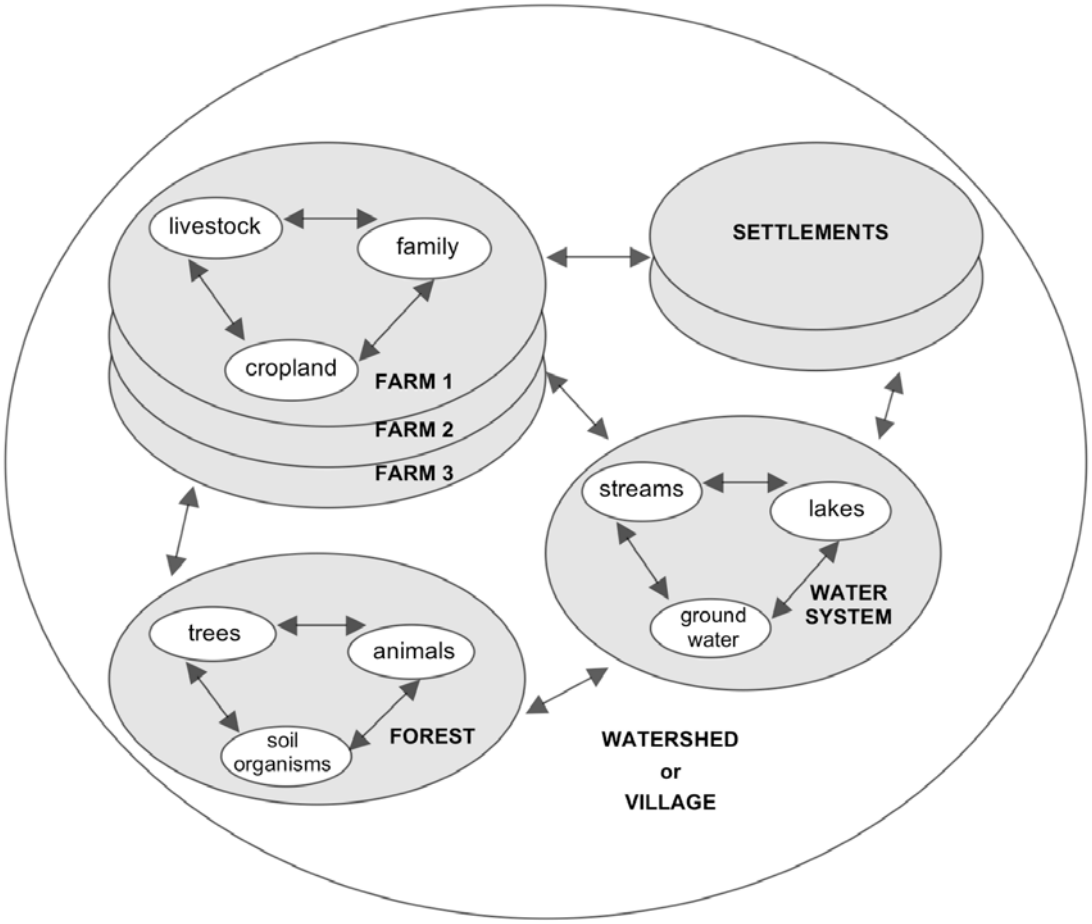
In his critic about the Green Revolution in order to answer the question: *"Why Africa missed out"*, CONWAY (2003,3) mentions one reason being the *"wide diversity of*

ecosystems". Although, the Green Revolution missed Africa almost completely other failings include that it benefited only the more prosperous farmers in the more favorable areas and even lead to rich farmers driving the poor of their land (CONWAY 2003,2). In addition, the new technologies yielded short-term gains at the expense of long-term soil erosion, nutrient depletion, falling water tables, and salinization (CONWAY 2003,2). So the question arises, what went wrong? SAYER and CAMPBELL (2001) have the answer, namely that the Green Revolution Science underestimated the complexity of the agro-ecosystems in which small-scale producers operate. However, agro-ecosystems by nature are complex and many interactions involving the socioeconomic environment need to be considered (CAMPBELL et al. 2000). For example, a fisherman may pursue several livelihood strategies such as agriculture or trading. Just like a farmer may supplement his income by fishing or other off-farm activities. This reality implies that productivity enhancement although important is superposed by risk reduction, improved food security, allocation of effort (out-migration, cropping particular species, building social capital), environmental conservation, and trade-offs among cash income that are of much greater importance (SAYER and CAMPBELL 2001; CAMPBELL et al. 2000). Other forms of multiple scales of interaction and response within the system include a high frequency of nonlinearity, uncertainty and time lags, e.g. highly variable rainfall, a constantly changing economic climate, and dynamic land use changes (SAYER and CAMPBELL 2001). Further, the multiple stakeholders with often contrasting objectives and activities challenge research on complex systems (SAYER and CAMPBELL 2001; CAMPBELL et al. 2000). In practice and transferred to a soil fertility conservation project carried out in northern Thailand, VAN KEER et al. (1998,12) recall widely varying agro-ecosystems as one main reason to explain the failure of the conventional transfer of technology approach. As another reason for failure they identify not considering the dynamics of the biophysical and human environment (VAN KEER et al. 1998,12).

2.2.4 Limitations of Objective Research: Staying 'Outside'

Conventional research is associated with objectivity (GRØNHAUG and OLSON 1999,10). One can argue, if true objectivity really exists or if we need not replace the paradigm of objectivity with the paradigm of subjectivity. Considering conventional research approaches and their methodology, e.g. transfer of technology and participatory technology development, it is unreasonable to expect the researcher not to be involved yet influencing the system he is studying. Especially in natural resource management, e.g. soil fertility conservation it seems odd to extract the study object "cropland" from its biophysical and socioeconomic setting, transfer it to sterile laboratory conditions for examination and technology development and then paste the newly developed solutions back into the total system of a farm or better yet a village setting. Neglecting the numerous interactions (cause and effect) within the natural resource management system 'village' leaves the researcher 'outside' the study object and limits understanding of the real world (see also Figure 4). LAL et al. (2001,2) go even further stating that traditional, single discipline resource management methods are "*generally ineffective in explaining real life with its complex interactions and uncertainties"*.

Figure 4. Integrated management deals with interacting nested systems. Subsystems contribute to viability and performance of component systems, which again contribute to the total system.



Source: BOSSEL (2000,16)

In an integrated natural resources management case study on soil erosion in Vietnam KAM et al. (2000,15-16) detected that unsustainable land use and lack of manure were the main reasons for soil erosion and the result of this action was lack of water through silted water reservoirs. The consequences of water shortage and soil erosion were low rice productivity, thus limited livestock production ultimately leading to poverty. Besides introducing soil conservation practices and the introduction of perennial annual crops, three more key intervention points were selected. These were: (1) the improvement of livestock production, (2) the improvement of rice production and last but not least (3) the improvement of means and confidence to diversify production. These measurements led to an improved income and food security in Tam Dao Village. The interdisciplinary research approach used in this case study underlines the necessity to address various dimensions and scales in dealing with complex natural resource management systems and their interactions. Nevertheless, KAM et al. (2000,9) concludes that: *"These new integrative methodologies are not meant to replace but to augment well-founded scientific outputs of the various disciplines (…)"*.

FEYERABEND (1993, cited in SWEPSON 1998,5) demonstrated, that there is no objective, value free knowledge as proposed by POPPER (1974, cited in SWEPSON 1998,4). However, HELLER (1997, cited in SWEPSON 1998,5) emphasizes the need of *"visions"* to guide our research and SWEPSON (1998,6) suggests objective, value-free research as such an ideal.

2.3 Evolution of Integrated Natural Resources Management Research

2.3.1 An Introduction to Integrated Natural Resources Management

The term integrated natural resources management (INRM) was first used within the consultative group on international agricultural research (CGIAR) in 1997. Previously the CGIAR had introduced the ecoregional approach in 1990, *"as a means of integrating resource management with productivity concerns (…)"*in an effort to expand resource management research (CGIAR 2003,4). In the following course the evolving subcommittee on integrated natural resources management together with the Centres Technical Advisory Committee (TAC) organized annual meetings on integrated natural resources management bringing together scientists to further develop methodologies and the conceptual framework of integrated natural resources management (CGIAR 2003,5). The first meeting in Bilderberg, Netherlands from 3rd to 5th September 1999 focused on strategic directions for integrated natural resources management work. The workshop held on Penang, Malaysia from 21st to 25th August 2000 focused on approaches and lessons. The third workshop held one year later in Cali, Columbia from the 28th to 31st of August 2001 dealt with ways to improve the organization of integrated natural resources management research in the CGIAR. The fourth workshop was held in Aleppo, Syria from 16th to 19th September 2002 and focused on a synthesis of the lessons learned from previous and existing integrated natural resources management projects to further conceptualize and provide an operational research framework. The fifth and so far last workshop from 20th to 21st October 2003 in Nairobi, Kenya focused on mainstreaming integrated natural resources management into agricultural research programs and impact assessment of integrated natural resources management. The next workshop is planned for 2005. These meetings have contributed widely to the literature available on integrated natural resources management today. Extensive workshop documentation, abstracts, and research papers of all meetings are available on the integrated natural resources management web site http://www.inrm.cgiar.org. The current definition on integrated natural resources management displayed on the CGIAR web site reads as follows:

> *"INRM is an approach to research that aims at improving livelihoods, agroecosystem resilience, agricultural productivity and environmental services. In other words, it aims to augment social, physical, human, natural and financial capital. It does this by helping solve complex real-world problems affecting natural resources in agroecosystems. Its efficiency in dealing with these problems comes from its ability to:*
>
> - *empower relevant stakeholders*
> - *resolve conflicting interests of stakeholders*
> - *foster adaptive management capacity*

- *focus on key causal elements (and thereby deal with complexity)*
- *integrate levels of analysis*
- *merge disciplinary perspectives*
- *make use of a wide range of available technologies*
- *guide research on component technologies*
- *generate policy, technological and institutional alternatives."*

This definition falls short in explaining integrated natural resources management in all its complexity. Integrated natural resources management is a holistic approach and as such trying to sum it up is inconsistent. Integrated natural resources management is very rich and diverse in its composition. In that sense, integrated natural resources management is not a wholly new approach but an ingenious way of linking different disciplines, methodologies, and approaches to achieve multiple goals, e.g. sustainable resource management, social equity and poverty alleviation. However, the multiple elements in integrated natural resources management do not compete with each other but work in conjunction to benefit the livelihoods of those involved. Integrated natural resources management is never static but always dynamic and very adaptable and thus can be applied to a wide range of different resource types and environments. The following sections describe the various elements of integrated natural resources management in detail and identify some underlying principles that remain relatively unchanged in the numerous varieties of integrated natural resources management approaches.

2.3.2 The Constructivist Paradigm: Multiple Realities

A paradigm is *"the basic way of perceiving, thinking, valuing, and doing associated with a particular vision of reality"* (HARMAN 1976). Paradigms may be defined as the *"basic belief system or worldview that guides the investigator"* (GUBA and LINCOLN 1994,105). The choice of paradigm is critical in providing an appropriate overall conceptual framework within which a researcher works. Scientific paradigms are supported by three philosophical assumptions: (1) ontology, (2) epistemology, and (3) methodology (PERRY, RIEGE and BROWN 1999,1949). Thereby ontology is the reality that researchers investigate. Epistemology explains the process of knowledge generation, i.e. the relationship between reality and the researcher and how knowledge about that reality becomes known to the researcher (PERRY, RIEGE and BROWN 1999,1950). Methodology describes the techniques used by researchers to investigate that reality (PERRY, RIEGE and BROWN 1999, 1950).

As mentioned above the constructivist paradigm plays a significant role in the research context, hence it deserves further explanation. The constructivist paradigm is based upon the idea of multiple realities (CAMPBELL and HAGMANN 2003,2). It stands in sharp contrast to the positivist-realism paradigm associated with 'hard' science, e.g. most natural science and some social science in which there is only one answer or explanation to a phenomenon.

The term 'positivist-realism' is widely used in integrated natural resources management terminology. However, this is misleading since realism differs substantially from positivism. Moreover, realism has elements of both positivism and constructivism, e.g.

realism assumes that there is only one reality, although several perceptions of that reality exist (PERRY, ALIZADEH and RIEGE 1997,554). In positivism the reality is seen as 'real' and apprehensible (PERRY, RIEGE and BROWN 1999,1950). In realism the reality is imperfect and probabilistic apprehensible and thus requires triangulation from many sources, i.e. admitting several perceptions of one reality exist (PERRY, RIEGE and BROWN 1999, 1952). The review of the literature reveals, that positivism and realism are always treated independently (see PERRY, RIEGE and BROWN 1999; PERRY, ALIZADEH and RIEGE 1997; GUBA and LINCOLN 1994; for further discussion). Therefore the term positivism will be used from now on solely.

The positivist perception of science has dominated the practice of natural and social sciences for more than 100 years (ALLEN 2001a,3). The underlying basis of the positivist perception, emanating from natural sciences in particular physics and characterizing all sciences (ARGYRIS, PUTNAM and MCLAIN SMITH 1985,19), is that scientific knowledge is only obtainable from data that is directly experienced and verified between independent observers (SUSMAN and EVERED 1978,583). Much has been said about the deficiencies of positivist science when transferred from the closely defined laboratory conditions and asked to cope with real life (Allen 2001a,3). However, the following moon-ghetto metaphor expresses this fact well: *"While science has enabled us to control the soft landings of space craft on distant planets, it has not helped us solve the 'lesser' problems associated with urban slums"* (ROSENHEAD 1989, cited in ALLEN 2001a,3).

Epistemically speaking in positivism the researcher takes an objective point of view and findings are perceived as true arguing that researchers only observe through a 'one way mirror' (GUBA and LINCOLN 1994,110). In constructivism epistemology the researcher takes a subjective point of view and findings are created. Perception is the most important reality and meaning is more valuable than measurement (PERRY, RIEGE and BROWN 1999,1951). *"Realities appear as multiple realities which are socially and experientially based, intangible mental constructions of individual persons"* (PERRY, RIEGE and BROWN 1999,1951). The methodology that goes with the paradigm of constructivism is of hermeneutical[5] and dialectical[6] nature (PERRY, RIEGE and BROWN 1999,1959). This approach demands that the researcher becomes a *"passionate participant"* within the investigation process (GUBA and LINCOLN 1994,112). Applied methods include participant observation, in-depth interviews and case studies. On the other hand methods in positivism are based on experiments and surveys, striving to verify hypotheses and

[5] Hermeneutics: the art of interpreting texts (mainly of biblical origin). Contemporary references refer to its role in the interpretation of languages, culture, and history. Its most important concept is that of the 'hermeneutics circle'. The underlying assumption of the circle is that there is no knowledge without foreknowledge. The objective of the circle is to gain a holistic understanding of a social system to interpret part of the system. The knowledge is gathered dialectically by moving from the whole to its parts and back again. Each time an incongruence occurs between the researcher's perception of the social system and that of its members, a reconceptualizing takes place. The frequency decreases with the number of mismatches. However, hermeneutic tradition reminds the researcher, that his interpretation of a social system will never be the same as that held by the members of a social system. This learning process is similar to the spiral formulated by Kurt Lewin which is one of the key concepts of integrated natural resource management. SUSMAN and EVERED (1978,595) (cf. LAMNEK 1993,71-78)

[6] Dialectic: the investigation of truth through discussion resolving conflict between two contradictory sides while recognizing multiple realities.

chiefly using quantitative methods such as regression analysis (PERRY, RIEGE and BROWN 1999, 1950). The philosophical assumptions that support the different paradigms and their encompassing discussions are summarized in Table 1.

Table 1: Research paradigms compared.

	Positivism	Constructivism
Ontology	A single reality exists and is apprehendable.	Multiple local and specific constructed realities exist.
Axiology[7]	Inquiry is value-free	Inquiry is value-bound
Epistemology	Objective point of view; findings are true. Observation takes place through a 'one way mirror'.	Subjective point of view; findings are created. Observation takes place with the researcher being a 'passionate participant'.
Methodology	Experiments and surveys: verification of hypotheses, chiefly quantitative methods, e.g. regression analysis.	Hermeneutical and dialectical: qualitative methods, e.g. participant observation, focus-group discussion.
Causal linkages	Real causes temporally precedent to or simultaneous with effects.	All entities simultaneously shaping each other. It is impossible to distinguish causes from effects.
Reasoning	Reasoning is Deductive moving from All to Some.	Reasoning is Inductive moving from Some to All.

Source: Synthesized from PERRY, RIEGE and BROWN (1999,1950); GUBA and LINCOLN (1994); PERRY, ALIZADEH and RIEGE (1997); BORTZ and DÖRING (2002,298).

Once the basic data is collected the researcher begins to try to understand it and make assumptions. At this point, the researcher begins to formulate some initial conclusions. This process is called reasoning. Within the scientific paradigms one can differentiate between two main methods of reasoning that will produce two different kinds of results.

Deductive reasoning moves from a general premise to a more specific conclusion and is associated with positivist science and quantitative research (BORTZ and DÖRING 2002,298-299). For example, if I know that Wednesdays doctor's offices are closed and today is Wednesday, I assume that my doctor's office won't be open either (BORTZ and DÖRING 2002,299). Deduction is generally past or present oriented, its premises are already tested and it is purported to be 'truth preserving' (BORTZ and DÖRING 2002,299). Hence, deductive reasoning offers no new knowledge about the world but only works out the consequences of what is already accepted (PEIRCE 1955, cited in SUSMAN and EVERED 1978,598).

Inductive reasoning moves from specific premises to a general conclusion and is associated with constructivist science and qualitative research (BORTZ and DÖRING 2002,298-299). For example, after person A has been late several times, it is assumed,

[7] Axiology: the study of values.

that this person will be late in the future too (BORTZ and DÖRING 2002,299). Induction is generally future oriented, just as its conclusion is testable in the future and it is purported to be 'truth expanding' (BORTZ and DÖRING 2002,299). However, there is a general flaw, namely, uncertainty of the validity of results. Inductive reasoning is always uncertain, because it is not based upon exhaustive evidence (BORTZ and DÖRING 2002,299).

The implication for the researcher regarding the selection of a scientific paradigm and the appropriate technique is best understood through the following example. Assuming a social science phenomenon like collective action involving humans and their real-life experiences, a positivist might choose 'observation' as his research method but fail to interpret his insights, because he or she seeks to provide causal explanations and objective research findings (see also PERRY, RIEGE and BROWN 1999 for further explanation on this point). In fact observation is a constructivist research methodology and as such requires a subjective view of knowledge development and how the researcher engages with the researched, e.g. triangulation[8] of several perceptions. In brief, a researcher has to select the right paradigm and with it the associated methodology, or vice versa, on the basis of the applied methods the researcher needs to select the related paradigm to achieve logic. However, this does not imply, that only one single scientific paradigm is applied, quite the contrary, a balance of the two paradigms is required to achieve impact both in developing theory and problem-oriented solutions (cf. PARKHE 1993,252; PERRY, RIEGE and BROWN 1999,1956).

Just as pure deduction may prevent the development of new and useful theory, pure induction may prevent the researcher from benefiting from existing theory (PERRY, RIEGE and BROWN 1999,1956).

In his pleading on examining catastrophes from a sociological stance VOSS (2003,21) asks, if sustainability is multivalued and although his example is civil protection from natural disasters, his insights are transferable to the collective action example above. He argues, that the attempt to transfer qualitative generated knowledge (theory) to various but similar real-world situations is most likely to result in different effects, because elsewhere collective action will have different meanings. On the other hand, qualitative generated knowledge, knowing all the details and interactions of collective action, might paralyze in view of the complexity of the matter, i.e. not being able to make decisions without knowingly acting against other peoples' interests (VOSS 2003,21). Both proposed solutions have difficulties determining their optimum. The constructivist approach misses the point where further information leads to confusion. The positivist approach solely improving technical-operational methods does not achieve sustainability, because fixation on technical solutions results in ignorance of unscheduled variations in research projects (VOSS 2003,21 emphasis added). Therefore, VOSS (2003,22) argues that only the development of a normative guideline allowing for variability debunking detailed solutions as counterproductive and providing a framework for planning research from all disciplines will safeguard natural resources and hence prevent civil catastrophes. Consequently, understanding is necessary of the complementary means of research approaches and their overall conceptual paradigms to integrate findings in an overall concept.

[8] Triangulation is the combination of several perceptions in the study of the same reality (PERRY, RIEGE and BROWN 1999,1952).

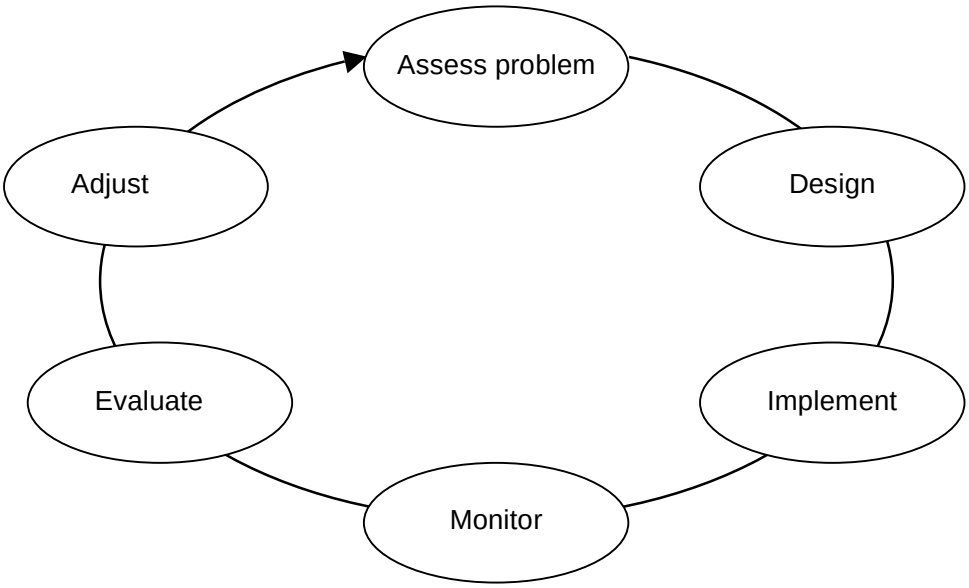
The need to emphasize the constructivist paradigm stems from the dominance of the positivist paradigm in the scientific world and curriculum. Natural resource management systems comprise of both, a biological-technical system that requires positivistic solutions and a sociological-institutional system that requires constructivist solutions. Only a balance of the two scientific paradigms will achieve sustainability.

2.3.3 Increasing Capacity for Adaptive Management

Coastal fishery ecosystems are complex and dynamic. As a result, our understanding of them is limited and the outcome of certain management strategies is uncertain. The main problem lies in the mismatch of coastal ecosystem change and coastal governance (AIDENVIRONMENT 2004,9). KNOFLACHER and GIGLER (2004,3) describe three reasons that limit the influence of general law on the complex interactions between human actors and physical impacts: (1) each individual lives under different conditions, (2) individual values and objectives are variable, and (3) the probability of getting punished if violating the law depends on the number of violations. Adaptive management is an approach to learn from the outcomes of management actions for continually improving management policies and practices (NYBERG 1999,i) in an environment characterized by complexity, uncertainty, and unexpected situations (HOLLING 1978, cited in KNOFLACHER and GIGLER 2004,1). In other words, adaptive management is an integrated, multidisciplinary approach for managing natural resources (KNOFLACHER and GIGLER 2004,2) acknowledging, that natural systems always change as a result of human intervention and therefore require an adaptive, learning approach that is capable of responding to such changes (GUNDERSON 1999,1). *"The approach attempts to find viable solutions in situations where many stakeholders with differing objectives facing limited information must make decisions"* (KNOFLACHER and GIGLER 2004,2). Thereby, ecosystem management is seen as a long-term experiment that builds on its results, both failure and success, as it progresses (AIDENVIRONMENT 2004,9). The key elements of adaptive management include the experiment itself, the monitoring of the management process, and the involvement of all stakeholders, providing input and taking part in decision-making (KNOFLACHER and GIGLER 2004,2).

Applying adaptive management involves six main steps and begins with the (1) **problem assessment**, i.e. the collection of ecological, socioeconomic and institutional information. Then the management plan is (2) **designed**, including the definition of goals, priorities and a monitoring program that will provide reliable feedback. Next the plan is (3) **implemented**, assumptions formulated, and working hypotheses selected. In step four the assumptions and *"hypothesized relationships"* are tested via ecological and socioeconomic (4) **monitoring**, to determine the effectiveness of the plan in meeting the management objectives. This step is followed by an (5) **evaluation** of the actual outcome in contrast to the assumptions. In the last step understanding gained in each of the steps is integrated back into the cycle of improvement to (6) **adjust** the management plan, e.g. reassess the problem, select different objectives or to optimize decision-making. Therefore communicating results and involving all relevant stakeholders from the very beginning is crucial (KNOFLACHER and GIGLER 2004,2), especially for long-term projects. The six steps are shown in Figure 5. (AIDENVIRONMENT 2004,9; NYBERG 1999,1-2)

Figure 5: Framework for adaptive management.



Source: NYBERG (1999,2)

2.3.4 Addressing People through Participatory Action Research

Effective adaptive management requires all stakeholders associated with sustainable ecosystem management problems to develop solutions together. Participation in decision-making encourages stakeholders to buy into outcomes and see them implemented. Thus putting people in the centre of research for development is crucial. This strategy follows the principles of Integrated Rural Development (IRD) that emanated in the 1970´s. IRD has been criticized for its ambitious development goals and limited realization (THIMM and URFF 1982,398-401; RAUCH 1997,363). RAUCH (1997,363) becomes concrete, formulating two questions that relate to the successful implementation of IRD. (1) How can IRD development goals be implemented under prevailing adverse local conditions? (2) Who is responsible and for what in case of implementing IRD? For further clarification participatory action research is chosen from the research methodologies, according to HACKMAN (1992, cited in SANKARAN 2001) *"the research question should drive the methodology"*. Participatory action research is a methodology that builds upon a learning process. In addition, participatory action research enhances the capacity of adaptive management by developing the mandate of science, i.e. scientists no longer remain external actors but instead engage with the studied community (PROBST and HAGMANN 2003,9). The role of the action researcher is to help communities to identify and adopt more sustainable natural resource management practices (ALLEN, 2001,2). Thereby the establishment of the learning process greatly relies on the facilitative skills of the researcher, i.e. asking the right questions at the right time (HAGMANN et al. 2000,9). The quality of facilitation proved to be the most important factor for setting off the learning process in integrated natural resources management research carried out by HAGMANN et al. (2000,9). They experienced, that this skill proved to be the most difficult to learn by development workers and local people. These two elements of participatory

action research, the learning process and the quality of facilitation, are important for a people-centered approach. Through self-reflection people learn about the consequences of their present perceptions, behavior and its long-term effects, as well as possible solutions to it, which further leads to an ownership of the problem (HAGMANN et al. 2000,9). OJA and SMULYAN (1989,14) emphasize, *"that effective social change depends on the commitment and understanding of those involved in the change process"*. HAGMANN et al. (2000,9) discovered that *"values of ownership, participation, and emancipation were crucial in facilitating the 'construction of new realities'"*. There is a striking parallel and a possible emerging answer here to the difficulties in implementing the emancipatory principles in natural resource management that have been guiding rural development approaches since the 1980´s as described by RAUCH (1997,364-368). However, HAGMANN et al. (2000,9) identified three core elements to guide the facilitation process: (1) a vision as a guideline, (2) empathy and *"the ability to question apparently simple things"*, and (3) a facilitation framework that *"defines the objectives, key questions and issues, core methodologies and partners for each process step"*. Bearing this in mind action researchers are responsible for building shared visions and developing a learning environment enabling people to shape their future (ALLEN 2001a,2).

2.3.5 Understanding Complexity: Becoming Focused System Thinkers

In 10 years of practical experience with integrated natural resource management in Zimbabwe HAGMANN et al. (2002,11) recall, that *"at the beginning we tried to understand the livelihood system through analyzing the system from outside"*. They soon learned, that this was of limited understanding to them and that *"the only way to understand it better was through action within the system and through becoming an actor ourselves"* (HAGMANN et al. 2000,11). This *"pro-active process"* with other actors from within rather than 'understanding complexity' through system analysis from outside *"was the key success factor in the identification of the most effective intervention points"* (HAGMANN et al. 2000,11). CAMPBELL and HAGMANN (2003,5) paraphrasing GUNDERSON and HOLLING (2002) argue, that complexity is not boundless but has its own natural subdivisions and boundaries and that further analysis may identify three to five key variables that drive the system. CAMPBELL and HAGMANN (2003,5) support the use of a 'throwaway' model designed for specific purposes that identifies and focuses on the (1) key drivers, the (2) key response variables and the (3) key intervention points of a particular system. Unfortunately, the question how to identify the key drivers of the problem being addressed remains unsolved (CAMPBELL and HAGMANN 2003,12). However, the authors point out, that they reveal themselves in the research process. Thereby it is important to initially 'cast the net wider', i.e. include a broader set of system boundaries beyond the researched system, and to identify interactions that might have a great impact on the overall system (CAMPBELL and HAGMANN 2003,5; HAGMANN et al. 2000,11).

HAGMANN et al. (2000,12) stress, that *"we better give up the notion that we can ever analyze, understand and even control all the factors in complex, non-linear systems like livelihoods and ecosystems from outside"*. They argue, that it is impossible to assess the systems dynamics from a clear reference point, because the reference point is always

moving. Instead they suggest interacting with the system and observing how research intervention induces change. In practice this implies focusing on parts of the system with the assumption that *"the part is not the whole, but can lead to it"* (HAGMANN et al. 2000,12). While recognizing all the complexity and *"through developing empathy to the felt needs of the participants"* (STREHLOW and PETERS 2004,5) the challenge is not to get lost (HAGMANN et al. 2000,13). In order not to lose focus HAGMANN et al. (2002,13) emphasize the use of a 'vision[9]' as guideline. In their research the strategic orientation from the beginning earmarked the choice of priority research topics and the integration of different components. In practice this meant, that issues, needing less attention or if research capacities were limited, were 'outsourced' to other actors to deal with. On the other hand if certain issues no longer had high priority, they were neglected. In this respect HAGMANN et al. (2000,13) emphasize strategic partnerships and networking. At a later date HAGMANN et al. (2000,13) complemented their strategic orientation with a *"conceptual and operational framework and guiding principles for process facilitation and management"*.

To reach impact at different levels both "hard" and "soft" research is required (HAGMANN et al. 2000,14). HAGMANN et al. (2000,14) experienced that "hard" research, e.g. on land degradation, demonstrated the need for "soft" research, e.g. building capacity for adaptive management. Thereby technical issues were the entry points for research, because technical issues proved to be more at the center of local people's lives than philosophy (HAGMANN et al. 2000,14).

HAGMANN et al. (2000,14) conclude, that in order to prioritize which traits to follow and how to interconnect the various research findings in a complex natural resource management system, a lot of common sense and a strong, shared vision is required.

2.4 Definitions of Terms and Concepts in Integrated Natural Resources Management

2.4.1 Natural Resources

Generally speaking natural resources are commodities that are considered valuable in their natural form, i.e. when the primary activity associated with it, is extraction as opposed to creation. Hence oil, coal, wood and fish are considered natural resources, while agricultural products are not. (WIKIPEDIA)

A more advanced and explicit definition from the CGIAR (2003,4) refers to natural resources, *"as geophysical resources of water, soil and its productive qualities, intermediate and long term carbon stocks, biodiversity of the managed landscapes, and the stability and resilience of the ecosystem of which agriculture is a part."*

According to the CGIAR definition AUTY (2003,6) specifies three categories of natural resources: renewable resources, finite resources and the global pollution sinks. However,

[9] In the INRM research project carried out by HAGMANN et al. (2000,13) this vision was the desire to improve rural life in a process whereby local people use their own potential to manage their resources adaptively.

for the following argumentation natural resources are classified into finite (non-renewable) and infinite (renewable) resources.

Finite natural resources are for example fossil fuels like coal or mineral oil, as well as iron ore and gold. The key characteristics of these finite resources are, that once extracted they are exhausted.

Infinite natural resources are generally living resources, e.g. fish and forests, which can renew themselves at approximately the rate at which they are extracted, if they are not overharvested. Non-living infinite natural resources include soil, water, wind and solar radiation. The unsustainable management of natural resources or resource degradation is no novelty and there is an enormous body of existing literature. The persistence of this problem and the various approaches to better management of natural resources demonstrate the need to look at more complex aspects of the framework natural resources are embedded in (RASMUSSEN and MEINZEN-DICK 1995,2). Independent from Rasmussen's and Meinzen-Dick's research objective determining the factors that affect local organization for natural resource management, I would like to focus on the physical and technical characteristics of natural resources as described by various authors (see SCHERR et al. 1995 for further discussion on this point). The physical characteristics focus on the excludability, i.e. how can others be excluded from using the resource, the subtractability, i.e. how does the use of the resource by one individual reduce the amount available to others, and the capacity, i.e. quantity and availability across time and space (adapted from RASMUSSEN and MEINZEN-DICK 1995,10). Moreover, technical characteristics also determine who will withdraw resources. However, terms that are applied easily on the mainland are not easily transferred to the oceans (MANN-BORGESE 1998,2). Hereby MANN-BORGESE (1998,2) refers to the fact, that fishery resources do not accept boundaries; boundaries that not only are ignored by fish but also by pollution and resource user-groups. In this regard the management of natural resources is of utmost importance.

2.4.2 Natural Resources Management

The ongoing degradation of natural resources through overexploitation and environmental destruction has led to a flood of literature dealing with the management of natural resources. Resources like fish, wildlife, surface and groundwater, rangelands and forests are by nature common-property resources (FEENY et al. 1990,3). According to FEENY et al.'s (1990,3-4) study on HARDIN'S (1968) *"The Tragedy of the Commons"* model common-property resources share two characteristics as described above: i) excludability and ii) subtractability. The control of access by potential users may not only be costly but in some cases impossible, e.g. migratory fish or groundwater. On the other hand *"the level of exploitation by one user adversely affects the ability of another user to exploit the resource"*, e.g. the harvest of fish by one user will reduce the catch per unit effort of other fishermen.

Besides the characteristics of the resource one needs to differentiate between the property-rights regimes under which the resource is held (FEENY et al. 1990,3-4). FEENY et al. (1990,4-5) continue describing four property-rights regimes based on ELINOR OSTROM (1986; cf. OSTROM 1990; OSTROM 1998): **open access**, i.e. access to the resource is

unregulated and open to everyone, **private property**, i.e. individuals or groups regulate the use of the resource and have the right to exclude others, these rights are usually exclusive and transferable, **communal property**, i.e. a community of resource-users excludes outsiders while regulating the use within their community, these rights are usually of equal access and use, and last **state property**, i.e. access to the resource and the level of exploitation are regulated by the government.

However, in a literature review conducted by BÉNÉ (2003,949-975), dealing with the socio-institutional mechanisms governing people's access to fisheries resources, he proposes four categories that exemplify the institutional richness in fishing communities. Although Béné thrives to shed light on the misperception of poverty in fisheries he accidentally disproves the *"open-access"* nature of the resource. His typology of *"socio-institutional"* processes leading to the exclusion or constraint of individuals over the resource includes: **economic exclusion**, i.e. fisheries are not open access but require entry-costs, **social marginalization**, i.e. the denial of command over a resource by individuals, groups, or communities based on social criteria such as caste, gender, or origin, **class exploitation**, i.e. the establishment of exploitation patron-client relationships between social classes whereby the poor are involved in the economic activity, and **political disempowerment**, i.e. the exclusion of the poor based on power whereby elites engage exclusively in decision-making processes and institution making to their own advantage.

BÉNÉ (2003,951) and FEENY et al. (1990,5,12) share the perception, that HARDIN'S (1968) fable *"The Tragedy of the Commons"* is incomplete and limited in explaining the overexploitation of a resource. Instead the authors conclude that access and use of a resource depends on a whole array of institutional arrangements.

A review of the published literature on natural resource management institutions conducted by DEBORAH SICK (2002,ii) reveals, that various institutional arrangements are possible for managing natural resources. The most crucial elements define user-groups, resource boundaries, use-rights, and responsibilities. The simplest form of management is the establishment of conservation areas to protect environmental resources. But the cost of excluding local people from resource management is high (SICK 2002,8). In addition, separating people from their environment and preventing them from utilizing natural resources leads to conflict and rejection of the introduced institutions. Consequently the literature in SICK'S (2002,5) review accentuates the benefit of local people actively managing resources. BOCOUM et al. (2003) express this in their title *"Social Inclusion: a pre-requisite for equitable and sustainable natural resource management"*. The attempt to incorporate conservation and development objectives has resulted in an *"explosion"* of Community-Based Resource Management (CBRM) (SICK 2003,6), also known as Community-Based Natural Resource Management (CBNRM). Matching the scale of local decision-making and management with the scale of environmental and ecological processes has led to the establishment of co-management (SICK 2003,7). There is no widely accepted definition of the exact nature of co-management schemes (BERKES, GEORGE and PRESTON 1991,12; SICK 2003,8). However both studies agree, that cooperative-management involves the combination of local and state-led resource management. The wider implication implies, that governments provide administrative, regulatory and infrastructural capacities for efficient resource utilization and protection, while communities of resource users provide their knowledge and presence in the

resource system to encourage the protection of resources, the monitoring, and enforcement of rules, for equal opportunities and the devolution[10] of natural resource management (BERKES, FAST and BERKES 1996,4; SICK 2003,8). In this respect SICK (2003,28) concludes that the effectiveness of shared decision-making for equitable and sustainable natural resource management depends on the democratic climate (see also DEVAS and GRANT 2003,307 for further discussion on this point).

The development and introduction of institutions by outsiders rather than by the multi-stakeholder communities themselves is the biggest problem in the establishment of successful CBRM and co-management (SICK 2003,9). SICK (2003,9) links this to the *"overly simplistic notion of two key concepts of CBRM"*, namely 'community' and 'participation'. All too often communities are seen as homogenous groups rather than multiple interest groups struggling over power and resources. These community-differences including age, income, religion, caste, ethnicity and gender inhibit participation regarding which citizens exercise influence and control over decision-making processes (DEVAS and GRANT 2003,309). Furthermore many studies indicate that in reality most local participation in natural resource management initiatives has been passive or limited to more visible community elites (SICK 2003,9; DEVAS and GRANT 2003,309-310; BOCOUM et al. 2003,11). Unfortunately increasing participatory research to empower local communities and establish partnerships between formal researchers and local stakeholders is looked upon as 'muddying the waters' by mixing development-driven agendas with research-driven ones (SUMBERG and OKALI 1997, cited in HUMPHRIES et al. 2000,2). *"As human activity remains the major destructive force in nature, improving natural resource management primarily requires changing human behavior"* (RÖLING 1994, 1996, 2000, cited in PROBST and HAGMANN 2003,2). Therefore it is necessary, that local people be in the centre of research efforts in resource management and owners of the innovations in order to improve decision-making and their willingness to participate (PROBST and HAGMANN 2003,2). But simple inclusion in management processes does not imply, that decision-making is effective and reflects the needs and priorities of local citizens. In heavily funded projects external donors often dominate decision-making (SICK 2003,10) and the accountability of local governments is often low in respect to the actual use of resources and delivery of services (DEVAS and GRANT 2003,314). Participatory learning and action research approaches as in integrated natural resource management seek to strengthen the capacities of local stakeholders ultimately leading to the application of market-led and demand-oriented approaches not only to achieve local impact but also to generate strategic knowledge (PROBST and HAGMANN 2003,10-12). The authors conclude, that the implementation of participatory approaches is difficult and outcomes often unpredictable. But because integrated natural resource management underpins, that *"decisions must be made, owned and internalized by NR managers and other stakeholders"* and acts as a strong tool to build awareness, it is the first choice in complex natural resource management (CAMPBELL and HAGMANN 2003,2-4). ZANETELL and KNUTH'S (2004,803) work on factors that influence the willingness to participate in a Venezuelan freshwater fishery underline this assertion

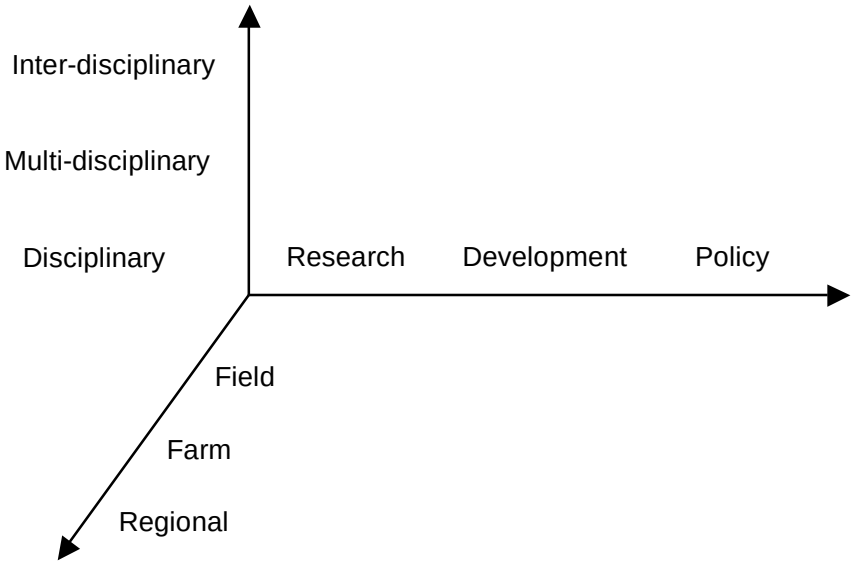
[10] Devolution is the transfer of rights and responsibilities from central government agencies to user groups at the local level (MEINZEN-DICK and KNOX 1999,42).

concluding *"that willingness to participate and thus CBM could be enhanced by extension efforts that raise villager awareness (…)"*.

2.4.3 Integration of Diverse Elements

The need to adopt a more integrated approach in NRM emanates from concerns, that "*ecological sustainability cover broader geographical areas than fields and farms, and NRM research ought to be able to benefit large numbers of people"* (KAM et al. 2000,3). Integrated natural resources management is about understanding the existing interactions between the resource system and social dynamics and the relationships among levels of organization (KAM et al. 2000,3). However KAM et al. (2000,3) point out, that there are many facets of integration in integrated natural resources management. In CAMPBELL and HAGMANN'S (2003,4) work towards the establishment of a conceptual and operational framework for integrated natural resource management they state: *"integration is the central concept in INRM"*. There are several dimensions of integration in integrated natural resource management. One is the integration of multi-stakeholders. This integration is divided into (i) the integration of more stakeholders in more communities and (ii) the integration across scales, i.e. local and national government organizations (CGIAR 2003,8) or what KAM et al. (2000,3) call *"strengthen linkages along the research-development-policy continuum"* (Figure x). Second is the integration across disciplines to go beyond sectoral considerations (KAM et al. 2000,3). This assertion implies, that (i) for example the fishery, aquaculture, and agricultural sector are not viewed independently from each other and (ii) that effects of natural resource overexploitation are studied from an ecological, biological, sociological, economical, organizational, institutional, and political perspective. TOWNSLEY (1998,146) describes, how the intensification of agriculture or urban and industrial development can have strong impacts on the aquatic habitat. He continuous, that unless planning and policy are coordinated across sectors, efforts to manage aquatic resources are ineffective. Last but not least is the integration across geographical and socio-ecological scales, i.e. going beyond site specificity (KAM et al. 2000,3) and (i) expanding integrated natural resources management efforts from fields to farms and further to other regions (Figure 6), as well as (ii) taking various socio-ecologic components such as markets, prices or fishing arrangements into consideration.

Figure 6: Integration of diverse elements.



Source: adapted from KAM et al. (2000,14)

Integration does not imply, that every relevant element within a natural resource system is researched on and added to the research framework (CAMPBELL and HAGMANN 2003,4). Instead *"pragmatism dictates that we only integrate those additional components, stakeholders or scales that appear to be essential to solving the problem at hand"* (CAMPBELL and HAGMANN 2003,4). Thereby the cost of adding an additional element to the research framework has to be less than the benefits of adding this element (CAMPBELL and HAGMANN 2003,4). This rule of thumb may be applied in decision-making when efficient use of human and financial resources within a given time frame is required to achieve adaptive and sustainable management of natural resources.

2.4.4 The Sustainable Livelihoods Concept

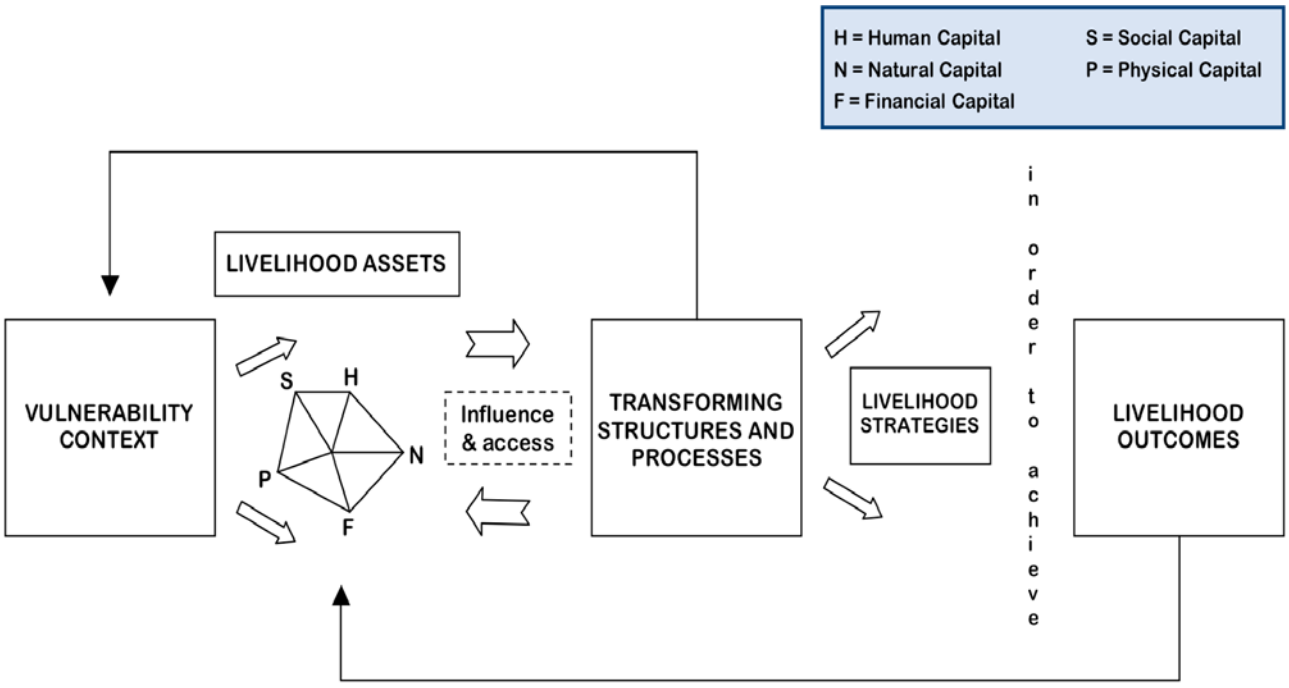
In 1997 the Department for International Development (DFID) developed the sustainable rural livelihoods approach (CARNEY 1998,3). The main objective of this approach is to improve livelihoods and to protect and improve the management of the natural and physical environment thus contributing to poverty eradication (CARNEY 1998,3). The holistic and dynamic sustainable livelihood framework (CARNEY 1998,21) was developed as a versatile tool for use in planning and management to help order complexity and the many factors that affect livelihoods (DFID 1999). One of the core principals of the sustainable livelihoods approach is putting people at the center of development (DFID 1999). On the other hand *"the central concept of INRM is based on the sustainable rural livelihoods framework"* (STREHLOW and PETERS 2004,2). The sustainable livelihoods framework not only acts as a tool in integrated natural resources management research but also reminds the integrated natural resources management scientist of the multiple aspects and the complexity of a natural resource system (STREHLOW and PETERS 2004,2) (see DFID 1999; MEINZEN-DICK and ADATO 2001,6 for further discussion on this point). Furthermore the sustainable livelihoods framework has found broad application in

assessing the impact of integrated natural resource management (MEINZEN-DICK and ADATO 2001,1; GOTTRET and WHITE 2001,3). Sustainable rural livelihoods are defined as follows:

> *"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base."* (CHAMBERS and HAGMANN 1992, cited in SCOONES 1998,5)

The conceptual framework for sustainable livelihoods is depicted in Figure 7. The framework is dynamic, recognizing changes due to both external influence and the results of people's own action (MEINZEN-DICK and ADATO 2001,3). In the center of the contemplation stand the livelihoods assets illustrated through the capital pentagon. The vulnerability context frames the external environment and is affected by state and private structures, policies, institutions, and processes. The outcomes are livelihood strategies to cope with the given circumstances in order to achieve a balanced life on the basis of sustainable natural resource use. These outcomes are not static but feed back into the future asset base ((MEINZEN-DICK and ADATO 2001,3).

Figure 7: The sustainable livelihoods framework.



Source: DFID 2000

The **livelihood assets** lie at the center of the livelihood framework within the vulnerability context (DFID 1999). The asset base upon which people build their livelihoods identifies

five core asset categories or types of capital[11] as depicted in figure x (MEINZEN-DICK and ADATO 2001,3; DFID 1999). The ability to pursue different livelihood strategies is dependent on people's access to assets (SCOONES 1998,7). The shape of the pentagon symbolizes the variation in people's access to assets (DFID 1999). The center point represents zero access to assets while the outer boundary represents maximum access to assets (DFID 1999). Therefore the shape of the pentagon varies according to the different communities and their asset base (DFID 1999). The sustainable livelihood framework from the DFID (1999) defines five types of assets:

- Human capital represents skills, knowledge, ability to labor and good health. MEINZEN-DICK and ADATO (2001,4) suggest local knowledge of flora, fauna, or the ecosystem as particular valuable assets for integrated natural resources management. For example, a good fisherman knows how to catch fish considering factors such as location, time, seasonality, equipment, techniques and markets. This is particular important when inexperienced immigrants and outsiders enter the fishing sector choosing illegal fishing techniques to compensate for their lack of knowledge.
- Social capital refers to networks that increase people's trust and ability to work together and to expand their access to wider institutions and organizations; membership of more formalized groups; relationships of trust, reciprocity and exchanges that facilitate cooperation, reduce transaction costs and provide informal safety nets. For example, fishermen might contact other fishermen to inform them of the appearance of fish schools and their location expecting to be informed in return to reduce costs and time searching for fish.
- Natural capital includes land, forests, marine resources, water and the services deriving from them such as air quality, erosion protection, waste assimilation, storm protection and the state of biodiversity. MEINZEN-DICK and ADATO (2001,4) point out, that these assets may be under different property rights regimes (private ownership, common property) or that individuals may only have certain use rights over the resources. Especially the biodiversity of aquatic resources is important, as various low-value species of fish, mollusks, and shellfish have a recognized role in food supply and income–generation strategies (TOWNSLEY 1998,139). For example, fishing communities with lack of access to land and therefore limited opportunities pursuing alternative livelihood strategies may enter the fishing sector as a last resort.
- Physical capital comprises basic infrastructure like transportation, roads, buildings, water supply and sanitation, energy, technology, and access to information (communication). Although some fishermen own a big motorized boat for example, they are not necessarily better off than those fishermen using small motorized boats because of high maintenance, labor and gas costs. In another example, a fisherman's boat might not be his own but borrowed from a middleman with the obligation to sell his catch for a lower price.

[11] The term 'capital' does not refer to capital in the strict economic sense but perhaps is best thought of as livelihood building blocks (DFID 1999).

- Financial capital refers to the financial resources available such as savings (cash or liquid assets), credit, or regular inflows (pensions, subsidies, and remittances). Financial capital is the most versatile type of capital, as it can be used to acquire natural, physical, and human capital, e.g. purchase of land, access to fishing equipment and to education (KLEITH, GREENHALGH and OUDWATER 2003,39). In dependence on the example above, middlemen often act as moneylenders offering informal credit to fishermen and although perceived as exploitative, it has the advantage of being locally available with no bureaucratic hassle (KLEITH, GREENHALGH and OUDWATER 2003,40).

A **vulnerability context** surrounds the external environment in which people live (DFID 1999). The DFID (1999) continues, *"people's livelihoods and the wider availability of assets are fundamentally affected by critical trends, shocks, and seasonality – over which they have limited or no control"*. According to the DFID (1999) the vulnerability context encompasses:

- Trends in population, resource degradation or regeneration (MEINZEN-DICK and ADATO 2001,3), national/international economies e.g. increasing investment in aquaculture may have negative impact on small-scale and artisanal operations (TOWNSLEY 1998,146), governance (politics), or technology;
- Shocks like conflict, changes in human or crop/livestock health e.g. in aquaculture the spread of disease from cultured species to the wild (TOWNSLEY 1998,146), natural disasters, or sudden economic changes; and
- Seasonality in resource availability (MEINZEN-DICK and ADATO 2001,3), prices, production, employment opportunities, or health.

Vulnerability in this context is usually negative but it can also provide opportunities (MEINZEN-DICK and ADATO 2001,3). Moreover, it is not only actual vulnerability that matters but also people's perceived vulnerability that makes them vulnerable and influences people's decisions and thus their livelihood strategies (MEINZEN-DICK and ADATO 2001,3). MEINZEN-DICK and ADATO (2001,3) emphasize this matter, as *"it is especially important for whether people are willing or interested in adopting INRM practices"*.

Transforming structures and processes within the livelihood framework are the organizations[12], institutions[13], policies and legislation that affect how people use their assets in pursuit of different livelihood strategies (DFID 1999; MEINZEN-DICK and ADATO 2001,4). Moreover, organizations and institutions or structures and processes have the greatest impact on sustainable livelihoods and therefore are the key for development interventions (SCOONES 1998,12; CARNEY 1998,12; GOTTRET and WHITE 2001,4; DFID 1999).

[12] An organization is characterized through the implementation of an institution forming a concrete agency defined by institutions.

[13] The term institution stands for the mechanisms, rules, and customs by which people and organizations interact with each other. These often so called 'rules of the game' may be formal or informal structure market transactions and make the behavior of organizations somewhat predictable. (DFID 1999)

- Structures are the *"hardware"* – the organizations, both private (companies, cooperatives, NGOs[14]) and public (ministries, departments) that exist at various levels from local through to international and that set and implement policy and legislation, provide services, purchase, trade, and perform all kinds of other functions that affect rural livelihoods (DFID 1999).
- Processes are the *"software"* – the policies, laws (international agreements), institutions (markets, use rights), and culture (societal norms and beliefs, power relations) that determine the way in which structures and individuals operate and interact (DFID 1999).

These formal and informal institutions and organizations shape livelihoods by both influencing access to assets and inter-personal relations (DFID 1999). On the other hand the people may influence the policy-makers, hence reinforcing the two-way 'influence & access' arrows between people's assets and transforming structures and processes (DFID 1999). TOWNSLEY (1998,144) describes how according to people's level of investment in resource use, i.e. physical capital, they participate in decision-making. But he also emphasizes, that processes are often dominated by a relatively small number of gear and craft owners to the exclusion of the far larger group of small-scale fishermen. Transforming structures and processes also has an indirect influence on people's livelihoods by directly affecting the vulnerability context, e.g. state-enacted family planning may reverse population growth and lower the pressure on natural resources just as the seasonality of prices may be accompanied by a market information system thus lowering producers susceptibility to fluctuations of market prices.

The outcome is an enormous diversity of **livelihood strategies** whereby households and individuals may pursue multiple strategies simultaneously (DFID 1999; MEINZEN-DICK and ADATO 2001,4). These somewhat adaptive strategies can include farming and fishing, non-farm enterprises, or seasonal and permanent migration of household members between urban and rural centers (DFID 1999; MEINZEN-DICK and ADATO 2001,4-5). This implies, that households and communities must be viewed in their wider context, i.e. we should not assume, that a fisherman will remain a fisherman his entire life just as urban people considered wage laborers might engage in fishing activities nor should we overlook even small livelihood strategies (MEINZEN-DICK and ADATO 2001,5; DFID 1999). MEINZEN-DICK and ADATO (2001,5) emphasize this point, because *"the pursuit of multiple activities can have important implications for cash and labor availability at different times of the year, and hence of the adoption of INRM practices"*.

The last elements of the sustainable livelihood framework are the **livelihood outcomes** that are achievements of certain livelihood strategies (DFID 1999). The DFID (1999) continues: *"livelihood outcomes are important because they help us to understand (…) people's priorities, why they do what they do, and where the major constraints lie"*. Potential outcomes according to the DFID (1999) include:

- More income – Although often criticized people continue to seek higher net returns to the activities they undertake. In SCOONES (1998,5) diagram of a sustainable livelihood he equates the creation of more working days with more income.

[14] Non-governmental organizations (NGOs) are non-profit, value-based organizations independent from governments that pursue activities to eradicate poverty, manage natural resources and implement projects with the goal of addressing social problems (WORLD BANK 2001).

- Increased well-being – The notion of 'well-being' refers to non-material goods that affect people's sense of well-being such as self-esteem, security, happiness, stress, vulnerability, power, exclusion (CHAMBERS 1989, cited in SCOONES 1998,6), or access to services, political enfranchisement, and maintenance of their cultural heritage.
- Reduced vulnerability – Strengthening resilience to better cope with and recover from stresses and shocks enables people to adapt their livelihoods (DAVIES 1996, cited in SCOONES 1998,6) through avoidance, repartitioning, resistance or tolerance mechanisms (PAYNE and LIPTON 1994, cited in SCOONES 1998,6).
- Improved food security – Food security, a core dimension with fundamental importance, has evolved from participatory poverty assessment, which revealed, that hunger and dietary inadequacy are distinct dimensions of deprivation.
- More sustainable use of the natural resource base – Although most rural livelihoods depend on the natural resource base and environmental sustainability is often viewed as a donor objective, its dimension is not adequately captured in the other livelihood outcome categories above. In addition short-term survival rather than sustainable management of natural resources is often the priority of people living in poverty (CARNEY 1998,9). There is no doubt of the long-term benefits that accrue from cautious resource use. However assessing natural resource sustainability remains notoriously difficult (SCOONES 1998,7).

Livelihood outcomes are often incommensurable and sometimes have negative impacts on the livelihood assets (note the feedback arrow), e.g. higher income may be achieved through unsustainable action using destructive fishing techniques. The sustainable livelihood framework does not offer any answers to these dilemmas but provides a structure to guide development activities in a comprehensive way to find solutions to the problems at hand (DFID 1999).

Applying the framework to integrated natural resource management is indicated in Figure 7. By this integrated natural resources management affects the vulnerability context, is linked to the asset base or a part of the policies, institutions, and processes (MEINZEN-DICK and ADATO 2001,7). Integrated natural resources management can reduce vulnerability through diversifying livelihood strategies, shape the asset base by adapting sustainable fishing techniques that improve the natural capital of aquatic resources, or be part of the policies, institutions, and processes that promote and enforce sustainable fishing techniques. Furthermore, participatory or action research processes can strengthen the human and social capital asset base generating knowledge and encouraging collective action and cooperation (MEINZEN-DICK and ADATO 2001,7). MEINZEN-DICK and ADATO (2001,8) provide further examples for the use of the sustainable livelihood framework to explain the adoption or rejection of integrated natural resources management practices. They found that vulnerability especially to climatic or biophysical shocks and deteriorating trends provided a motivation for integrated natural resources management research and practices. Moreover, this finding highlights the importance of perceived vulnerability over conventional measures like average income. Of similar importance in the adoption of integrated natural resources management practices is the expanded treatment of assets, i.e. considering more than natural capital especially remittances, infrastructure, knowledge, and relationships among people.

> *"Recognizing that agriculture is only one possible livelihood strategy (…) and that people invest in more than just their farms makes impact assessment more accurate, and helps explain people's strategies in adopting or not adopting INRM practices"* (MEINZEN-DICK and ADATO 2001,8-9).

MEINZEN-DICK and ADATO (2001,9) assert, that neither integrated natural resources management practices requiring significant costs are adopted nor benefits valued, if investment in human capital rather than natural capital is the objective. They report, that people often know, that they are degrading the resource base through unsustainable practices, *"but that this is a conscious strategy to fund their children's education, so that the next generation will have a better life, outside of farming"*.

Last but not least MEINZEN-DICK and ADATO (2001,9) emphasize the benefit of using a common conceptual framework as the sustainable livelihood framework that simplifies comparison of results between case studies.

MEINZEN-DICK and ADATO (2001,11) also identified **limitations of the sustainable livelihoods framework** in the context of agricultural research. They suggest including 'cultural capital' in the framework arguing that beliefs, traditions, language, festivals, and sacred sites are centrally important in people's lives, especially where these assets are transformed into tourism or handicraft production.

The second aspect, MEINZEN-DICK and ADATO (2001,11) are missing in the framework, is empowerment and its presence, absence or change, as it has significant influence on people's livelihoods. Whereas the institutional dimension of decision-making power is captured through the transforming structures and processes and the social capital dimension of the framework, especially when relating to households, it is more difficult to apply this at the level of individuals.

Thirdly, the importance of the historical factors that influence people depending on their experience in the past is not explicitly recognized in the framework. These findings are used to underline, that the framework does not include a temporal dimension, although livelihood strategies, the vulnerability context and the asset portfolio are often in a state of flux.

Finally, MEINZEN-DICK and ADATO (2001,12) experienced limited participation in their research when structuring the participation around the sustainable livelihood framework, because some participants had difficulty in using the framework's concepts and this led to less time for problem and priority assessment. Using brainstorming techniques first and introducing the framework later in the research process avoided this problem.

The sustainable livelihood framework is gaining in popularity (MEINZEN-DICK and ADATO 2001,15). However it was never designed to paint an exact picture of reality but to stimulate reflection and learning (DFID 1999). Keeping the wider picture in mind the framework can help to identify entry points for development interventions (SCOONES 1998,14).

2.4.5 Participatory Action Research

This section sets out to identify the main characteristics of participatory action research in great detail for the following reasons: (1) participatory action research offers a view how

all science can be understood according to the constructivist paradigm (WADSWORTH 1998,2) and (2) it is a well-established tool for implementing integrated natural resource management (CAMPBELL and HAGMANN 2003,6).

Action research comprises a family of research methodologies (ALLEN 2001a,1) and acts as an umbrella term as mentioned above. The more recent term 'participatory action research' stresses the participatory component albeit no general diction exists and the domain of the concept remains *"fuzzy"* (GRØNHAUG and OLSON 1999,10; also cf. RAPOPORT 1970,499-503; SUSMAN and EVERED 1978,586-588; ALLEN 2001a,1; WADSWORTH 1998,1-2). Despite the proliferation of meanings and uses of the term action research the differences of some of the efforts are minor and particular contexts are overall quite complementary (NOFFKE 1994,9). The reason for the diversity of approaches lies in the history of action research and in the multitudes of contexts where it has taken root (NOFFKE 1994,12). RAPOPORT (1970,499-501) locates four streams of development in the history of action research namely, the Tavistock stream, the operational research stream, the group dynamics stream, and the applied anthropology stream. He also describes how the original concepts and methods were developed in the context of social psychiatry and later spread to other fields, e.g. industry, clinical area, family and community. Keeping the historical background in mind helps to understand the conceptual formulation of action research, i.e. the role of the action researcher in collaboration with the client to work through a problematic situation and perhaps detect a deeper underlying problem which bears analogy to earlier work based on psychoanalytic situations (RAPOPORT 1970,502). This circumstance is reflected in a term used by SOFER in 1961 called *"social consultancy"* (SOFER 1961, cited in RAPOPORT 1970,503) and which recurs 42 years later with apparent resemblance in CAMPBELL and HAGMANN'S (2003,6) work linking integrated natural resource management with action research comparing the process with *"marriage counseling"*. However Kurt Lewin played a significant role in introducing the term action research in the 1940's and his work is most frequently cited (ADELMAN 1993, cited in NOFFKE 1994,10).

Although over the years action research has become more and more accepted and visible, it has also been criticized for producing *"research of mediocre quality"* (GRØNHAUG and OLSON 1999,6). According to GRØNHAUG and OLSON (1999,7) the main reason for such criticism lies in how scientific knowledge is produced. Their particular view is reflected in the following quote:

> *"The term 'research' literally means search again ('re' (lat.) – 'again'), indicating that research can be considered a process unfolding over time, but also that accepted truths may be questioned and reexamined. The word 'science' is derived from the Latin word 'scire', 'to know'. Throughout history, knowledge has been acquired in various ways. One way of acquiring knowledge is through what has been termed 'the scientific approach'. As will be dealt with shortly, there is no common agreement on what is the proper scientific approach, nor on what constitutes scientific knowledge."*

GRØNHAUG and OLSON (1999,7) continue, that knowledge is something, that we know is "true" or following a different perception, knowledge is created by society and is what society believes to be "correct". In their elaboration scientific knowledge, consisting of theories, is knowledge that has repeatedly survived rigorous falsification attempts (cf. CALDER, PHILLIPS and TYBOUT 1981,198). In this regard research testing theory under

laboratory settings with homogeneous samples leads to stronger test of the theory than heterogeneous samples under field conditions (CALDER, PHILLIPS and TYBOUT 1981,206). But one should resist jumping to conclusions. CALDER, PHILLIPS and TYBOUT (1981,205) differentiate between *"effects research"* perceived as *"intuitively practical"* and *"theory research"* perceived as *"academically respectable"*.

Effects research aims to obtain findings in a research setting corresponding to a real-world situation that can be generalized. This real-world situation usually is heterogeneous and the research methods applied are not only different, but also incompatible with the methods that lead to theory application. CALDER, PHILLIPS and TYBOUT (1981,205) conclude, that effects research *"rests on very soft ground"* and may be viewed as *"reasoning by analogy"*, i.e. research conditions are related to events in the real world, thereby reasoning by analogy does not depend on logic but on the researcher's insights and could improve through the use of more qualitative methods.

Theory research aims to identify scientific theories through falsification procedures that provide a general understanding of the real world. The ideal theory falsification procedure consists of homogeneous respondents, because it allows for a stronger test of the theory, in contrast a heterogeneous group makes precise predictions more difficult. Theory research rests on the logical principle of falsification, i.e. methodological procedures that expose theories to refutation (CALDER, PHILLIPS and TYBOUT 1981,206). However in a second often neglected step accepted theories need to be applied to the real world to ensure, that they will yield usable interventions and the interventions perform as predicted by the theories, whereby qualitative methods are not essential (CALDER, PHILLIPS and TYBOUT 1981,206).

The lessons learned here are, that effects application and theory application are based on different philosophical assumptions, in sum are incompatible, and therefore can only be evaluated according to the research goal and procedure pursued, if needless criticism within the disciplines is to be avoided (CALDER, PHILLIPS and TYBOUT 1981,206). GRØNHAUG and OLSON (1999,7) pinpoint research and knowledge creation to the philosophy of science perspective held by the researcher including *"core assumptions about ontology, epistemology and human nature"*. This in turn leads to the old debate about value- and ideology-free observation and analysis, perhaps possible in the physical sciences but virtually impossible in social sciences (cf. BROWN and TANDON 1983,281). According to this subjective-objective dimension, better known as constructivism versus positivism, *"action research can base its legitimacy as science in philosophical traditions that are different from those which legitimate positivist science"* (SUSMAN and EVERED 1978,582). SUSMAN and EVERED (1978,582), who criticize positivist science for failing to generate knowledge for use in problem solving within organizational science, e.g. resource-users in a natural resource system, provide alternative methods of science as found in action research (emphasis added). The *"crisis in organizational science"* is reflected in a *"separation of theory from practice"*, i.e. published research is only read by researchers rather than practitioners and as a result practitioners and clients complain, that published research lacks relevance to the problems they face (SUSMAN and EVERED 1978,582). SUSMAN and EVERED (1978,597) argue, *"the action researcher brings theoretical knowledge as well as breadth of experience to the problem-solving process"* and *"the client brings practical knowledge and experience of the situation in which they are trying to solve problems"*. In an attempt to explain why researchers and clients should

interact and complement their knowledge base, GRØNHAUG and OLSON (1999,10) differentiate between clients *"experienced-based knowledge"* and researchers *"theory-based knowledge"*. They are both experts collaborating in analysis, selection of alternative actions, and evaluation of outcomes to serve the objective to solve the problem at hand (SUSMAN and EVERED 1978,598). As organizations are created by human beings and do not exist independently, actions within them have consequences that must be faced by the action researcher and which success depends on understanding the values of the relevant actors (SUSMAN and EVERED 1978,598). Developing empathy to the felt needs of the participants is therefore an effective means for making the knowledge of the researcher useful and accepted by the clients (SUSMAN and EVERED 1978,599). And last but not least SUSMAN and EVERED (1978,599) quote an argument, that if the world would be structured logically, *"one could work out possible consequences of taking an action without ever having to take the action"*. However, in action research exists a dualism, whereby knowledge not only is gained by acting in the real-world situation, *"but the situation itself is simultaneously a product of the current level of knowledge"* (SUSMAN and EVERED 1978,599). Consequently, SUSMAN and EVERED (1978,600) suggest the use of action research, when the object of analysis is a *"self-reflecting subject"* or when the research problem that needs to be solved has been defined together with the actors.

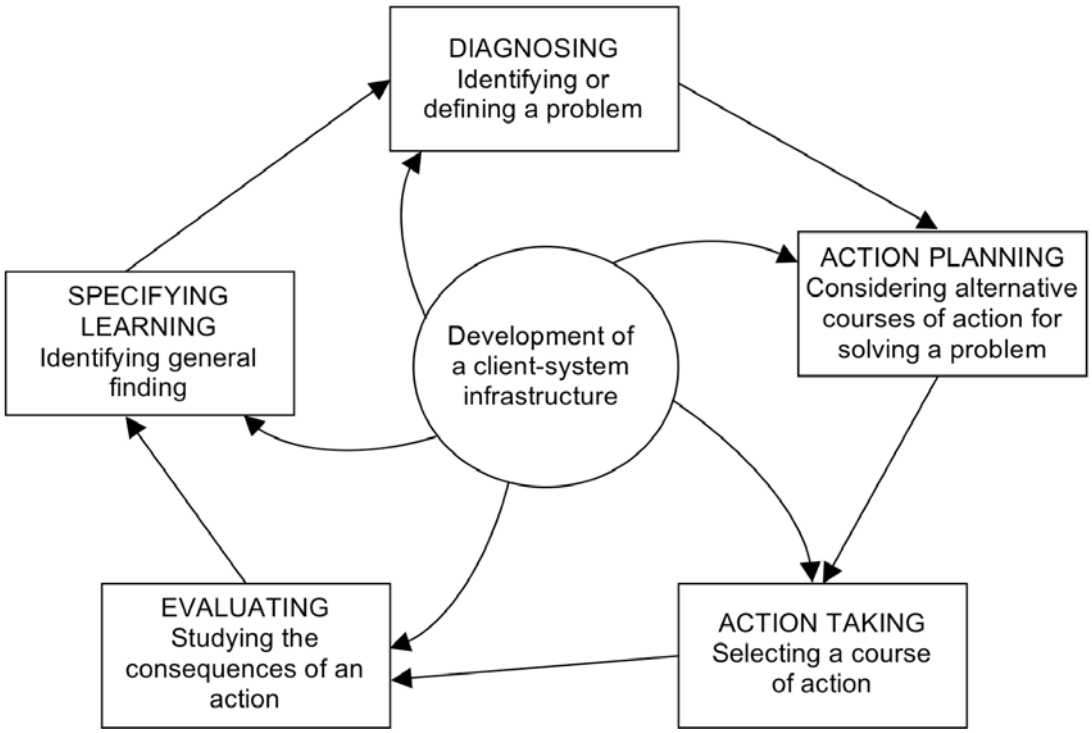
But what exactly is action research one would ask after these rather explicit remarks? Certainly the most commonly used definition originates from RAPOPORT (1970,499):

> *"Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework."*

However there is no commonly agreed definition of action research and different authors have different descriptions and understandings of action research or in other words *"(…) what to subsume under and what to exclude from action research is not self-evident, and the domain of the concept is rather fuzzy"* (GRØNHAUG and OLSON 1999,10). Hence I will offer a bird's eye view of what action research comprises.

In Rapoport's definition he focuses on the aims of action research and the collaboration of researchers and clients. Although these are important elements, a key aspect of action research is the cyclical research process (SUSMAN and EVERED 1978,588) also referred to as iterative learning cycle in integrated natural resource management (CAMPBELL and HAGMANN 2003,7) (Figure 8). The learning cycle reflects the fundamental concept of action research, namely, 'learning by doing' and provides a framework to make this process more visible (ALLEN 2001a,5-6; for further discussion see KOLB 1984). It consists of five phases: diagnosing, action planning, action taking, evaluating, and specifying learning (SUSMAN and EVERED 1978,588) and is depicted more comprehensive in Figure 8.

Figure 8. The cyclical process of action research



Source: SUSMAN and EVERED (1978,588)

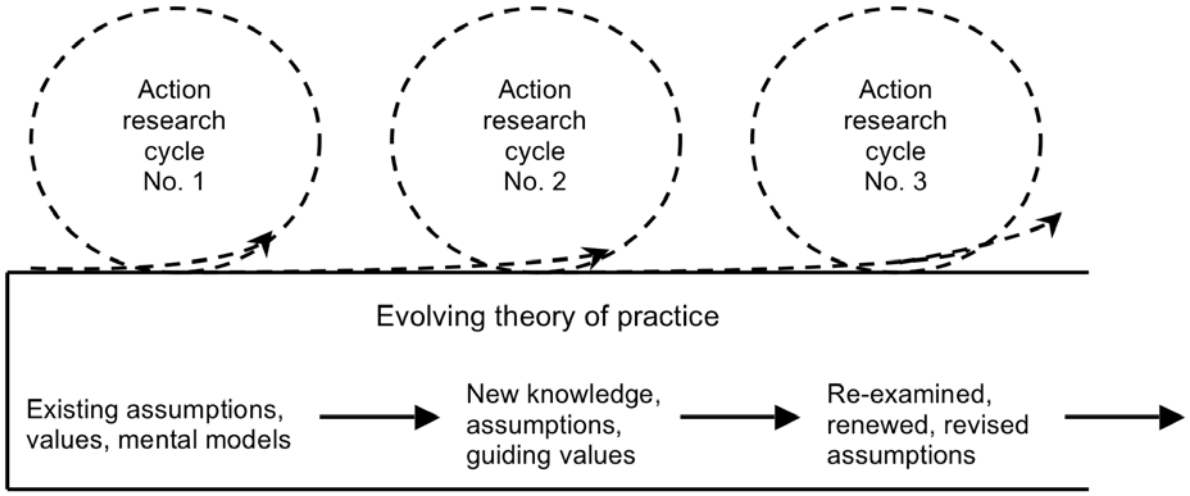
Although SUSMAN and EVERED (1978,588) consider all five phases necessary for a comprehensive definition of action research, they admit, that in reality the number of phases in an action research project may differ. For example the researcher may *"only be involved in collecting data for diagnosis and feeding the data back to the client system"* (SUSMAN and EVERED 1978,588). They continue, that in addition to the difference in the number of phases in the research cycle different techniques for data collection may be used in the diagnosing and evaluating phase such as questionnaires, semi-structured interviews, observation, focus group discussions, or records, memos, and reports from the client system dependent on the researcher's skills and backgrounds (cf. ALLEN 2001a,6).

In contrast to conventional research that starts with a precise research question and strives to answer it with precision, action research cannot be fully detailed in advance and then rigorously carried out (DICK 1993,10). The reason for this lies in the nature of the social system that demands responsiveness and flexibility and action research provides that responsiveness (DICK 1993,8). Action research develops progressively, according to the events and analyses during the research project, i.e. the objective, the problem, and the research methods generate from the process itself and the consequences of selected actions are not fully known ahead of time (SUSMAN and EVERED 1978,590). Although many will find this odd and rather a disadvantage of action research, closer examination reveals responsiveness the true virtue of action research. *"It is what allows you to turn unpromising beginnings into effective endings (…) and improve both action and research outcomes through a process of iteration"* (DICK 1993,8). In this context I would like to stress, that responsiveness and replicability are mutually exclusive (see DICK 1993,28 for

further discussion on this point). Conventional research sacrifices responsiveness to achieve replicability and uses elements such as control, standardization, statistics, etc. to gain their rigor (DICK 1993,28).

The rigor in action research is achieved through assuring the quality of the collected data and the correctness of interpretation, i.e. the interpretation offered by the researcher is consistent with the data and satisfies him and others (DICK 1993,8). The most effective way of doing this is the use of what GUMMESSON (1991) calls the *"hermeneutic spiral*[15]*"*, where each turn builds on the understanding of the previous turn or paraphrasing DICK (1993,10) who calls this a process of iteration, whereby each cycle challenges the information and interpretation from earlier cycles, i.e. at each of the steps you learn something and at other steps you either confirm previous learning or decide from experience, that your previous learning was inadequate as shown in Figure 9 (GUMMESSON 1991, cited in DICK 1993,13). Like this, each interview becomes a turn of the research spiral (DICK 1993,12). As mentioned before in action research the initial research question is likely to be fuzzy. The methodology will be fuzzy too and the best you can hope for is a fuzzy answer. DICK (1993,11) uses this wording to exemplify the spiral process that refines both question and methods to achieve less fuzzy questions, methods, and answers and eventually converges towards precision.

Figure 9. Action research cycles.



Source: adapted from DAMME (1998)

The action research cycles involve action and reflection that emphasizes understanding and learning. This form of learning is what ARGYRIS (1983,116) calls *"double-loop learning"* and is related to the nonroutine, long-range outcome. According to GRØNHAUG and OLSON (1999,10) the underlying assumption is, that new knowledge will change the cognitive structure of the actor's or their reality construction and this will initiate change for improvements (see HAGMANN et al. 2000,7 for further discussion on this point).

[15] Hermeneutic refers to the theory and practice of interpretation; the spiral indicates that interpretation does not simply come back to the place from which it set out (cf. SUSMAN and EVERED 1978,595).

HAGMANN et al. (2000,7) refers to this as awareness building. In their research project HAGMANN et al. (2000,9) facilitate critical self-awareness and self-discovery through asking the right questions at the right time. Hence the quality of the relationship between the researcher and the client plays an important role.

"One of the key principles of action research is: let the data decide." Hereby DICK (1993,11) refers one last time to the research cycle implying, that one needs to use the information available from different data sources or in other words creating dialectic. DICK (1993,11) equates dialectic with triangulation that may be achieved through:

- Different informants, or different samples of informants;
- Different research settings (to increase the generalisability);
- The same informant responding to different questions which address the same topic from a different point of view;
- Different researchers;
- Different methods.

BROWN and TANDON (1983,278) provide a powerful example of applied action research. In their analysis of a research project carried out by PASMORE and FRIEDLANDER (1982) they evaluate why an epidemic of mysterious 'sore arms' struck almost a third of an electronic plant's 300 workers. Although at the beginning of the research project a conflict erupted between managers and employees and PASMORE and FRIEDLANDER (1982) were shocked by top management's resistance to study results, the incidence of sore arms began a steep and continuing decline throughout the research process. PASMORE and FRIEDLANDER (1982) demonstrate, that it depends on the researcher's skills to manage conflict and maintain acceptance by multiple interests (BROWN and TANDON 1983,289-290). This example demonstrates the capacity of action research to generate knowledge for use in solving problems that members of organizations face. GRØNHAUG and OLSON (1999,12) challenge the action researcher to determine, whether the observed relationships are true to assure that the knowledge produced is 'scientific'.

After presenting the merits of action research I would like to clarify some of the limitation of this research approach. The close researcher-client relationship bears a *"threat of reactivity"* (GRØNHAUG and OLSON 1999,12) or what RAPOPORT (1970,503) calls *"ethical dilemma"*. Briefly this means that personal involvement in the client organization's affair may result in bias (RAPOPORT 1970,505).

The second dilemma is what RAPOPORT (1970,505) calls *"goal dilemma"* which refers to the tendency of the client system and the scientific community to become separated. That means on the one side social research that is purely service oriented with little or no yield for social science and on the opposite 'ivory tower' extreme the researcher who has used the client system to gather information for scientific purpose but with no or little relevance to the client system (RAPOPORT 1970,506). ARGYRIS (1983,115) complains about client-centered scholars that failed to question how clients themselves defined their problems and that ignored the building and testing of propositions and theories.

Argyris assertion is reminiscent of RAPOPORT'S (1983,508) last dilemma termed *"dilemma of initiative"*. RAPOPORT (1983,508) places the initiative with the client who states that he has a problem that needs to be solved and approaches the social scientist,

which contrasts with the academic world where the scholars are protected from the outside world, so that they may conduct the unbiased pursuit of knowledge (RAPOPORT 1983,508). This challenges the researcher twofold. If the researcher allowed the definition of the problem to rest too exclusively with the client, he might be eroding the scientific goals and on the other hand if he were too brusque in pressing his own perception, he might jeopardize the research because of resistance from the client system (RAPOPORT 1983,509). However, RAPOPORT (1983,510) evokes action researchers *"to take initiatives hitherto unthinkable in academic spheres"* to be effective.

HAGMANN et al. (2000,9), who applied action research within an integrated natural resources management project carried out in Zimbabwe for over 10 years, offer several answers in resolving the various dilemmas associated with action research and attribute the main difficulties in the research project to facilitation of the learning process, which requires several skills and conditions:

- **A clear vision and the values of the process goal**. The vision acts as a *"guiding star"* not to get lost in the research process and enables the facilitator (researcher) to be flexible and ask the 'right' questions to enhance learning. Therefore the facilitator needs to be one step ahead and guide the process but not its outcome. The vision builds upon values as for example: development based on participation, ownership, people's self-development, transparency, etc.
- **Empathy and the 'culture of inquiry'**. The facilitator needs to be able to empathize with the clients in order to react appropriately. Hereby *"empathy goes beyond knowledge about group dynamics, as it is a skill that depends on personality and emotional intelligence"* (GOLEMAN 1988, cited in HAGMANN et al. 2000,9). The 'culture of inquiry' is another skill and resembles the ability to ask apparently simple questions to get down to detail, as the 'real' problems often lie in the details. Aside from that this process reveals the mental models of the clients and enables the deconstruction through their own reflection, whereby new ways of thinking and acting can be generated.
- **Clear understanding of the process design and steps**. An operational framework defines the objectives, key questions and issues, core methodologies and partners for each process step and is a necessity for beginners in process facilitation. Once having gone through a whole process cycle with its ups and downs facilitators gain understanding that helps to reduce the frustration experienced, when things do not go as desired and enables them to implement and modify process steps according to their own experience, empathy and common sense.

Besides these skills GRØNHAUG and OLSON (1999,13) emphasize **the importance of process documentation**, i.e. detailed recording of the research activities and the steps how action researchers have arrived at their interpretations and actions to allow for re-examination of reported findings and legitimate action research, a step, which they sense, is often neglected in the literature they examined.

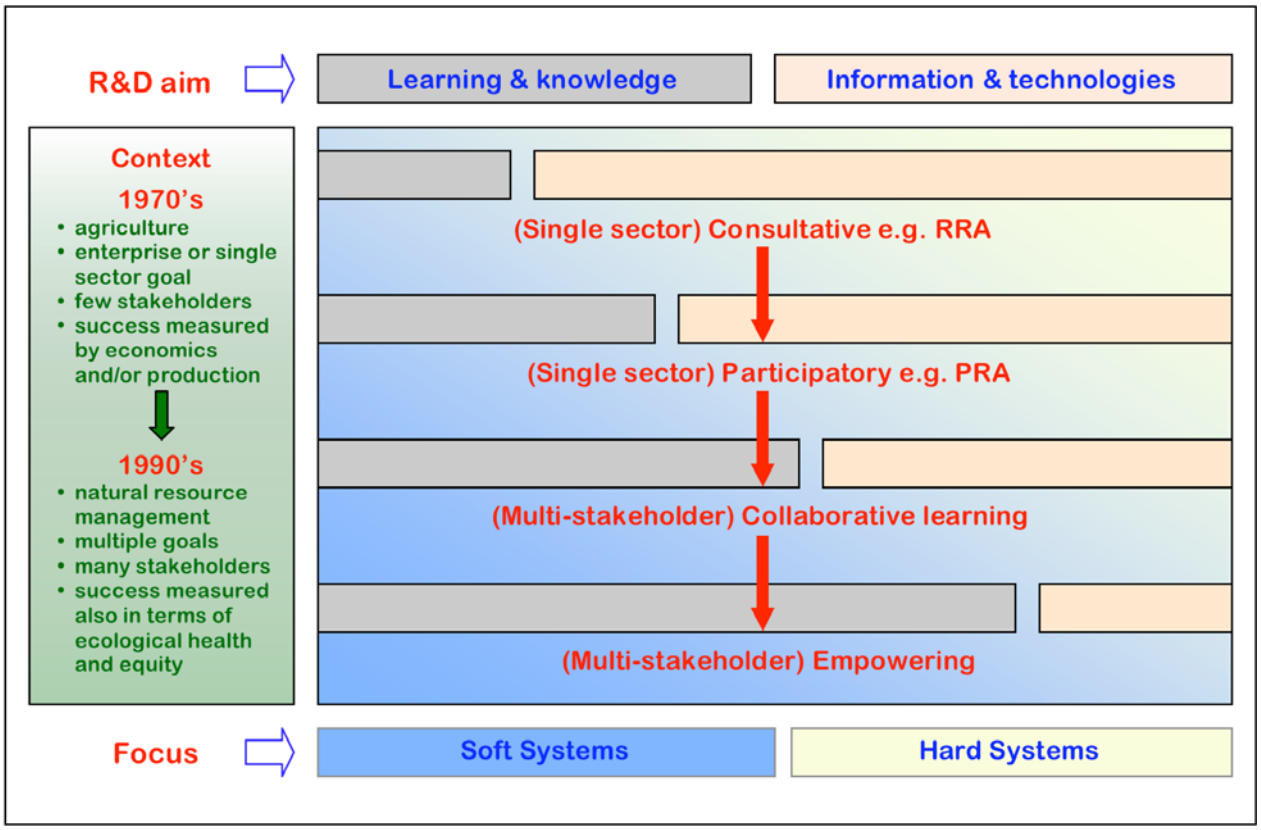
The role of participatory action research in integrated natural resource management is fundamental. As complex systems such as natural resource management can only be explored through action within the system, participatory action research is a key success factor to exploit the potentials of these approaches (PROBST and HAGMANN 2003,12). CAMPBELL and HAGMANN (2003,6) simply adapted the learning cycle of action research

to integrated natural resource management and specified each process step (Figure x). However HAGMANN et al. (2000,19) point out, that the framework presented does not claim to be complete or universal and requires further development and that participatory action research should not be considered the panacea methodology in integrated natural resource management, as this would be very reductionist (2000,8).

2.4.6 Interdisciplinarity: Blending "Hard" and "Soft" Science

The early efforts in research and development (R&D) focused on approaches that provided 'information and technologies' to improve farm production and productivity. These approaches can be regarded as 'hard systems' also associated with positivism. In the following years as researchers became aware of the importance to involve clients in the research process, more participatory approaches emerged. In recent years R&D efforts have broadened to look more generally at natural resource management and help the multiple stakeholders involved to develop a shared understanding and a coordinated response to achieve sustainable development. These approaches that bring about 'learning and knowledge' and focus on the human activity are termed 'soft systems' and are associated with constructivism. The different dimensions are illustrated in Figure 10. (ALLEN 2000,4)

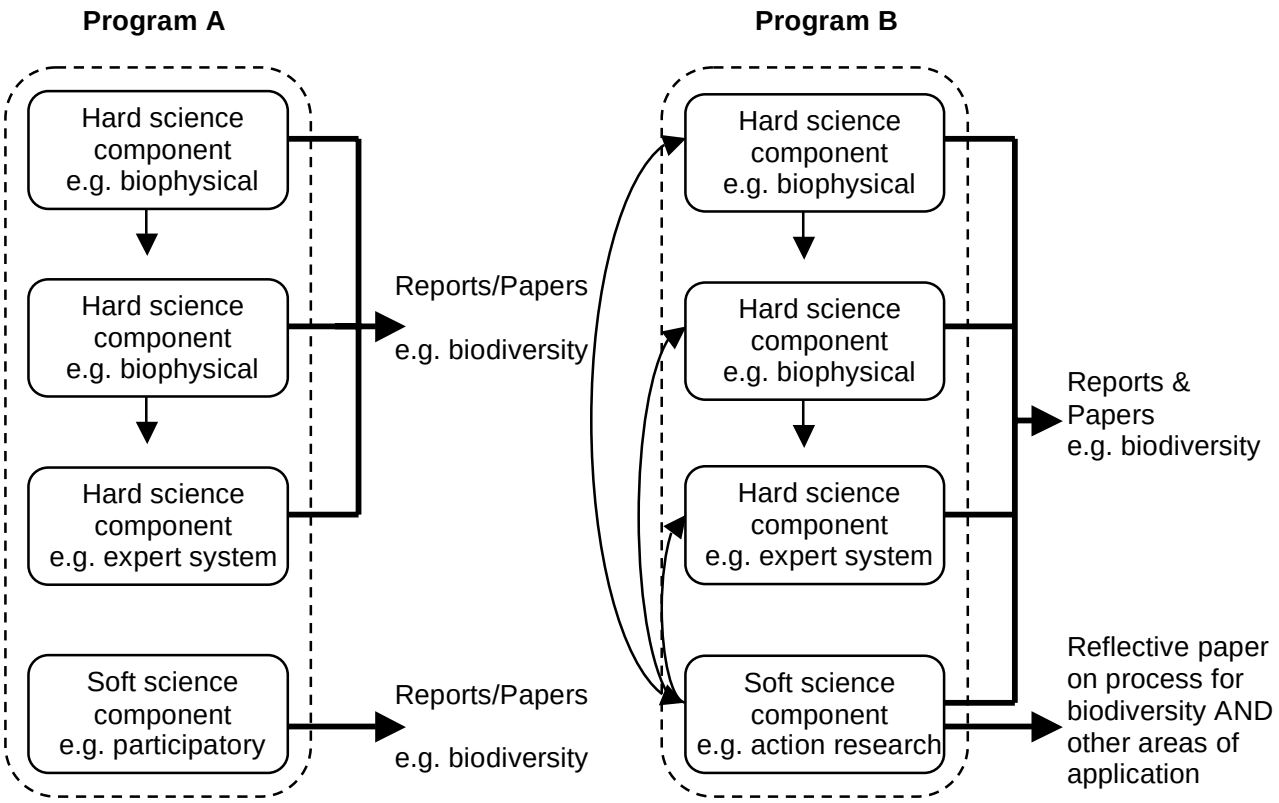
Figure 10: Changes in key characteristics of evolving approaches to involve people in natural resource management research and development.



Source: adapted and modified from ALLEN (2000,4)

In CAMPBELL and HAGMANN'S (2003,2) keynote paper *"Rising to the Challenge of Poverty and Environmental Sustainability: Towards a conceptual and operational framework for INRM"* they call for *"a new type of science", that balances 'hard' and 'soft' approaches*. This does not imply, that positivist, 'hard' science has no right to exist and needs to be replaced but rather used within a constructivist perspective and combined with social, 'soft' approaches *"maintaining excellence in disciplinary science while moving towards synthesis"* (CAMPBELL and HAGMANN 2003,10). Integrated natural resource management focuses on integrating natural system and institutional social dimensions through an emphasis on cross-disciplinary integration. Successful integrated natural resources management therefore needs people from different disciplinary and social backgrounds to work together (DOUTHWAITE et al. 2001a). However it is not enough to include a participatory component to fulfill the social science requirement (MCALLISTER and VERNOOY 1999,6). Such an assumption would fail to recognize the limitations of *"quick and dirty"* participatory methods and their potential to misrepresent complex social realities (ALLEN 2001b,2). Unfortunately participation has often been used to *"get local people to do what researchers or project leaders want"* rather than to involve local people in project design and strategy (GOEBEL 1998,279). The following Figure 11 demonstrates, how participatory exercises within conventional research programs (see Figure x, Program A) were merely seen as another way of producing a paper or output with no apparent linkages back into research implementation (ALLEN 2001b,2). In more integrated programs (see Figure 11, Program B) the participatory component is viewed as complementary, reinforcing other technical components and through building a social environment improves interest and ownership in the results of the research (ALLEN 2001b,3).

Figure 11. Research programs integrating (Program B) or excluding (Program A) participatory components to complement 'hard' technical components.



Source: ALLEN (2001,3)

Choosing action research as soft science component has several advantages: (1) it contributes to joint understanding and insights (2) and leads to an improved understanding of the wider processes that are required to successfully involve people in such a research project (ALLEN 2001b,3). In order to achieve successful action research the program leadership needs to put *"change and learning project"* on the agenda and keep it there, just as other staff needs to be similarly enthusiastic and dispose characteristics such as being open, self-reflective, and strategic (ALLEN 2001b,3).

Change is an outcome of learning and requires information such as developed in a research program. High levels of social capital must characterize the environment, if the information is to be appreciated by the multiple stakeholders (ALLEN 2001b,5). The reason for emphasizing the social component lies in REYNOLDS and BUSBY'S (1996, cited in ALLEN and KILVINGTON 1999,11) perception, where they point out, that *"it has become clear that major obstacles to increased use of information in decision-making are organizational, not technical in nature"* which challenges multidisciplinary approaches to include personnel with complementary skills in participation and conflict solving and the integration of biophysical and social aspects of problem solving (ALLEN and KILVINGTON 1999,11).

2.4.7 Concepts of Vertical and Horizontal Scaling

To achieve maximum impact in integrated natural resource management and benefit many people across large areas within sensible time frames we need to scale up and out (CAMPBELL and HAGMANN 2003,16; LOVELL, MANDONDO and MORIARTY 2000,6; MENTER et al. 2004,11). However it is not just about improving human well-being, civil society, policymakers, and donors who are increasingly pressuring, that money spent in research and development produces adoptable solutions for the rural poor (ROOTHEART and KAARIA 2004,71; MENTER et al. 2004,11). In a workshop carried out by the International Institute for Rural Reconstruction (IIRR 2000,17) horizontal scaling up/scaling out and vertical scaling up were defined as follows:

> *"**Horizontal scaling** up/scaling out is geographical spread to cover more people and communities through replication and adaptation, and involves expansion within the same sector or stakeholder group.*
>
> ***Vertical scaling** up is moving higher up the ladder. It is institutional in nature and involves other sectors/stakeholder groups in the process of expansion—from the level of grass-roots organizations to policymakers, donors, development institutions, and investors at international levels."*

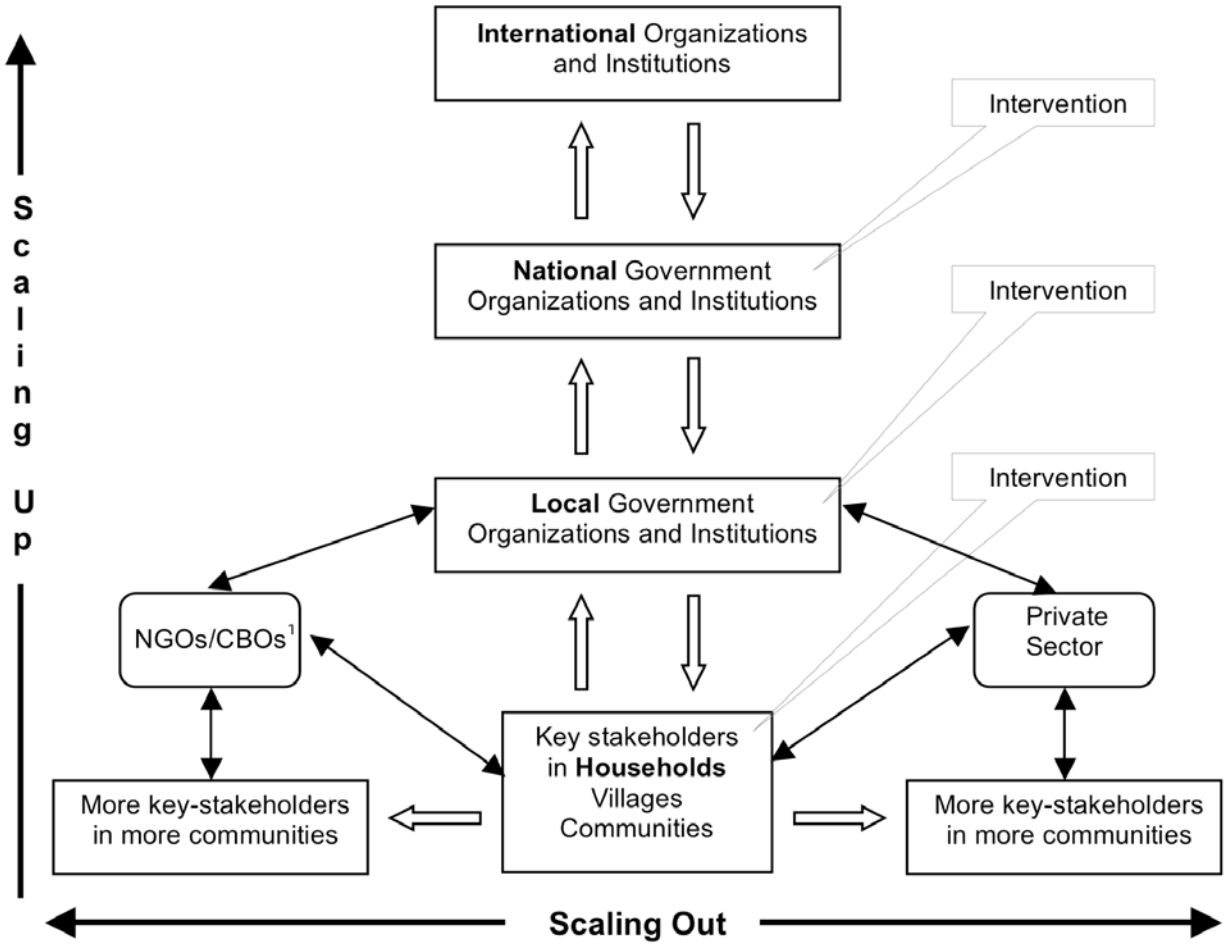
In general horizontal and vertical scaling are linked as displayed in Figure x which means, that as innovations spread geographically the greater the chances of influencing higher scales, on the other hand, communicating options to higher institutional levels increases the chances of horizontal spread (DOUTHWAITE et al. 2001b,11). As integrated natural resource management is complex, many interactions have to be addressed (LOVELL, MANDONDO and MORIARTY 2002,1). That means, that positive and negative externalities from the adoption of new resource management practices need to be assessed and managed, e.g. improved fishing techniques used by one person may destroy fish stocks if used by everyone (HARRINGTON et al. 2001,4). However scaling is not about scaling out technologies but scaling up the processes and principles behind them, just as it is not about replication but adaptation and learning, communicating options to people and strengthening their ability to adapt to changing circumstances (IIRR 2000).

Horizontal scaling out refers to reaching more stakeholders in other communities, leading to expanded geographical coverage of suitable practices (HARRINGTON et al. 2001,4) (Figure 12). Hereby one should not mistake horizontal scaling of more complex research outcomes with the process of dissemination of new technologies, because it implies building capacity and transferring understanding about the underlying principles of an innovation and not just transferring the innovations themselves (MENTER et al. 2004,15-16). HARRINGTON et al. (2001,4) describe several tools that can help in this process, e.g. site similarity analysis, GIS simulation models, and farmer and land type categories. However the success of spatial scaling in integrated natural resource management varies considerably, as integrated natural resources management practices identified at one scale will often be location and time-specific and thus appropriate strategies in one environment can not be applied consistently over huge areas (LOVELL, MANDONDO and MORIARTY 2000,6).

Vertical scaling up depends primarily on relationship building (LOVELL, MANDONDO and MORIARTY 2000,6). It is institutional in nature and involves other sectors or stakeholder groups from the level of grassroots organizations to policymakers, donors, and investors

at international levels (IIRR 2000,17) (Figure 12). Vertical scaling up includes institutionalization, implying that *"institutions accept and internalize the underlying principles of an innovation so that these will remain as guiding principles of practice even after the initial innovative project or program has come to an end"* (ROOTHEART and KAARIA 2004,73). These processes of institutional change are a prerequisite for successful scaling up innovations (MENTER et al. 2004,17). In this respect one of the biggest challenges remaining is how to achieve successful scaling up with institutions that are not used to working multi-disciplinary as integrated natural resource management involves a multi-disciplinary approach and incorporates multiple stakeholders into the research process (MENTER et al. 2004,17).

Figure 12: Concepts of vertical and horizontal scaling.



Source: adapted from DOUTHWAITE and SCHULZ (2001,5); [1] Community-based organizations

In an analysis of four international workshops on participants' experiences MENTER et al. (2004,17-20) identified six key strategies for successful scaling up and out:

- **Incorporating scaling up considerations into project planning**, i.e. scaling up must be considered from the beginning of the research and planning process to increase the impact of research.

- **Capacity building** of farmers, scientific personnel, and the institutional system is an important strategy to foster understanding of the principles underlying the innovations and how they can help communities to adapt to changing circumstances. Although this process occurs in participatory learning and action research processes, this needs to be made explicit in scaling up.
- To assure effective decision making by multiple stakeholders in the scaling-up process **information and learning** to draw lessons and undertake corrections of the project cycles is vital. In the case of integrated natural resource management learning and reflection is immanent within the research approach and embodied through the learning cycle.
- **Building linkages** through developing partnerships and strategic alliances with other stakeholders is crucial and a prerequisite for maximizing impact, as this creates pathways through which innovations can be scaled up.
- Likewise to achieve impacts it is critical to **engage in policy dialogue** at an early stage of the research project. This implies to place research in the context of local, regional, and national development agendas, not only to gather support for innovations and overcome institutional barriers but more important to identify key entry points and the major priorities.
- To **sustain the process** reliable, long-term funding is required. This applies for the donors but also involves paying special attention to mechanisms for self-financing.

Addressing the question of scale in integrated natural resource management has two dimensions see Figure 13. First of all there is the top-down approach, where National Agricultural Research and Extension Systems (NARES) decide which innovations to target and where (DOUTHWAITE et al. 2001b,29). Central to top-down approaches is the implicit hierarchy embedded in organizations and structures and the prevailing top-down information flows that make it difficult to receive bottom-up contributions, such as views of fishermen (RAMISCH 2004,189) (Figure 13). Although the top-down approach apparently misses the element of local ownership and therefore the incentive to undertake any integrated natural resource management strategies, they are essential to assert authority and provide an institutional framework that regulates property rights and helps to formulate and strengthen local institutions that support and enforce resource use agreements (LOVELL, MANDONDO and MORIARTY 2002,11; cf. SCHLAGER and OSTROM 1992,32).

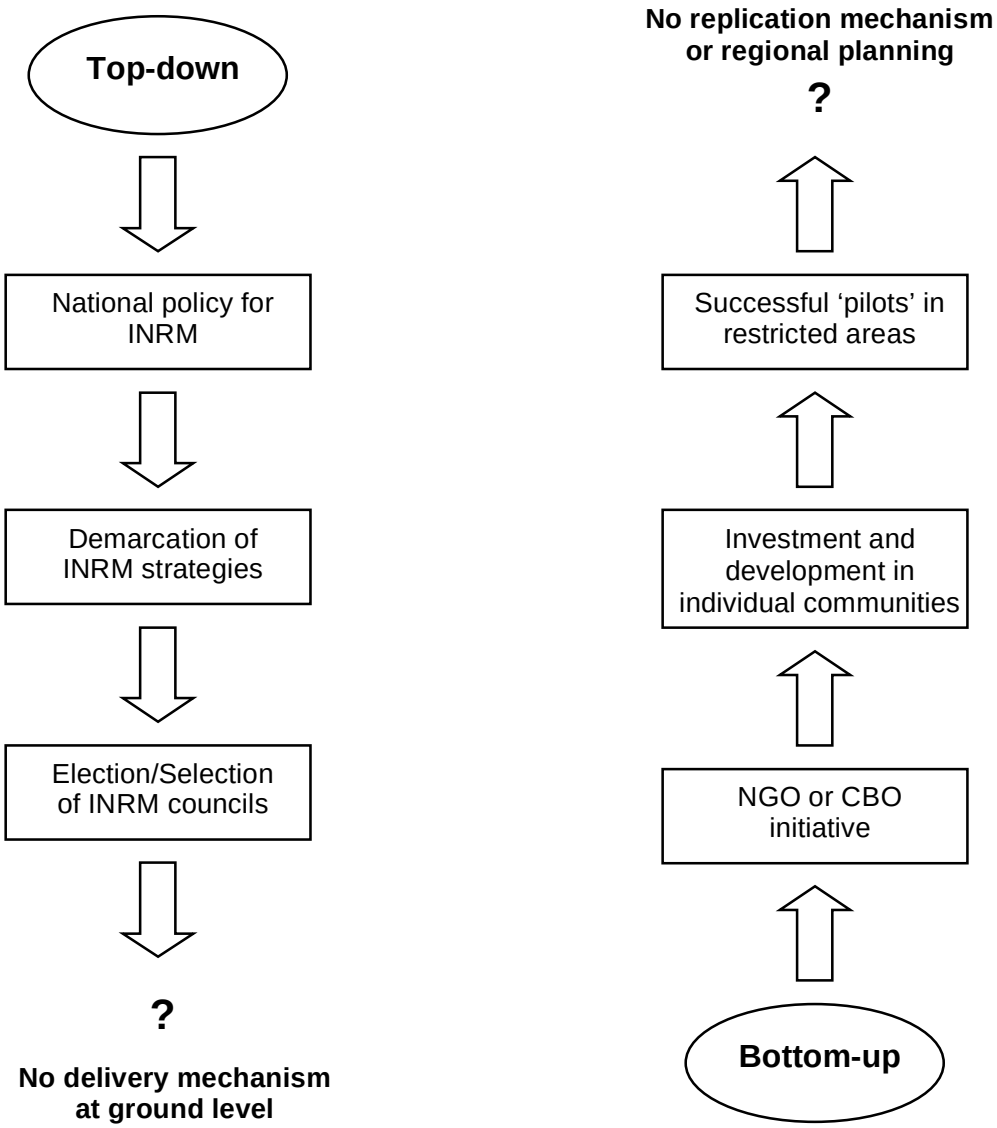
Second is the bottom-up approach that scales up community-based schemes to regional or higher levels (LOVELL, MANDONDO and MORIARTY 2002,10) (Figure 13). Although this approach achieves local ownership of the process, it has disadvantages such as structure, regulation, and equity or in other words *"parachuting to community level, for example, as many external NGOs do, will not help INRM go to scale"* (LOVELL, MANDONDO and MORIARTY 2002,11). LOVELL, MANDONDO and MORIARTY (2002,10) provide the example of communities that are developing projects in headwater catchments that are unlikely to put a high priority on ensuring that downstream users are not adversely affected.

The key issue is to link both top-down approaches (predominately technical) national programs and bottom-up approaches (predominately social/institutional) community-level projects, so that they meet in the middle (LOVELL, MANDONDO and MORIARTY 2002,2).

Hereby *"authority and responsibility for management must be vested at the lowest appropriate level and only delegated upward where absolutely necessary"* (LOVELL, MANDONDO and MORIARTY 2002,11). In order to bridge the gap between top-down and bottom-up approaches in integrated natural resource management, governments and NGOs will have to be committed and share the following principles, LOVELL, MANDONDO and MORIARTY (2002,14) identified to ensure, that integrated natural resource management can be successfully scaled:

- political will for democracy to genuinely empower local communities;
- shared visions across all institutional levels;
- effective coordination of research agendas;
- commitment to a continuous and iterative learning process; and
- long-term financial support.

Figure 13. Reconciling top-down and bottom-up approaches.



Source: adapted from LOVELL, MANDONDO and MORIARTY (2002,10)

2.4.8 A Conceptual Research Framework

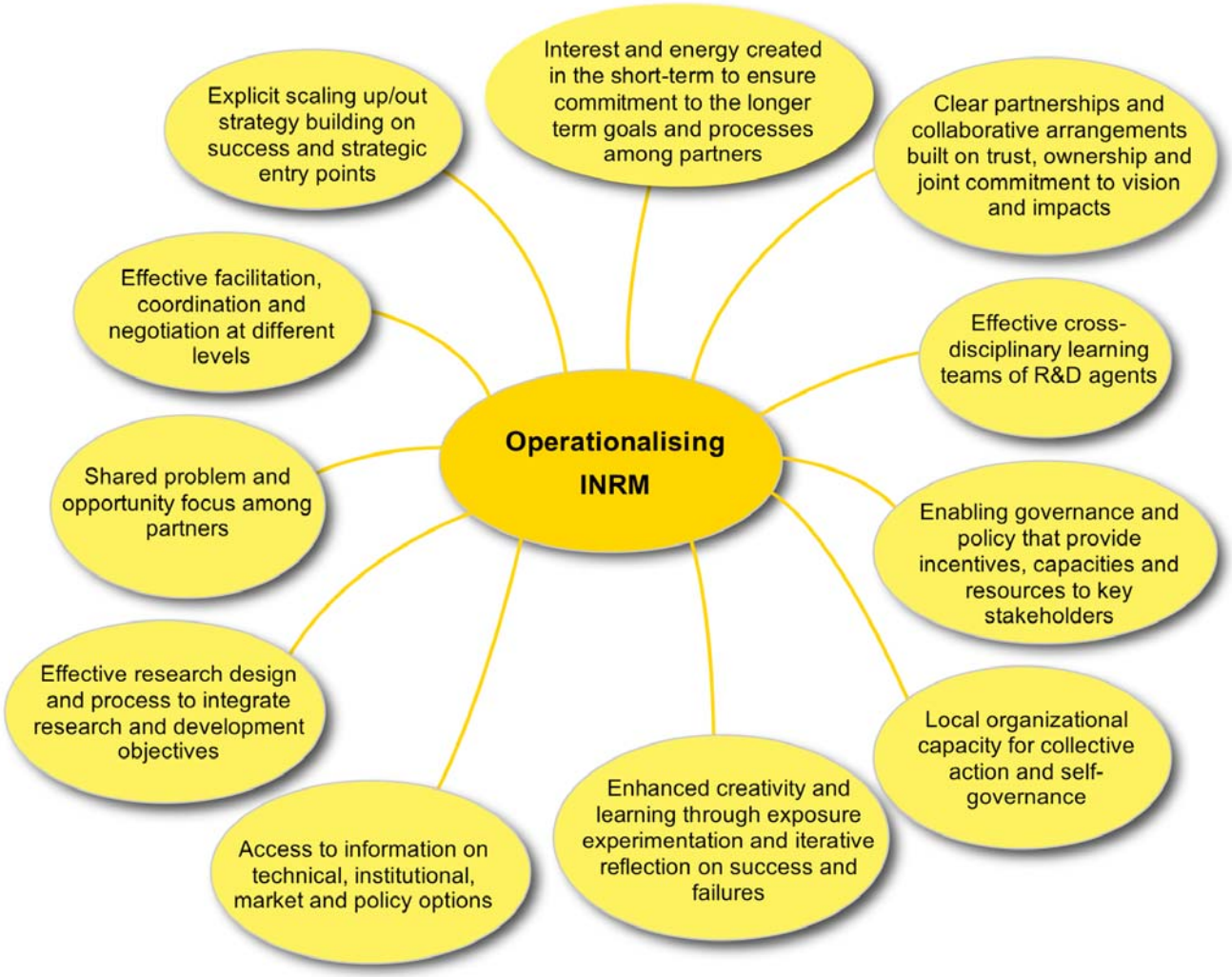
As mentioned above the overall conceptual framework, within which a researcher pursuing integrated natural resource management works, is the scientific paradigm of constructivism.

The analytical framework in integrated natural resource management is that of the sustainable livelihoods approach illustrated above.

The conceptual framework, also referred to as operational framework or 'operational cornerstones', establishes a set of 'success factors' the researcher needs to keep in mind when implementing integrated natural resources management (CAMPBELL and HAGMANN 2003,11; HAGMANN et al. 2000,26; Figure 14). Unfortunately the terminology in integrated natural resources management is somewhat blurred. For example, what CAMPBELL and HAGMANN (2003,2) term 'the conceptual framework' or 'pillars' in their keynote paper about the development of a conceptual and operational framework for integrated natural resources management, they term 'INRM principles' in their most recent publication *"Operationalising INRM: Principles and Challenges"* (CAMPBELL et al. 2003,13). To my understanding and bearing in mind what is said in the beginning of this section the 'success factors', HAGMANN et al. (2000,19) offer in their 'flexible framework' and which are further developed by CAMPBELL et al. (2003,12) are a set of principles that guide the researcher and development organizations during the planning, implementing and evaluation processes of an integrated natural resources management research project. As these 'cornerstones' offer a conceptual design for research and development agents not to become lost in the whole, I refer to this framework as conceptual framework. However it is important not to confuse the rather abstract concept of cornerstones with process steps, as the latter demands concrete methods and tools for application and is visualized in an operational framework.

The following conceptual framework contains eleven cornerstones and "*is a systematization of successful practice"* (CAMPBELL and HAGMANN 2003,11; Figure 14). As the conceptual framework emerged out of practice, each cornerstone will be described briefly followed by an outlook on the consequences for implication and according to the work from CAMPBELL and HAGMANN (2003,11-17) and CAMPBELL et al. (2003,12).

Figure 14. Operationalising integrated natural resources management.



Source: CAMPBELL et al. (2003,13)

1. Partnership built on mutual trust, ownership and joint commitment of vision and impacts is a vital cornerstone and a pre-condition for joint success. Hereby the emphasis lies on going beyond 'collaboration' engaging in joint action to create synergies and full transparency in communication.
2. Focusing on cross-disciplinary learning teams in research and development might sound trite. However in reality many organizations are still highly compartmentalized, social science is often under-represented in multi-disciplinary teams and if experiencing the number of non-researchers is low in a research-planning workshop, one might need to ask, whether priorities match those of the clients.
3. Enabling governance and policy to strengthen the organizational capacity for integrated natural resources management processes implies to firstly share knowledge with key stakeholders and communities to build social capital and secondly to facilitate local organizational development and conflict resolution among them to encourage and enhance self-organization processes.

4. This cornerstone was formerly termed ‘clear roles and commitments of implementing partners at each level’ and dealt with the need to continuously re-negotiate roles and responsibilities of different partners in an integrated natural resources management process hence strengthening the organizational capacity for collective action and self-governance.
5. Integrated natural resources management is responsive in nature and follows a learning cycle where stakeholders undergo reflection on success and failures. Participatory action research (PAR) is an excepted and widely developed research approach that offers the scientific merits to achieve this responsiveness while delivering problem-oriented research results (see SUSMAN and EVERED 1978 for further discussion on this point).
6. Access to knowledge is central to any innovation process (cf. ALLEN et al. 1998). Thus integrated natural resources management must deliver information on technologies, institutions, markets and policy options for the clients in an appropriate form.
7. Formerly termed ‘effective communication strategy’ this cornerstone places particular emphasis on the communication at the client-extension and client-researcher level through effective research design to achieve desired impact in research and development.
8. Strikingly this cornerstone has not undergone any change. As shared understanding and perception is the key success of any multi-stakeholder action, this is not surprising. Establishing a shared ownership of a problem not only encourages the willingness to change but also creates mechanisms to negotiate and deal with differences and in the anticipation of a shared vision and goals foster commitment.
9. In accordance to the previous cornerstone multi-stakeholder systems are complex and comprise of various conflicting interests. Effective facilitation of stakeholders at different levels to reach fair and equitable agreements and processes for decision-making is therefore a key competency of the research and development agents in an integrated natural resources management process.
10. To achieve maximum impact integrated natural resource management needs to be scaled up and out from the outset. This involves identifying potential success and strategic entry points, e.g. partnerships among the local, regional and national government organizations such as extension centers, departments and ministries or interventions at community, district, province and national levels.
11. By nature integrated natural resources management processes are long-term. This includes the risk that clients might get discouraged. Formerly, short-term gains (quick wins) were propagated in this cornerstone, however this has changed more recently and becomes explicit in what is called ‘interest and energy created in the short-term to ensure commitment to the long-term’ focusing on the need to be transparent and explain the scope of long-term gains versus short-term benefits.

CAMPBELL et al. (2003,13) emphasize key aspects for the effective utilization of cornerstones as a framework to design new projects, monitor and evaluate on-going programs, as a knowledge management tool and to create a common understanding and vision (cf. CAMPBELL and HAGMANN 2003,17).

2.5 Summary

In the previous chapter I have introduced several prototypical approaches that address poverty and environmental sustainability in natural resource management research. The shortcomings of conventional research are described in detail showing, how the complexity of natural resource management systems has led to a shift in paradigms in agricultural research and the emergence of integrated natural resource management.

Integrated natural resources management evolves around three main principles namely 1) the constructivist paradigm as an overall conceptual framework guiding the research process and delivering the necessary research approaches such as adaptive management and participatory action research, 2) the integration of diverse elements to allow multiple scale of analysis such as the sustainable livelihoods concept as an analytical framework and participatory action research to deliver the responsiveness needed to analyze social systems, as well as, 3) concepts of vertical and horizontal scaling to deliver research results to more people and across wider areas while simultaneously replacing the research development continuum.

Parallel, particular attention was paid to more theoretical considerations. This included a comprehensive description about achieving a balance of positivism and constructivism, hence between ‘hard’ and ‘soft’ science or better yet quantitative and qualitative methods followed by a more explicit presentation of the sustainable livelihood framework, i.e. the effective use of capital assets, the vulnerability context to identify people’s willingness to adopt integrated natural resources management practices (MEINZEN-DICK and ADATO 2001,3), the organizations and institutions perspective to identify key entry points and, last but not least, the pursuit of livelihood strategies to achieve acceptable outcomes that allow the determination of practicable integrated natural resources management practices and people’s priorities both vital for the adoption of integrated natural resources management.

At last I refer to the conceptual framework in integrated natural resources management that is built on a progression of ‘cornerstones’ that were developed in an analysis of successful practice, providing objectives and concepts that guide the research and development agents in the planning, implementation and evaluation of an integrated natural resources management project and helping them to ask the right questions.

3 Methods of Integrated Natural Resources Management

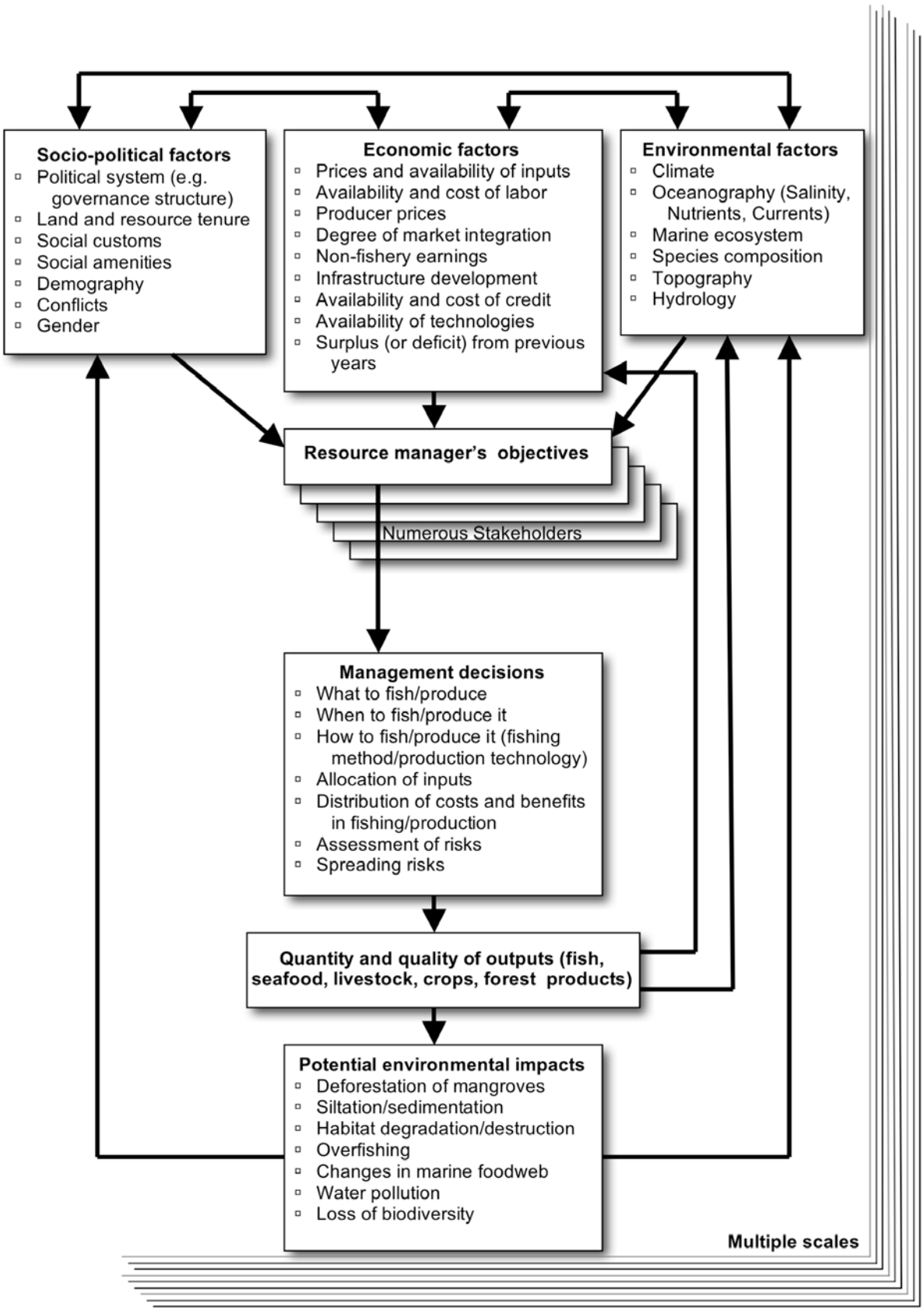
3.1 Research Design: From Concept to Practice

In this section the conceptual framework will be further developed into an operational framework that provides the researcher with concrete instructions, which methods and tools to use for assessing natural resource management systems and ends with a model of the process steps. In a next step the applied participatory methods and their strengths and weaknesses are described in detail. The data collection process and the quality of data are illustrated before introducing a few concepts of qualitative and quantitative data analysis. For further clarification the steps taken in qualitative data analysis are presented. The chapter concludes with the role of the researcher and personal limitations in the research process.

3.1.1 Model of the Research Process

An operational research framework is a tool to conceptualize the sequence of process steps in integrated natural resources management. It provides concrete process steps, which can be followed implementing integrated natural resources management at local resource users' level (HAGMANN et al. 2002,19). Although social scientists prefer a more loosely structured approach to data collection, i.e. a framework that emerges in the course of the study, this rather applies for experienced researchers with plenty of time (MILES and HUBERMAN 1994,17). In reality and being new to qualitative studies a tighter design is a wise course providing clarity and focus (MILES and HUBERMAN 1994,17). However, there is no general notion how tight or loose a research framework needs to be (MILES and HUBERMAN 1994,17). MILES and HUBERMAN (1994,17) notice that this depends on how much is already known about the phenomenon to be studied, where to look for it and how to gather the information. They continue, that the task of arriving at a set of analytical categories may be done deductively from the start or inductively in a step-by-step process. The development of such an operational framework to suit integrated natural resources management in practice has had various inputs. HARRINGTON et al. (2001,3) suggest the use of ecosystem analysis, focusing on genetic and environmental productivity, sustainability assessment, the definition of problem-cause relationships and how these affect system productivity and sustainability. VAN NOORDWIJK et al. (2001,11) suggest *"integrated models"* to illustrate process steps implementing integrated natural resources management in tropical forest margins focusing on policy analysis. However, major contributions came from CAMPBELL et al. (2001) who developed a raw model of a framework to help indicate the numerous entry points for intervention and performance assessment of natural resource systems (Figure 15). Their framework requires the researcher to clearly state his or her research objective, define spatial and temporal scales, and identify particular intervention possibilities (CAMPBELL et al. 2001). They further suggest focusing on the key relationships among system components and the constraints impacting on them (CAMPBELL et al. 2001).

Figure 15: Components of integrated natural resources management.

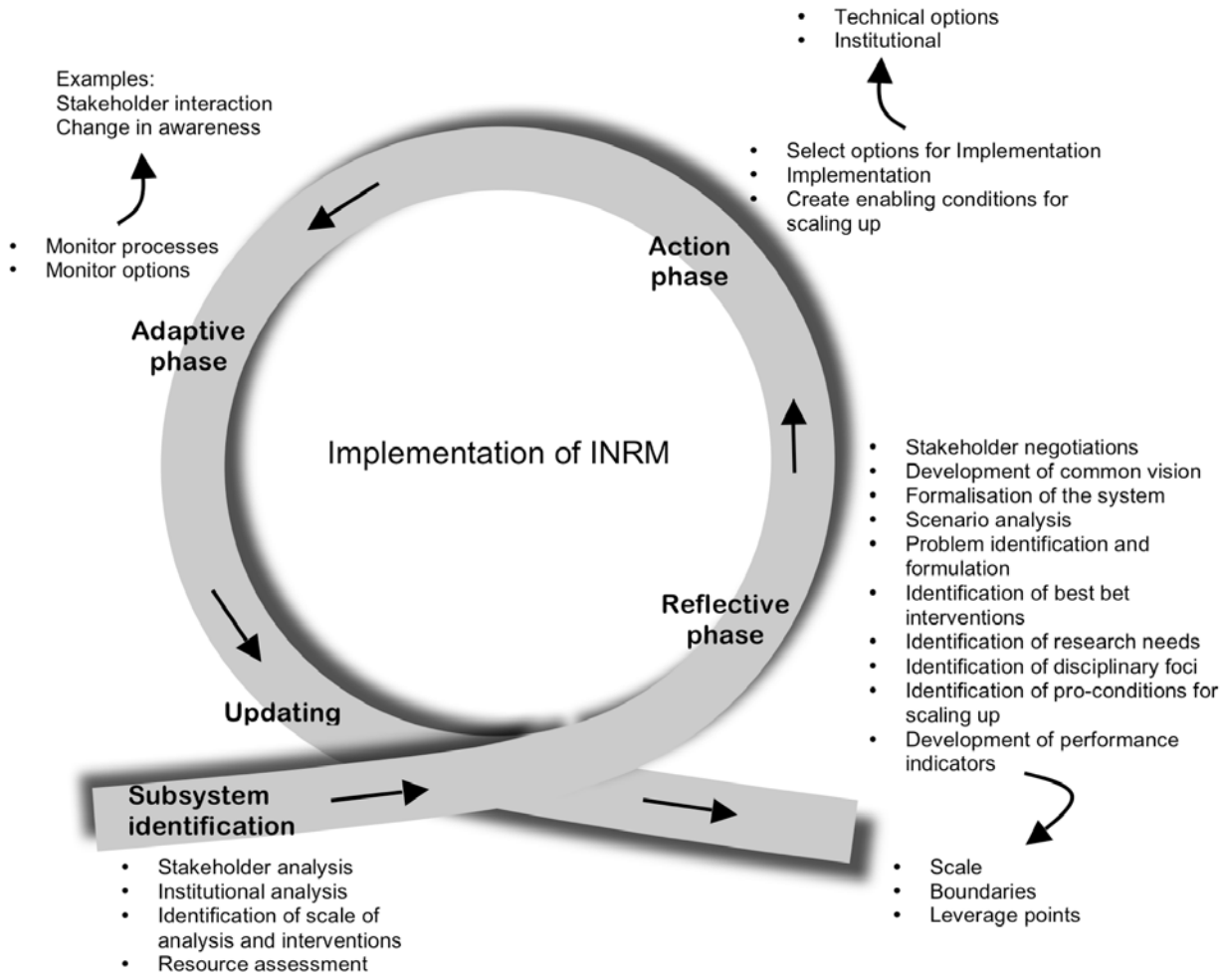


Source: adapted and modified from CAMPBELL et al. (2001); SWIFT et al. (1994)

Figure 15 reflects different factor areas and the multiple dimensions of stakeholders and scales, which are a main characteristic of integrated natural resources management systems. The arrows illustrate the multiple scales of interaction and response (CAMPBELL et al. 2001). Moreover, the framework takes into account that natural resource management systems involve multiple stakeholders with multiple perceptions and objectives and therefore multiple management strategies (CAMPBELL et al. 2001). It is these characteristics the researcher needs to consider while paying particular attention to identify integrated natural resources management aims and also find trade-offs that meet the often-contrasting stakeholder interests (CAMPBELL et al. 2001). In this context ALLEN (1997,633) emphasizes that 'cooperation' is far more realistic than 'consensus' and that with help of participatory processes, it may be possible to *"develop win-win strategies"*.

The illustrated components of integrated natural resources management give a rough outlook of the natural resource system and its resource users. The following illustration of an integrated natural resources management learning cycle helps the researcher to understand how integrated natural resources management research is implemented and which activities the researcher must cope with to accomplish the sharing of results and the evaluation of the ongoing integrated natural resources management research process best described as 'learning by doing'. The figure of the learning cycle embodies the essence of adaptive management, participatory action research and the conceptual framework (Figure 16). It is the direct answer to the natural resource system and its management, which is in a constant state of flux, hence demands to be adequately responsive to the situation. This implies that research does not start with a precise question and methodology but that the questions and the appropriate methodology arise from the study (DICK 1993,11). DICK (1993,11) continues *"let the data decide"* meaning that as the process of integrated natural resources management unfolds along the learning cycle, the information available at each step is used to determine the next step. Good process facilitation is essential to implement the integrated natural resources management learning cycle and move along its steps while developing appropriate solutions together with resource users (HAGMANN et al. 2002; SAYER and CAMPBELL 2001). SAYER and CAMPBELL (2001), who developed the learning cycle in integrated natural resources management research through enhancing HAGMANN'S et al. (2002,3) illustration of a framework with the sequence of process steps and the action research cycle, define the following steps: 1) exploratory phase or subsystem identification; 2) reflection and negotiation phase; 3) implementation or action phase; 4) evaluation phase; and 5) updating, i.e. readjustment and adaptation (cf. CGIAR 2003,9).

Figure 16. Implementation of the integrated natural resources management learning cycle.



Source: SAYER and CAMPBELL (2001)

The implementation of integrated natural resources management evolves across spatial and temporal scales. As a result integrated natural resources management research does not involve one learning cycle but depends on a number of interlinked learning cycles (SAYER and CAMPBELL 2001). However, depending on the phenomenon some may not complete a single learning cycle, whereas others will have been through many cycles within the project timeframe (SAYER and CAMPBELL 2001).

Both, the framework of integrated natural resources management components and the integrated natural resources management learning cycle, are concepts to develop a specific operational framework that integrates across disciplines, across scales, across stakeholders, and across components (LAL, LIM-APPLEGATE and SOCCIMARRO 2001,2), which will vary depending on the research project. As mentioned in the previous chapter the researcher needs to consider which component to add into his operational framework carefully weighing the additional costs and the potential benefits against each other (cf. CAMPBELL and HAGMANN 2003,4). However, complexity is not boundless and *"three to five key variables often drive any particular system"* (HOLLING et al. 2000, cited in

SAYER and CAMPBELL 2001), thus *"allowing system complexity to be reduced after an initial more inclusive phase"* (GUNDERSON and HOLLING 2002, cited in CAMPBELL and HAGMANN 2003,5).

3.1.2 An Operational Framework Emerging

The operational framework used in this study and the process steps associated with the appropriate research methods are described in greater detail in this section. The presented frameworks are modifications of natural resource management approach and offer a comprehensive overview of the relevant elements in a coastal fishery environment. In addition they exemplify the multitude of factors that need to be considered and the roles the researcher needs to adopt when conducting integrated natural resource management. Furthermore, integrated natural resource management of coastal and inland fisheries has been relatively neglected so far (cf. PAYNE 2000,1).

In their handbook on the rapid appraisal of fisheries management systems PIDO et al. (1996,8) present a framework for data collection and analysis consisting of contextual variables and their attributes of a coastal community's local-level fisheries management system. The framework sets out to identify the biophysical, technical, market, socioeconomic, institutional, organizational, and exogenous variables affecting the fishery system (PIDO et al. 1996,12). The contextual variables and their attributes in the framework from PIDO et al. (1996,9-16) are similar to the integrated natural resources management components presented in the framework from CAMPBELL et al. (2001), although PIDO'S et al. work misses the multi-sectoral dimension and the multiple scale of stakeholder interactions. In exchange they offer detailed characteristics of the fisheries management system and operational considerations, e.g. required researchers and field data collection techniques. PIDO et al. (1996,12) collect attributes associated with the contextual variables following guide questions about:

- Who is involved in a situation?
- What are their stakes and resources?
- What type of action can they take?
- What is the cost of those actions?
- What information is available to them?
- How much control do individuals have?
- How are individuals and actions linked to one another and to outcomes?
- What outcomes can be expected in relation to what action?
- How are rewards and punishments allocated to particular combinations of actions and outcomes?

PIDO et al. (1996,12) identify 33 attributes in six sets of contextual variables and present adequate techniques for field data collection and personnel requirements for the composition of a multidisciplinary research team (Table 2).

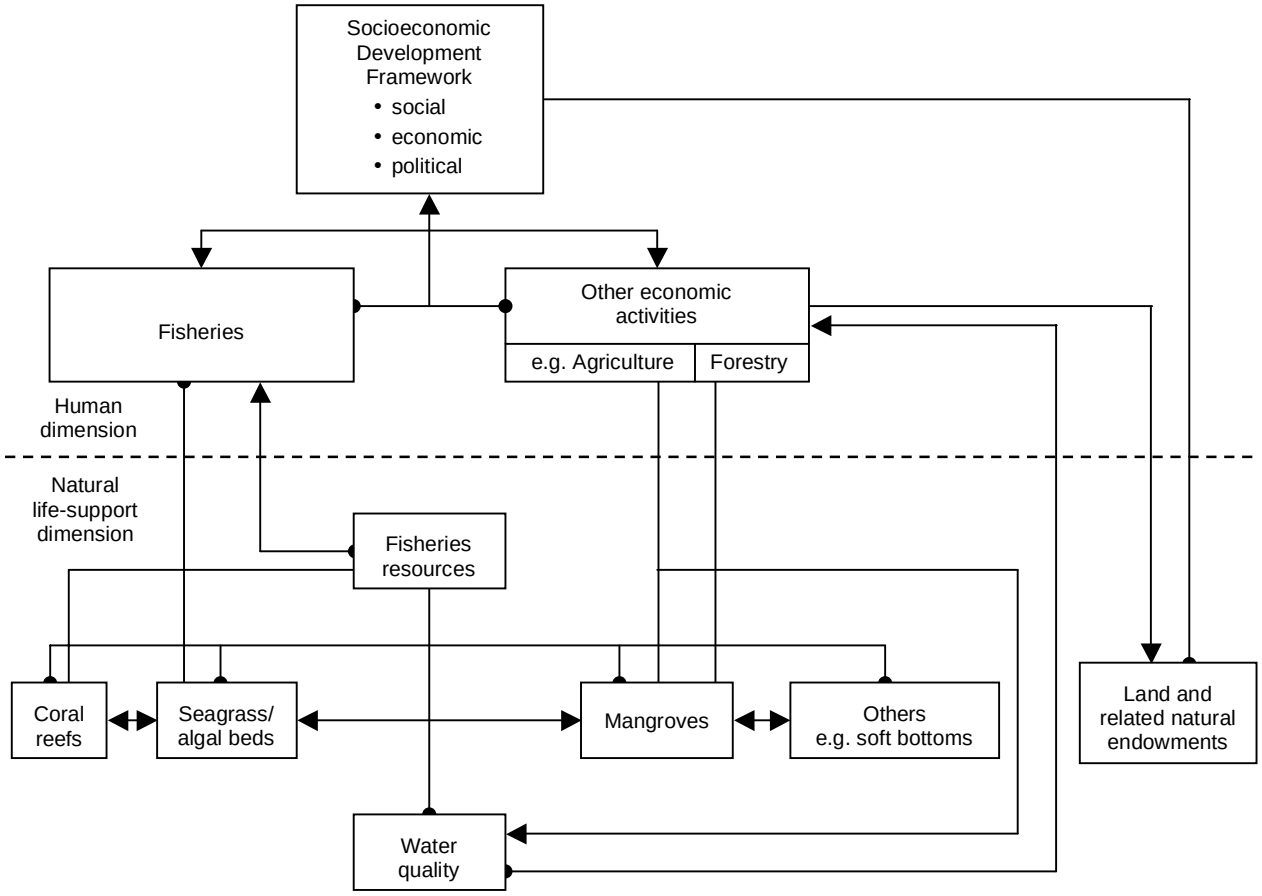
Table 2: Contextual variables and their attributes, field data collection techniques and the required researchers. **[Source: adapted and modified from PIDO et al. (1996,9)]**

Attributes	Data collection	Researchers
Group I. Biological, physical and technical attributes		
Physical attributes		
▫ resource use	- resource mapping	- Coastal habitat expert
▫ climatic data		
▫ physiography		
▫ physical oceanography	- observation	
▫ water quality	- mapping	
Biological and habitat attributes		
▫ seaweeds/seagrasses	- resource mapping	
▫ mangroves	- transect	
▫ coral reefs	- manta tow survey	
Technical attributes		
▫ gear/fishing technology	- interviews - site inspection	- Fisheries/marine biologist
▫ species harvested		
▫ level of exploitation		
Group II. Market (supply-demand) attributes		
▫ supply of marine products	- observation - semi-structured interviews - focus group discussion - mapping - interview	- Economist
▫ pricing scheme/system		
▫ market functions		
▫ market rules		
▫ stability of demand		
▫ market structure		
▫ market orientation		
Group III. Characteristics of fisher/community stakeholders		
▫ demography	- observation - semi-structured interviews - focus group discussion - walk through/boat ride - resource mapping - interviews	- Sociologist/ anthropologist
▫ tenurial status		
▫ economic status		
▫ culture		
▫ livelihood (occupational structure)		
▫ attitudes and outlook of fishers		
▫ resource use/harvesting conflicts		
▫ ecological knowledge		
▫ community		
Group IV. Fisher/community institutional and organizational arrangements		
▫ individual organizations	- interviews	- Political scientist/ public policy analyst
▫ institutional arrangements		
Group V. External institutional and organizational arrangements		
▫ individual organizations	- interviews	
▫ institutional arrangements		
Group VI. Exogenous factors		
▫ natural calamities	- interviews	
▫ economic/political/sociocultural factors		

The biophysical and technical attributes (Group I) provide information over the natural resource system, its productivity, exploitation level and the employed fishing techniques. The market attributes (Group II) focus on the market structure, prices and their fluctuation. The characteristics of stakeholders (Group III) refer to the socioeconomic status, livelihood strategies, resource conflicts and stakeholders perceptions that affect their incentive to cooperate. Group IV relates to institutional and organizational arrangements inside the communities, i.e. arrangements concerning access to and use of natural resources for example. Group V relates to institutional and organizational arrangements outside the communities, i.e. at national, provincial, district or municipal levels, that regulate or restrict the use of natural resources that are responsible for decision-making, policy development and implementation. PIDO et al. (1996,13) point out that there *"may be nested, multiple layers of organizations, formal or informal, at different political and administrative levels"*. Finally, exogenous factors (Group VI) relate to sudden shocks that affect the management system, i.e. weather, political or cultural changes.

To further emphasize the role of the researcher in integrated natural resources management particularly the 'integrated' aspect of sectoral and disciplinary considerations SILVESTRE (1996,6) offers a schematic representation of an expanded multisectoral and multidisciplinary framework for fisheries management, which he uses to demonstrate the key constraints in integrated fisheries management efforts (Figure 17). The following framework originated from ICLARM research activities in San Miguel Bay, Philippines, from 1979 to 1982 and from 1992 to 1994. The framework (Figure 17) highlights the human and natural dimension in coastal fisheries. SILVESTRE (1996,12) stresses that, *"successful management requires good communication and agreement among three groups - the managers, the resource users or stakeholders, and the scientists"*. Furthermore he emphasizes that the key constraints pertain to sectoral and disciplinary "blinders", i.e. the human perception seeing parts rather than the relevant whole being conditioned by sectoral interests and disciplinary background.

Figure 17. Schematic representation of an expanded framework for fisheries management.

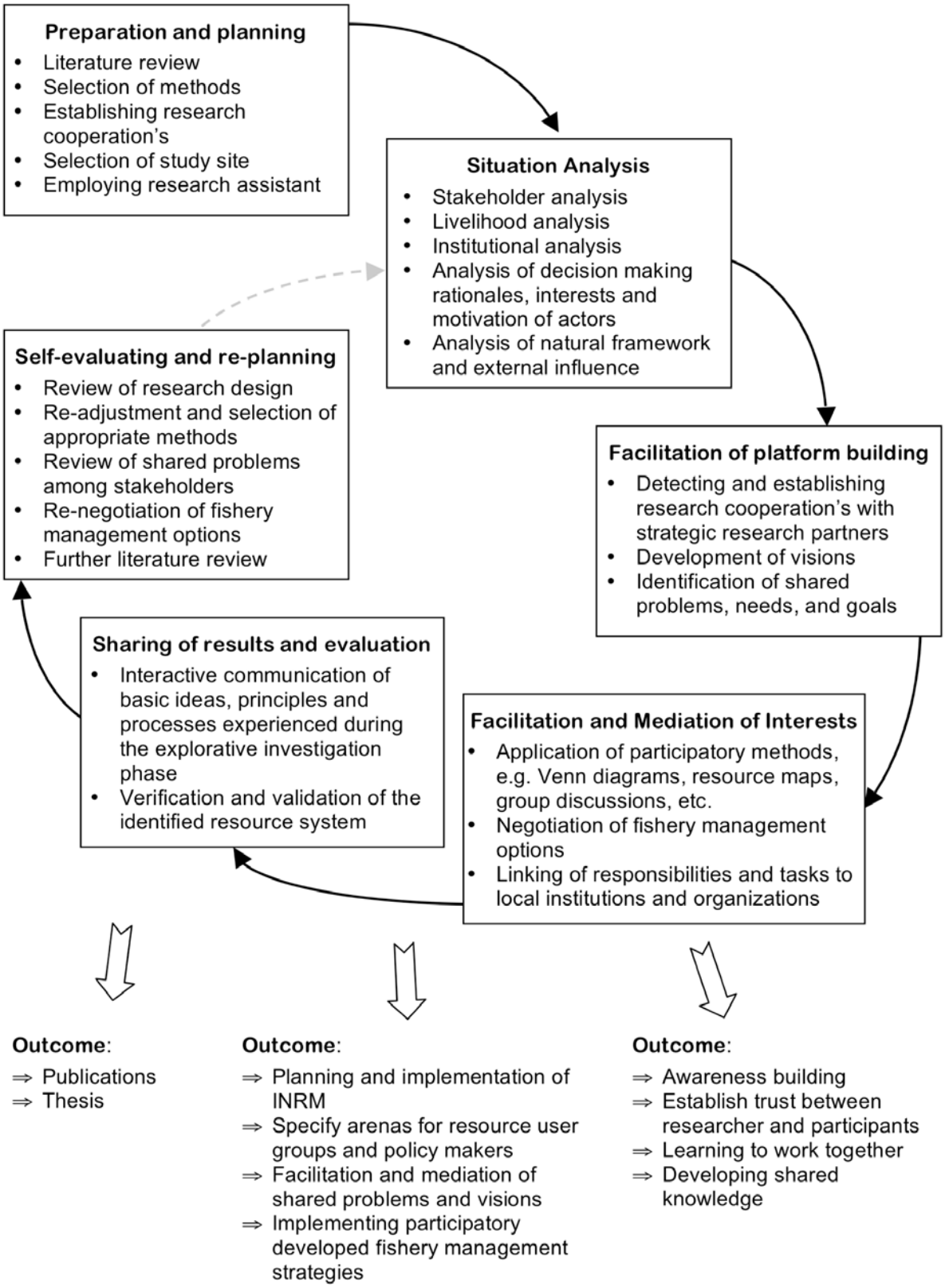


Source: SILVESTRE (1996,6)

Influenced by the previous frameworks for fisheries management systems I developed the following operational framework with the sequence of process steps (Figure 18). Beginning with a preparation and planning phase including desktop studies and the organization of the fieldwork I quickly moved into the field to conduct a situation analysis (Figure 18). After learning more about the resource system and its multi-stakeholders the next step included the development of shared visions to establish platforms for further procedure. By means of participatory methods and facilitation and mediation of interests participants were encouraged to envision sustainable fishery management options. Through sharing of results the collected data was verified concerning the validity of the studied resource system. The self-evaluation of past experience was an important step to re-adjust the research process, including research design, applied methods, shared problems, and the fishery management options collected so far. It is important to understand that the research cycle and the sequence of process steps were not followed stringent but instead that process steps were repeatedly passed through, i.e. process steps recurred in repeating sequences. The outcomes are various: (i) first and foremost awareness building among participants laying the basis for shared decision-making to successfully introduce fishery management strategies; (ii) second of all and not subject of

this study planning and implementing integrated natural resources management; and (iii) last but not least publications and the present thesis (Figure 18).

Figure 18. Operational research framework with sequence of process steps.



Source: adapted and modified from HAGMANN et al. (2000,27)

3.1.2 Choice of Methods

The following section provides an overview of the applied methods and techniques during the six-month investigation period in Vietnam. All methods and techniques were extracted from the three-volume sourcebook *"Participatory Methods in Community-based Coastal Resource Management"* published by the International Institute for Rural Reconstruction (IIRR 1998). At first, qualitative methods such as observation, identification of key informants, semi-structured interviews, focus-group discussions, resource mapping, and institutional analysis were chosen to establish partnership between the various stakeholders and learn more about the coastal fishery sector, rural livelihoods, and existing problems. In addition more quantitative methods were selected including problem ranking, Venn diagrams, and questionnaires. The combination of qualitative and quantitative methods is an important and recognized technique that leads to an improved quality of information (MARSLAND et al. 2001,14).

The selection of methods was based on personal experience with participatory methods, the achievement of research objectives, and the suitability of creating a learning-cycle for awareness building and self-reflection, and the feasibility of methods according to the utilization of financial and human resources in a given time frame.

The selected tools and techniques were modified to the circumstances at hand, i.e. cultural and societal characteristics. In addition methods were adapted according to scarce resources particularly personnel and time. For example, the questionnaire was not handed out to participants as planned but filled out by a research assistant in a process of reading the questions out loud to the respondents and filling in their answers, because high illiteracy and limited reading skills threatened the quality and return of the questionnaires.

Observation is probably the most simple and direct empirical method to gain insight into a community and the processes within it. By observing what actually happens in a community it is possible to understand how it operates. Observation took place anywhere the subject was found, e.g. during fishing activities, at landing sites, at processing or marketing facilities, government agencies, and in households. The observations were carried out taking notes immediately afterwards or if customs prevented, e.g. at formal meetings especially when government officials attended, memorized observations were written down on the very same day. Observation not only took place in the beginning of the field study but during the entire project especially when conducting participatory methods and techniques to enhance learning, e.g. while drawing resource maps or facilitating group discussions, where after a brief introduction I withdrew from the exercise or the discussion and observed the unfolding events. The relatively unsystematic gathering of information through observation provides the researcher with preliminary data necessary for developing more refined research methods like semi-structured interviews, questionnaires or matrix-ranking techniques (MCGOODWIN 2001). Furthermore, observation established the basis for developing relationships with the stakeholders and thus for interviews and follow-up visits. By structuring the observations i.e. choosing surroundings and social settings, I considered central for the coastal fisheries resource system, focusing on the identification of the key drivers, the key response variables, and the key intervention points of the problem being addressed, namely the degradation of coastal resources, and through writing down observations immediately

afterwards, the method of observation became systematized and thus scientific (cf. MCGOODWIN 2001). Observation is more than simply gathering information in the field and passively recording what people are doing and saying (MCGOODWIN 2001). The researcher needs to combine the observed events and behaviors with additional information from further questions or literature according to his personal frame of reference (MCGOODWIN 2001). In addition the researcher needs to be aware that his presence affects the social interactions, e.g. my presence as observer in particular as a foreigner focused the overall attention and distracted people from their daily activities but as I became more and more accepted by the communities and stakeholders, my influence on the observed people and events declined. In order to avoid biased observations the researcher also needs to be aware, that he or she selects and notes down that which precisely supports his or her research hypotheses. To prevent selective observation I used my research framework as guideline and formulated research hypotheses much later in the research process. The strength of the observation is certainly to observe social interactions, which would not occur in an interview. For example, I saw how fishermen using illegal fishing techniques were separated from the social life of the village, discriminated, and how they formed their own groups. The strongest limitation of using observation as a method is its demand of resources, i.e. time and effort. Transportation, agreements, cancellations, and the time spend for the actual observation take up a large amount of time. In addition a fair amount of time was spent for noting down the observed. Observation is a powerful tool of data collection and retrieving first hand information to adjust the further research process to the situation at hand and complement qualitative research methods. However, its efficiency depends on the researcher's abilities to interact with people and to deal with new and changing situations regarding culture, society, politics, and geography.

The **identification of key informants** is an important step to gather relevant information and utilize scarce resources in the research process. The IIRR (Vol. 2 1998,61) defines key informants as *"purposely selected community members who are able to provide information on a particular research topic based on their knowledge, skills or experience"*. The purpose of using key informants is to obtain accurate, relevant, and detailed information about the community or from an individual community member without talking to everybody (IIRR Vol. 2 1998,62). This is also one of the first steps before applying other participatory methods such as semi-structured interviews, resource mapping, or Venn diagrams. The authors assume that *"chairpersons and members of a fishers' organization for example can give detailed information about issues confronting fishers in the locality (e.g. marketing, illegal fishing) using their experience as basis"*, but although this may apply in most cases, there is a danger of selecting biased information and drawing a distorted picture. For example, I detected that the information from interviewed chairpersons was tinted according to the view of the Communist Party and in sharp contrast to the information obtained from other group members because only party cadres and functionaries acted as chairpersons or village leaders. In my field study the identification of key informants was carried out moving down the hierarchic ladder, i.e. visiting the government authorities, members of the Politburos, chairmen of the People's Committees, village leaders and finally individual community households and members. The reason for this was that I had to apply for a permit to visit each government district

that gave me access rights to the different villages and letters of invitation. After following the formal procedures and building first contacts other key informants were identified within the communities usually with help of the village leader. According to the suggested approach in the IIRR (Vol. 2 1998,64) sourcebook a meeting was arranged with help of the village leader to explain the purpose of the field study. Preceding that the village leader was asked to identify community members that hold key positions in the fishery, aquaculture, and agricultural sector. An attempt to include women in this procedure failed due to sexual inequality (gender issues). As a result women were approached directly at home or during fish processing and marketing activities at local markets. The village leader also helped in providing telephone numbers and addresses of the identified key informants. In the next step the key informants were selected according to their relevance to provide information for the research objective. Another method of identifying key informants was to visit the people whose names I heard repeatedly, e.g. during group discussions, semi-structured interviews, and through visits of People's Committee meetings.

The biggest limitation in the process of identifying key informants is to detect those informants that give misleading or biased information. For example I noticed that in many incidences the opinion of key informants was in line with the Communist Party ideology. By crosschecking the information by asking many informants the same questions this problem was avoided. Another limitation is that some persons dominate participatory processes which lead to biased assertions or prevent people from expressing their opinion, e.g. in some villages the village leader dominated these processes. In such cases facilitation skills were applied to help participants express their opinions, but not to offend local values, and key informants were visited privately.

The identification of key informants is a quick and powerful tool to get to know many individuals in a certain area and context. The knowledge that may be gained from key informants should not be underestimated especially about more complex issues that may be not appropriate for group discussions (DFID 2000). However, by means of triangulation[1], asking a number of people the same questions, the researcher needs to crosscheck information to avoid bias.

The IIRR sourcebook (Vol. 2 1998,78) defines **semi-structured interviews** as a conversation with a purpose that differs from a structured interview with a specific set of questions. In a semi-structured interview there is only a set of guide questions or discussion points, e.g. fishery degradation, illegal fishing, or enforcement and the interview evolves in response to the interview situation and the participant's assertions (cf. DEFFNER 2004,3).

The purpose of the semi-structured interview is to generate information by means of leaving the development of an interview to the interviewed individual and his or her personal experience.

Selecting possible interview partners follows the same approach as in the identification of key informants, as described in the previous section. However, I frequently selected

[1] Triangulation is the application and combination of research methods, theories, observers, or empirical material (key informants) in the study of the same phenomenon (MAYRING 2001,25).

interview partners randomly on the street, in cafes and markets, or during boat and net repairs, where it was obvious that the approached persons will be able to provide relevant information on the research subject. Through this procedure I could also make sure that the participants felt at ease conducting the interview in their familiar surroundings.

The questions should be phrased, so that informants are required to tell a story. The IIRR sourcebook (Vol. 2 1998,79) gives four examples:

1. Descriptive questions – to prompt informants to describe their daily activities.
   Example: *"Could you describe what happened after the fish traps were constructed?"*
2. Structural questions – to find out how informants understand their situation and acquire knowledge.
   Example: *"Has the use of cyanide affected your fish catch? If so, how?"*
3. Contrast questions – to encourage informants to discuss situations and provide an opportunity for comparison.
   Example: *"How would you compare the fish catch today with that of 10 years ago?"*
4. Probing questions – to allow informants to analyze and reflect on the underlying causes of a particular situation.
   Example: *"Why?"* and *"How?"*

After a short introduction I asked the informants, if he or she had some time to answer a few questions. I explained the purpose of the interview and gave a brief overview of my research. The semi-structured interview was started with general questions about the informant's family and household and then moved to more specific questions encouraging him or her to become more descriptive. In order to deepen the conversation questions were asked in different ways especially by use of probing questions. Usually the interview was written up simultaneously. This procedure was only possible, because interviews were carried out with a translator and the time during translation was utilized this way. Most interviews lasted between one and two and a half hours. At a later stage in the field study I used the semi-structured interviews to feed information from the research project back to the participants. Again, just like in the other applied participatory methods combined with the learning cycle inherent in integrated natural resource management, this led to deep self-reflection and further insights of the complex natural resource system and its users.

The strength of semi-structured interviews is its responsiveness to the individual and the situation at hand. Besides gathering information it can generate perceptions and emotions (IIRR Vol. 2 1998,81). After some experience semi-structured interviews are easy to apply and require no additional preparation time or appointments. For example, I carried out semi-structured interviews between fixed appointments or whenever the situation allowed.

A limitation of semi-structured interviews is certainly that responses may be influenced by biases (IIRR Vol. 2 1998,81), e.g. informants interviewed in cafes most likely responded differently due to the surrounding people listening. On the other hand interviewing people privately does not guaranty, that the answers given are not what they think you expect to hear. Therefore applied interview technique puts a high demand on the interviewer and his communication and mediation skills incorporating the

accumulated information into the interview process and establishing a form of triangulation.

Group discussions, also referred to as focus group discussions, are discussions with a selected group of community members (key informants or others chosen for their relevance to the objective of the study) following a guideline designed to generate discussion on a particular topic (IIRR Vol. 2 1998,45). The purpose of group discussions is to gather information on livelihood practices, decision-making structures, issues in fishery or agriculture and other information (IIRR Vol. 2 1998,45). In addition information previously collected during group discussions may be verified or detail added.

I used group discussions to create a learning cycle, i.e. information from previous visits and different communities was shared among the participating group in order to enhance people's self-reflection and raise awareness. On other occasions group discussions were used to reach a consensus between conflicting groups or when discussing contentious issues.

Preparation for a group discussion started with inviting target participants, e.g. drag net fishermen or shrimp farmers. These were usually selected together with the village leader paying attention that group members represented various income categories or community organizations. As mentioned before bias is a problem and too homogenous groups should be avoided. After briefly introducing my translator and myself I presented the purpose and time frame of my research. The introduction varied considerably since I held several group discussions in each village and community members started to recognize and become acquainted with me making the introduction redundant. The actual group discussion was started with any non-controversial topic raised by the participants to warm up. To initiate discussion open-ended questions were asked.

For example: What could be done to improve fishery production?
Who should enforce regulations and how?
How do you envision your future?

Questions were also phrased to encourage self-reflection and a personal responsibility for the problems the community members expressed, through mirroring back to people *"the consequences of their present perceptions and behaviour and possible solutions in the long run"* (HAGMANN et al. 2000,9). During the discussion I offered cookies, because bringing along small presents is a custom in Vietnam and I also discovered that this habit also acted as an icebreaker. The entire discussion was handled flexibly according to how it developed. In order not to lose focus my research framework (goals and objectives) acted as a guideline. However, due to the complexity of the coastal fishery sector and following an action research approach the course of a group discussion was very much left to the participating community members, i.e. the discussed topics usually in one way or the other referred to fisheries and I only participated in the discussion as much as necessary, e.g. providing suggestions when the matter was of no importance or acting as a mediator when discussions went overboard. During group discussions participants sometimes left to take care of their duties or sometimes new faces would join a discussion.

The strength of group discussion is certainly the generation of information, which is verified and clarified at the same time. Even discussing apparently simple topics, as for example, which fish drag net fishermen catch, lead to deeper insights learning that the neighboring village did not use any drag nets compared to the first village where all of the fishermen engaged in mostly illegal drag net fishing. Group discussions are not only important to understand livelihoods but they promote learning and lead to awareness building if following a participatory learning approach. For example, towards the end of my field study participants frequently suggested possible approaches how to manage natural resources, a phenomenon nonexistent in the beginning of my study. The limitation of applying group discussions in integrated natural resource management is its personal requirements, i.e. group discussion demands a great deal of facilitative skills, a clear understanding of the research framework, and specific knowledge of the addressed disciplines (cf. HAGMANN et al. 2000,10).

Resource mapping is a method of visualizing the occurrence, distribution, access, conflict over, and use of resources within a specific area (IIRR, Vol. 2 1998,222). The resource map provides a topographic overview and generates further information during the making. Resource maps are helpful for internal discussions, for planning and monitoring purposes, and support the researcher in the conduct of in-depth assessment (IIRR, Vol. 2 1998,223).

The purpose of drawing a resource map is to allow community members to identify and map critical locations such as areas known for illegal fishing, pollution, siltation, mangrove deforestation, etc. The map also helps the researcher to learn more about the particular view of a community's physical boundaries and spatial distribution of issues. Last but not least, drawing a resource map serves as an ice-breaker and helps to develop a relationship with the community and for this reason was conducted early in the field study but only after a few introduction visits. The IIRR sourcebook (Vol. 2 1998,224) endorses this adding *"resource distribution, use and access may be considered a sensitive issue by the community"* and highlights that *"knowledge of the social structure of a community is a prerequisite for the facilitator"*.

The following materials were used:
- craft paper (1x2m)
- pencils in assorted colors
- felt tip pens in assorted colors
- markers

The use of a topographic map as suggested in the IIRR sourcebook was cancelled, because it drew too much attention away from the actual map-drawing exercise and discouraged people to draw freehanded.

The mapping exercise was planned together with the village leader who invited the same community members as for group discussion. According to the suggestions of the sourcebook I explained that the map will stay in the community and I will only make a small copy. In my opinion this step is vital to show the participants that they are not being taken advantage of, but rather through a consultative way of participation the collegial role between researcher and clients is strengthened and approved (cf. PROBST and HAGMANN 2003,11; SUSMAN and EVERED 1978,597). Next the purpose and scope of the exercise was described to the group and then the craft paper spread out on the floor. Then

the group was asked to select individuals, who they thought, are knowledgeable about certain resources or sectors, e.g. drag net fishing, gill net fishing, aquaculture, etc. The selected individuals were told to draw the outline of the lagoon first, locate their village, and add landmarks, e.g. roads, mountains, islands, rivers, etc. together with their names. After finishing the first step and receiving confirmation by the group the pencil marking was fixed with permanent marker. In the next step the participants were asked to locate fishing areas, spawning grounds, corals, mangroves, conflict areas, areas with aquaculture, specific species areas, and specific gear fishing areas on the map and draw them in any order they chose. In addition I asked participants to use different symbols and colors and generate a corresponding legend. During the resource mapping the rest of the group was encouraged to comment and correct the map drawers. This process varied considerably from active participation to dominance by the village leader. After completing the map and verifying it by the entire group the pencil marking was fixed with felt tip pens.

Documenting the resource mapping exercise is an essential part of the output and plays an important role. For this reason I did the introduction to the exercise and then my translator took over the supervision to allow for thorough process observation and documentation. The composition of the map and its features reflect the perception and relationship between the participants and the natural resources (IIRR Vol. 2 1998,227). For example, the most important fishery resource will appear first on the map, just as issues on resources like illegal fishing will appear exaggerated in size and color, an observation I can confirm (IIRR Vol. 2 1998,227).

The strength of resource mapping is that it visualizes the distribution and use of natural resources in a certain area. The exercise itself helps to improve the relationship with the community (cf. IIRR Vol. 2 1998,229). Besides visualization the process also generates information and provides insights that may not have been detected otherwise. In addition it triggers self-reflection and awareness building of participants and thus participatory learning. Another major advantage is that I became familiar with the area, e.g. fishing sites and conflict areas in a particularly short time. However, a limitation to resource mapping was the amount of time it demanded especially in view of the scarce personnel resources.

Institutional analysis is the identification of various resource users, stakeholders and organizations respectively their institutional arrangements in a community (IIRR Vol. 3 1998,118).

The purpose is to identify existing legislation, policies and regulations that regulate use and access of coastal fishery resources and in particular to determine the decision-making processes of who decides and implements institutions governing coastal resource management at various government levels, i.e. village, municipal, district, province, national (IIRR Vol. 3 1998,119). Evaluating the existing involvement of local resource user groups in the management of coastal fishery resources is vital to determine key intervention points for the involvement of resource users in future integrated natural resource management. This is a delicate process where the researcher needs to be aware of the existing structures and that the incentive to improve resource management and

encourage resource user participation in this process threatens existing power structures hence is unpopular.

In my field study institutional analysis took place throughout the entire study period. During the first step secondary data was collected from documents, reports, publication, national policy papers and fishery laws both national and provincial documents. In a second step informants from communities, organizations, and government offices were added to collect primary data using semi-structured interviews, group discussions, resource mapping, and Venn diagrams. The IIRR (Vol. 3 1998,121) sourcebook and PIDO'S et al. (1996,46) handbook for rapid appraisal of fisheries management systems suggest the use of guide questions at this point and offer a wide range. However, I pursued an investigative action research approach constantly adjusting and improvising as the events unfolded and according to the circumstances and whatever interview partners suggested. Therefore the guide questions only served as an orientation in the back of my head and data about institutional arrangements was collected whenever and however the situation allowed. The collected data was verified according to compliance, complementariness and conflict to ensure accuracy and to fill in gaps. Yet community members often lacked information and government officials were secretive and retained information.

This method provides information about formal and informal institutions governing coastal fishery resource management in Nha Phu Lagoon.

The strength of institutional analysis is that it provides the researcher with knowledge that he may not consider to collect otherwise and through sharing this with the communities and other stakeholders in the research process, resource users may deepen their understanding about resource management and government officials may learn about practices of resource users which otherwise are not available. Especially when developing management strategies together with participants, how to manage coastal fishery resources more sustainable, integrating bio-physical and socio-economic elements with institutional information proved vital (STREHLOW and PETERS 2004,5).

The limitation to institutional analysis is that it requires a skilled facilitator due to the complexity of the matter (IIRR Vol. 3 1998,129).

Problem ranking, also referred to as matrix ranking, is a tool to identify and rank problems according to a set of criteria within a community (IIRR Vol. 2 1998,21).

The purpose of problem ranking is to allow community members to prioritize their problems and thus focus their attention and resources to the most important problems (IIRR Vol. 2 1998,21). In my study the problems that negatively affect the degradation of fishery resources were identified during previous visits by means of focus-group discussions, resource mapping, and semi-structured interviews. Moreover, the problem ranking exercise was part of a questionnaire that I conducted in all 12 villages covering six households in each village. Its format therefore differs widely from the problem ranking exercise as described by the IIRR sourcebook using Meta-Plan technique. Participants were encouraged to name further problems to those mentioned in the questionnaire. Next the participants were asked to compare each problem and rank it from one to ten according to its relevance on the degradation of fishery resources. The problem

with the highest number is considered the number one problem. If several problems have the same number, they are considered to be of equal importance.

The strength of problem ranking is that it provides a systematic way of prioritizing problems in a community (IIRR Vol. 2 1998,26). Problem ranking is also a powerful tool for awareness building in a community, because it reflects back problems gathered during previous visits and thus is part of implementing the integrated natural resource management learning cycle.

The limitation of problem ranking is that it is time consuming and the ranking procedure requires thorough explanation. In addition the researcher should be aware that problem ranking may raise expectations in a community and is best followed by planning and implementing a course of action (IIRR Vol. 2 1998,26).

Venn diagrams are a tool for illustrating relationships between different groups and organizations within a community (IIRR Vol. 2 1998,116; PIDO et al. 1996,33). They are particular useful to identify potential conflicts between stakeholders (PIDO et al. 1996,33) but also potential key intervention points to introduce more sustainable resource management practices. For example, Venn diagrams can identify different decision-making patterns concerning resource management and which stakeholder group is responsible for making decisions about a given resource (SCHOONMAKER FREUDENBERGER 1994).

The purpose of Venn diagrams is to identify groups and stakeholders and the relationships between them and the community (IIRR Vol. 2 1998,117). Furthermore, Venn diagrams identify the influence of organizations on each other and a particular subject in the community, e.g. in this study the economic development of fishery households[2] (IIRR Vol. 2 1998,117). Thereby the circle, its form and position stand for:

- Circles – symbolize the organizations and stakeholders in the coastal fishery sector.
- Size – is determined through ranking and resembles the influence of the identified organizations or stakeholders on the local coastal fishery.
- Position – means the distance of the organizations or stakeholders to the economic development of fishery households and represents the relationship between them and the fishery households. In addition overlapping circles or circles in close proximity represent business ties and relationships between stakeholders, organizations and/or fishery households.

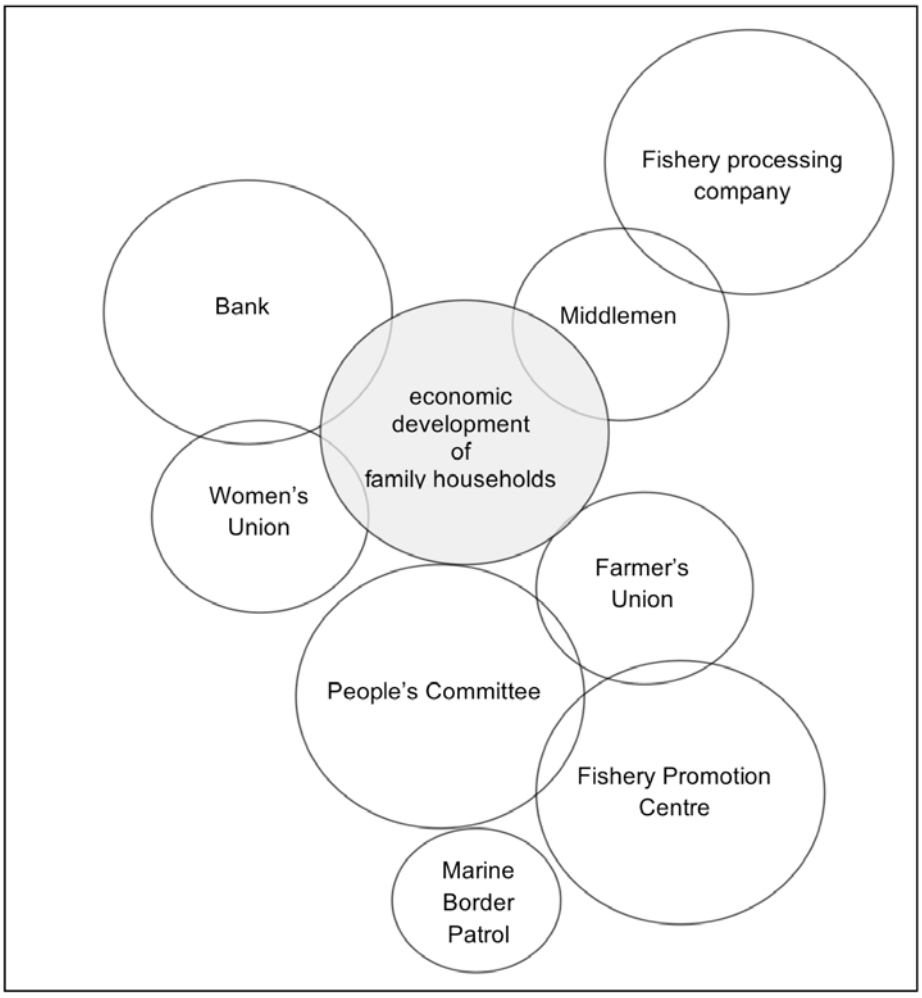
The following materials were used:
craft paper (1x2m)
colored paper cut into three sizes of circles
markers
glue

[2] I chose the 'economic development of family households' as the center of the contemplation, because people in different communities perceived the influence of stakeholder groups and organizations on the community itself variedly, according to income, fishing gear, education, location of their village in the lagoon, etc. only the influence on their own financial situation was perceived to be somewhat equal.

The Venn diagram was conducted in three representative villages of the 12 villages situated around Nha Phu Lagoon. Due to lack of personnel resources and time the course of preparing a Venn diagram was modified pursuing the following process steps:

1. A meeting was arranged and previous selected key informants, between four and eight participants, invited. Particular emphasis was paid to invite people from various professions that bear reference to the coastal fishery sector.
2. The objective and use of the Venn diagram was explained, including the notice that the original diagram will stay in the village and only a small copy made.
3. In a next step the participants were encouraged to complete a list of previously selected stakeholders related to the coastal fishery sector by either adding or crossing out stakeholders.
4. The list of stakeholders was ranked according to the ranking technique in the previous section. The ranking resembles the influence of the stakeholders on the local coastal fishery ranging from one to ten.
5. In the meantime the three sizes of circles were labeled with the stakeholders in relation to their rank, i.e. the larger the circle the more influence the stakeholder group represented by that circle has on the issue (see Figure 19), namely:
   - 1-3 small
   - 4-7 medium
   - 8-10 large.
6. The craft paper was placed on a table, the participants provided with the prepared circles and the subject economic development of family households drawn as a large circle in the middle of the craft paper (Figure 19).
7. Then the participants were asked to place the circles according to:
   - their influence/relationship on the economic development of the family households and
   - their influence/relationship on each other through its relative distance from the middle or through overlapping each other (Figure 19).
8. After allowing enough time to discuss the positioning of the symbols and letting the participants review their outputs, the circles were glued to their final position.
9. The finished Venn diagram was then object of a thorough discussion about the role and influence of stakeholder groups on the livelihoods of fishery households and the entire coastal fishery sector (Figure 19).

Figure 19: Sample output of a Venn diagram.



The strength of Venn diagrams is that it summarizes complex information in a visual manner, identifies informal groups and other stakeholders which have not been detected in the previous research process, and that it reveals the local perception on relationships and the level of influences of stakeholder groups and organizations (IIRR Vol. 2 1998,123). Besides producing detailed information about stakeholders and their influence the process provides the participants with a better understanding about the most powerful and influential key stakeholders affecting their livelihoods. I found the Venn diagram technique precious for learning more about power relations inside the coastal fishery sector without provoking people to take a stand and retrieving biased information but instead producing many lively discussions.

A weakness of Venn diagrams is that it consumes a lot of time and requires educated participants who are able to transfer their knowledge to the abstract concept of circles, sizes, and positions. Due to the perceived high rate of illiteracy among fishermen and thus the encounter of difficulties conducting the Venn diagram, the selection of participants orientated itself along the educational level instead of selecting a representative group of the community. In addition conducting Venn diagrams also puts a high demand on the researcher, i.e. thorough preparation, the capability to explain matters, and the facilitation of the long and multi-faceted process of guiding people but not dominating them. Although the exercise marked the end of the field study in Vietnam and is good for

fostering the integrated natural resource management learning cycle to enhance reflection, create awareness and prompt discussions, I experienced that comprehensive participatory research is a prerequisite before applying this tool.

Questionnaires are a method to collect data using prearranged questions in a specific order or in other words a written interview. A questionnaire is designed in line with the research project, i.e. the objective of the study, the overall circumstances, cultural and social factors.

The purpose of a questionnaire is to collect information that provides a genuine reflection of the attitudes and beliefs of people. Thereby the questionnaire gives the researcher greater confidentiality, because the interaction between the respondent and the researcher is limited, so that the questions can be answered more thoroughly.

The questionnaire was carried out in each of the 12 villages around Nha Phu Lagoon, with respectively six households, totaling 72 households. The households were selected using a stratified approach. The objective was to cover sales persons, middlemen and representatives in agriculture, aquaculture and fishing particularly of the most common gear-fishing categories in each village.

Respondents were explained the purpose and use of the questionnaire and assured that their answers will be handled confidentially. Due to widespread illiteracy the questionnaire was read to the respondents and filled in by the research assistant. Hence questions concerning the length, design, distribution and return (response rate), and attractiveness of the questionnaire were not an issue. However, the language used in the questionnaire is kept simple and questions easy to read.

The question structure in the questionnaire survey comprises a combination of open-ended and closed questions with the majority being closed questions to assess demographic and fishery data. Within the closed question range there are a number of response options from the simple Yes/No choice to multiple-choice questions including an ‘other’ exhaustive category offering a wide range of options for selection. Moreover, order questions were included in the questionnaire to perform a problem ranking (see also problem ranking in the previous section).

The strength of questionnaires is that they save time by allowing a large number of individuals to be questioned. Questionnaires also encourage objectivity, because confidentiality can be guaranteed and all questions are presented in an identical order. In addition the bias was somewhat controlled, because all 72 questionnaires were filed out by one person.

The weakness of questionnaires is that they are solely extractors of information with little or no use to the respondent. This is because questionnaires are inflexible and one short question follows the other giving the respondent little time to think and reflect his answers and the researcher no possibility to interrogate the respondent to clarify answers.

In order to reach the objective of creating a learning cycle and override some of the weaknesses mentioned above, I experienced the inclusion of the problem ranking exercise into the questionnaire as a major improvement.

3.1.3 Data Collection and Quality

Empirical data were collected using the 'choice of methods' mentioned above. In addition desk-based literature reviews were carried out prior to the field study and throughout the entire research process. The literature review mostly relied on web-based materials such as scientific journals, project reports, guidance sheets, best practice guidelines, articles, and abstracts of books to capture the global state of knowledge. On the other hand, more use was made of printed material, i.e. books, journals, project reports, and official documents. The latter were acts, decrees, and code of conducts published by the Vietnamese government particularly from the local government and related to coastal fishery management and aquaculture.

The research design concerning the selection of theories and paradigms, philosophy of science, methodological issues and varying qualitative approaches was largely influenced by websites committed to such areas. Inputs from sites such as http://nrm-changelinks.net (action research), www.iatp.org/AEAM (adaptive management), http://forum.objectivismonline.net (epistemology) or www.qualitative-research.net (qualitative social research), only to name a few, proved vital to encourage critical and reflective thinking.

In general data, collected during group discussions, participant observation, or resource mapping exercises, was entered into a journal directly afterwards in form of a summarized transcript. On other occasions I abandoned this procedure. This occurred in particular in my role as facilitator or mediator. In addition a lot of information was obtained casually after meetings and exercises, during lunch invitations, at local coffee shops or during long motorbike rides. This information was written down in field notes and then converted into write-ups at a later moment. Through this procedure some of the missing information were added back, because reviewing of field notes often lead to reminiscence of information (cf. MILES and HUBERMANN 1994,51). Complementarily over 230 photographs were taken to augment field notes and to provide a more comprehensive understanding of the coastal communities. By means of writing summarized transcripts or write-ups the amount of data was reduced considerably in advance compared to commonly used elaborate transcripts. This approach ensured that a fine balance was achieved between the amount of information generated and the number of participants engaged in the research process. MILES and HUBERMAN (1994,10-11) point out that data reduction occurs continuously throughout the research process even before data collection. They see data reduction as part of analysis and suggest, that scientist be conscious about their decisions and about which conceptual framework, which data collection procedures, and which data chunks to choose.

Approximately 242 respondents were involved in this research including the 72 respondents from the questionnaires. The respondents represent 21 stakeholder groups from four administrative levels: 1) village level, 2) local government level (municipal government), 3) local government level (district government), and 4) national government level (province government). At the village level representatives are fishermen, women, shrimp and lobster aquaculturists, middlemen, village leaders, Women's-, Farmer's-, and Fishermen's Unions, and the Fishery Resource Protection Group. At the municipal government level the participants come from the People's Committees and Councils and the Offshore Fishing Boat Support Group. At the district government level,

representatives come only from People's Committees and Councils. At the national government level these include representatives from the Ministry of Fisheries, Fisheries Resource Protection Department, the Fishery Promotion Centre, the Marine Border Police, and the Institute for Oceanography, the Research Institute for Aquaculture No. 3, the University of Fisheries, and banks (Table 3). However, respondents from Women's-, Farmer's-, and Fishermen's Unions and few other stakeholder groups are not listed independently, because these participants joined group discussions, resource mapping and Venn diagram exercises. Therefore, their number lies within the accumulated number of fishermen (Table 3).

Table 3: Distribution of respondents.

No	Stakeholder group	Number	Percentage (%)
	Village Level:		
01	Fishermen	153	
02	Women	31	
03	Shrimp farmers	15	
04	Lobster farmers	8	
05	Middlemen	2	
06	Village leaders (Village authority)	12	
07	Women's-, Farmer's-, and Fishermen's Union		
08	Fisheries Resource Protection Group	1	
	Local Government: *Municipal Level:*		
09	People's Committee	1	
10	People's Council		
11	Offshore Fishing Boat Support Group		
	District Level:		
12	People's Committee	3	
13	People's Council	1	
	National Government: *Province Level:*		
14	Ministry of Fisheries	1	
15	Fisheries Resource Protection Department	1	
16	Fishery Promotion Centre	1	
17	Research Institute for Aquaculture No. 3	3	
18	Institute for Oceanography	3	
19	Marine Border Patrol	2	
20	University	2	
21	Banks	2	
	Total	242	

By means of **triangulation** the validity and reliability of the collected data was assured. Triangulation is the application and combination of research methodologies to study the same phenomenon. Besides the triangulation of methods there are other forms of

triangulation including triangulation of observers, theories, empirical materials and data (cf. FIELDING and FIELDING 1989,25). The idea is to increase the accuracy of information through working with, preferably independent or partly independent, multiple information sources and determining similarities or differences between the data sources (DICK 1993,11). DICK (1993,11-12) distinguishes similarities between triangulation and dialectic and gives examples how to create dialectic using:

- different informants, e.g. asking fishermen and illegal fishermen the same questions;
- different research settings, e.g. visiting all twelve villages around Nha Phu Lagoon;
- the same informant responding to different questions, which address the same topic from somewhat different directions, e.g. what fishing technique do you use? How big is your boat and how big is the engine? Two questions to determine if the fisherman engages in illegal fishing, while keeping in mind that the motorization of boats corresponds to the applied fishing techniques;
- information collected at different times, e.g. visiting villages and fishermen at weekly intervals;
- different researchers or;
- different methods, e.g. asking questions that cover the same topic in semi-structured interviews as well as in resource mapping exercises.

Therefore triangulation of empirical data and qualitative and quantitative methods leads to more profound knowledge about the natural resource system and its users (cf. FLICK 1992,195). However, triangulation is no panacea or guarantee of validity, choosing the appropriate methods and avoiding bias, i.e. selecting field data that fits the personal perception of the research matter, remain the responsibility of the researcher (cf. FIELDING and FIELDING 1989,32). HAMMERSLEY and ATKINSON (1983,199) concretize that one should not assume that *"the aggregation of data from different sources will unproblematically add up to produce a more complete picture"*. In addition it is impractical and unwise to pursue all feasible means of data collection and analysis and use as many as possible (FIELDING and FIELDING 1989,34). Instead it is important to choose *"at least one method of data collection that describes and interprets the context in which the interaction occurs and one that is designed primarily to illuminate the process of interaction itself"* (FIELDING and FIELDING 1989,34). For example I used focus-group discussions and observations to learn about the problems that degraded fishery resources and combined them with Venn diagrams that revealed the various stakeholder groups and their interactions inside the coastal fishery sector.

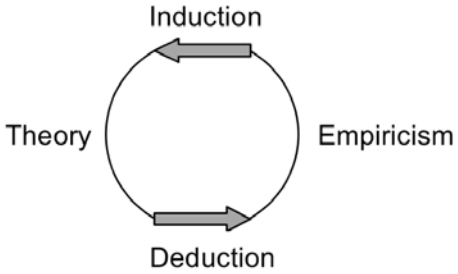
3.1.4 Qualitative and Quantitative Data Analysis

Integrated natural resource management borrows and combines paradigms theories and methods from various research approaches to address natural resource systems. I continued this practice applying a mixed-methodology design to data analysis mixing qualitative and quantitative paradigms at many methodological steps (cf. CRESWELL 1994,178;). This procedure combines the advantages of both the qualitative and the quantitative paradigms, e.g. working back and forth between inductive and deductive models of thinking to better understand the concept being explored (CRESWELL 1994,178). GREENE, CARACELLI and GRAHAM (1989, cited in CRESWELL 1998,175) highlight five major purposes that address mixed-method evaluation design:

1. Triangulation – to test the consistency of findings obtained through different instruments (cf. previous chapter).
2. Complementarity – to enhance and clarify facets of a phenomenon with the use of other method-type results.
3. Development – to shape subsequent methods or steps in the research process, where the first method is used to help inform the second method.
4. Initiation – to stimulate new research through challenging of results and open up new perspectives.
5. Expansion – to provide breadth and scope to a study exploring specific features of each method and bringing their different inquiry components together in a side-by-side fashion (cf. GREENE 1997,3).

Deduction versus Induction

Knowledge generation in empirical research may be understood as interplay between theory and empiricism, whereas **deduction** is the path from theoretical constructions to empirical observation and **induction** is the path from empirical findings to theory generation. Consequently scientific progress can be characterized as a circular model, wherein deduction from theories alternates with induction from empirical observations.



The beauty of this circular model is that the philosophical argument between empiricism and rationalism what came first, theory or observation, is unmasked as the unsolved question after the chicken or the egg. To emphasize knowledge generation the circular model is normally expanded to a spiral.

(ROST 2003,42)

A research strategy integrating different methods is likely to produce results that are potentially more useful and relevant in terms of quality and scope in contrast to research concepts following only one method (cf. GREENE 1997,2-3; MAYRING 2001,31; BURZAN 2004,25). Although authors like SEIPEL and RIEKER (2003) point out that the integration of qualitative and quantitative approaches cannot be done insouciant and demands a great deal of methodological expertise from the researcher, their biggest concern lies in the progression of qualitative and quantitative methods and the generally small sample size of qualitative research that does not allow statistical generalization (BURZAN 2004,24). MAYRING (2001,7) argues that the sample size is no clear demarcation criteria, since there

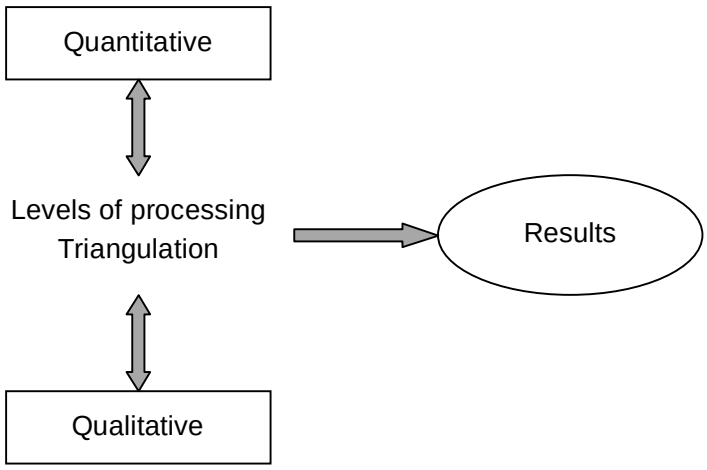
are quantitative individual case studies. He continues, that up until now no explicit definitions exist that distinguish between qualitative and quantitative analysis. However, this distinction cannot be done by listing methodological differences but must start at a level regarding epistemology and philosophy of science (ROST 2003,41). CRESWELL (1994,175) expresses this notion through asking whether paradigms *should* or *must* be linked with research methods.

There are three stances in the debate about mixing paradigms: (1) the *purists* argue that paradigms and methods should not be mixed; (2) the *pragmatists* see paradigms as useful conceptual constructions but of little value for the research practice, and that researchers should make the most efficient use of methods to maximize contextual responsiveness; and (3) the *dialectic* stance in which paradigms are seen as valuable frameworks for the inquiry process and the tension that exists between two conflicting or interacting paradigms is viewed as potentially prolific generating a *"more complete, more insightful, even more revisioned or transformed evaluative understanding"* (GREENE 1997,2). However, the same author pleads for *"a balance between philosophy and methodology, between paradigms and practice"* (GREENE 1997,2).

MAYRING (2001,5) emphasizes applying strategies for analysis according to their strengths and searching for strategies combining qualitative and quantitative methods. In the case of qualitative oriented research projects and adding quantitative analysis the research results gain generalization, transparency, and the research as such becomes comprehensive und revisable (MAYRING 2001,31). Furthermore systemizing and generalizing provide arguments against doing research of mediocre quality (MAYRING 2001,31; cf. GRØNHAUG and OLSON 1999,6).

The research design aims to evaluate the data through qualitative and quantitative methods according to the model of triangulation (Figure 20). Thereby, the idea is not to determine which approach for analysis produces the better results, rather the results mutually support each other and the intersecting individual findings represent the overall results (MAYRING 2001,25). The focus does not lie on the establishment of truth but to stepwise expand the cognition through comparing different approaches (MAYRING 2001,25).

Figure 20: Integrating qualitative and quantitative analysis in the model of triangulation.



Source: MAYRING (2001,21)

In order to understand the selection of adequate methods of analysis I emphasize that:

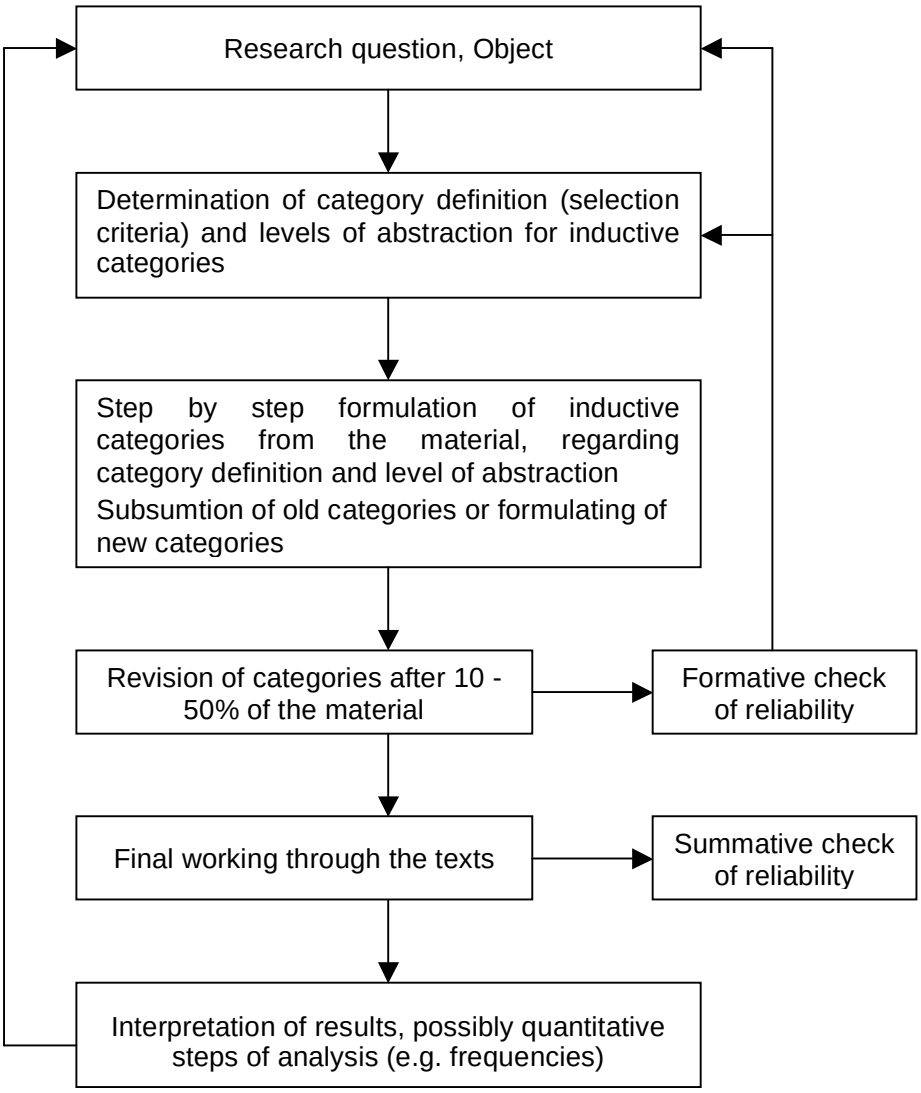
1. In farming systems research explorative research designs generally are evaluated and depicted in a quantitative and descriptive manner (cf. BITSCH 2000,9).
2. Integrated natural resources management offers only limited concepts how to systematically evaluate qualitative research data.

Due to the explorative research design applied in integrated natural resources management and participatory action research, I selected the grounded theory approach according to GLASER and STRAUSS (1979) as concept of inquiry, because it sees itself as strategy to discover new phenomenon and develop new theories in a methodological controlled manner while demanding an open-minded approach to the study object (cf. DEFFNER 2004,9). However, since the scope of the study was to implement integrated natural resources management in a coastal fishery environment and not to generate theory, only the first of three steps in grounded theory was applied (for further discussion on this decision, see GLASER 1992; STRAUSS 1994; STRAUSS and CORBIN 1996; BÖHM 1994). In an interview with LEGEWIE and SCHERVIER-LEGEWIE (2004,59) STRAUSS refers to this step as *"theoretical sampling"* a synonym for starting early in the research process with evaluation of interviews and writing of memos to produce theories and hypotheses that determine the selection of the next interview partner or comparison group. MAYRING (1999,83-84) calls this process *"stop and memo"* and refers to this term as writing memos of central aspects discovered during fieldwork and classically during participant observation. For the further evaluation of the collected data I choose qualitative content analysis according to MAYRING (1999, 91), which is specifically well suited to systematically analyze large quantities of textual data. In addition, its coding procedure is well described.

Qualitative content analysis is one social science approach developed some 20 years ago to systematically analyze texts (MAYRING 2000,1). This method ensures a methodological controlled and progressive analysis of data such as write-ups, summarized transcripts, or written memos (MAYRING 2000,5). Thereby the data material is viewed line by line and phrases, sentences, or paragraphs are coded into corresponding categories. Categories are developed inductively from within the textual material[3] by means of using terms or text passages that are formulated close to the textual content (MAYRING 1999,92). After formulating a new category I wrote a memo with a brief category definition. Scanning further through the write-ups, text passages were analyzed in a deductive manner, i.e. corresponding text passages were assigned to the previously generated categories (Subsumtion). If the following text passage did not fit into the already existing inductively generated category scheme, a new category was formulated inductively from the specific text material. After revising approximately 10-50% of the data material the categories are adjusted in a *"feedback loop"*, reduced to main categories, and checked in respect to their reliability (MAYRING 2000,11). In the final revision of the textual data MAYRING (2000,11) would suggest a summative check of reliability. The following Figure 21 gives a review of the category development process.

[3] This coding procedure is similar to the *"open coding"* phase in grounded theory (cf. DEFFNER 2004,10-11).

Figure 21: Model of inductive category development.



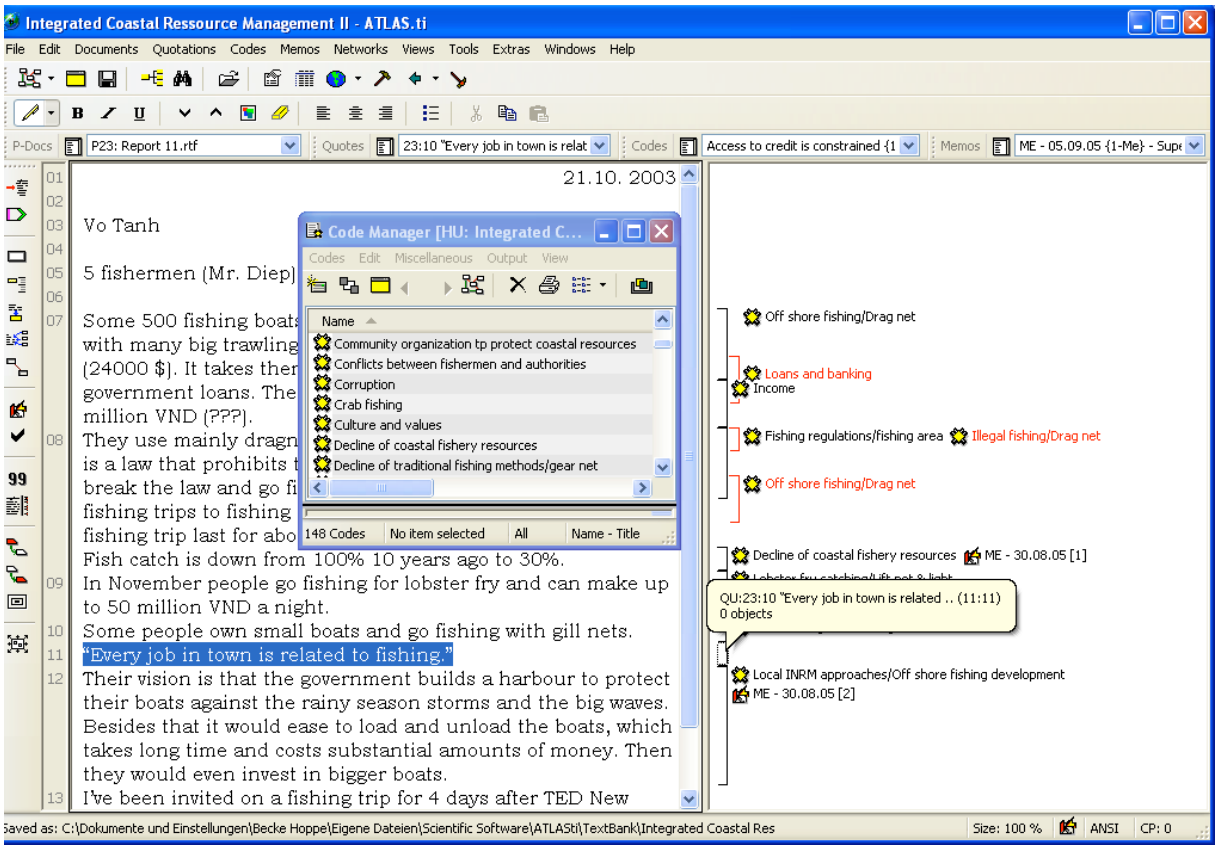
Source: adapted from MAYRING (2000,11)

The outcome is a set of categories (codes). Specific words, sentences, or text passages are dedicated to each category. Further analysis either interprets the category scheme regarding research questions and underlying theories, or coded text passages can be evaluated quantitative (MAYRING 1999,94). Quotations from the textual material serve as clarification of a category and respectively exemplify explanations. The quotations are cited using an ID provided by the software Atlas.ti®, for example (14:1). Thereby the first number refers to the document, i.e. the fourteenth (14:) document, and the second number refers to the chronological order in which the quotation was created, i.e. the 1st (:1) quotation that was created in this document. For further reference the quotation IDs and their original terms, as well as their assigned codes are listed in the appendix.

The possibility of a statistical evaluation of the individual coded categories was discarded. The frequency of entries and how often a category is assigned does not allow any assertions over the reviewed context. Free quotations were used to exemplify findings and theories.

Qualitative analysis software represents a computerized alternative to doing analysis by hand. The main advantage of using qualitative analysis software is to structure the large volumes of qualitative data (O'FLAHERTY and WHALLEY 2002,4). However, GLASER (1998,185-186, cited in FERNÁNDEZ 2004,91) warns about falling into the *"technological traps"* of data analysis software, so that he is concerned about the unnecessary restrictions they create, the possibility that they inhibit the development of the researcher's own skills, and the time-consuming learning curves they impose. In my work I use the software Atlas.ti® which is conceptually linked to the qualitative data analysis approach of grounded theory (MUHR 1994,318). I used Atlas.ti® to perform open coding of the textual data, select quotations for later reference, generate family codes, i.e. grouping of subcategories into categories, and write memos. Similar to FERNÁNDEZ' (2004,91) experience I quickly learned to appreciate the use of Atlas.ti® in my study as on the one hand it provided a fast way of coding and retrieving data records using the code manager without having to shuffle through large quantities of paper and on the other hand it did not impose a significant learning curve to work with the software. At first all data is transferred to a 'hermeneutic unit'. The hermeneutic unit contains all qualitative analysis steps, i.e. generated codes, quotations and memos (Figure 22).

Figure 22: Qualitative analysis software (Atlas.ti®) showing a group discussion write-up with coding stripes to the right of the screen, the code manager, a highlighted quotation, and two memos (ME).



Although Atlas.ti® offers automatic coding tools, the entire material was coded manually following qualitative content analysis as described earlier. Thereby a text passage is

marked with the mouse pointer. Subsequently one or more codes are assigned to the citation, whereas either a selection is made from the code list in the code manager or a new code is assigned (see Figure 22). Next the coded categories were grouped into code families with help of the family manager. The entire process was documented by writing memos in the memo manager. In my opinion one of the major advantages of working with qualitative data analysis software such as Atlas.ti® is that underlying text passages of codes can be easily retrieved and viewed for comparison.

Quantitative data analysis was applied through the statistical evaluation of the 72 questionnaires that were carried out in the final phase of the fieldwork. The outcomes are used to give proof of or reject the results from the qualitative data analysis thereby adding to generalizing results and theories in this study. As measure of the most common central tendency the arithmetic average or mean was applied. Adding the values of all observations and then dividing that sum by the number of observations calculates the mean.

4 A Case Study: Integrated Natural Resources Management of Coastal Fisheries

4.1 Introduction

The following findings are either cited with help of the quotation ID or the associated methods that were used for their identification are named. However the origin of findings from participant observation or from a dialog in a coffee shop, for example, are not always notably mentioned, as this would disrupt the narrative form of the text. I would like to stress that I have put great emphasis on the comprehensive presentation of findings, so that the reader is able to relate to them.

After a short introduction to the study location I provide a short outlook into Vietnams political system and the Vietnamese values and believe systems. The next chapter addresses Vietnams fishery sector, policies, institutions, organizations and management. Focusing on the study location Nha Phu Lagoon I describe its agro-ecosystems and socioeconomic background followed by its coastal fishery resources and their use. Various fishing techniques and aquaculture systems are specified before elaborating on marketing and financial institutions in the fishery sector. Further stakeholders in the natural resource system are introduced and the decision-making structures between them. Highlighting trends leads to a more thorough investigation of problems, particular illegal fishing and the negative effects of intensive shrimp farming that threaten the livelihoods of the coastal fishery communities. The devolution of natural resources management and the formation of a self-formed community organization to protect fisheries resources finish off the case study.

4.1.1 Vietnam country profile

Vietnam extends 1650 km from north to south in an S-like shape and only 50 km across at its narrowest point. It covers 329 560 square kilometers which is slightly smaller than Germany. In July 2005 the population was estimated at 83,5 million people, growing at an estimated rate of 1.04 percent annually. Vietnam's coastline runs 3 444 km alongside the Gulf of Thailand, Gulf of Tonkin and the South China Sea. In the north Vietnam borders China in the west Laos and Cambodia. (Figure 23)

Vietnamese (*Kinh*) account for 86 percent of the population, the rest come from 53 smaller ethnic minority groups, e.g. Muong, Tay, Khmer, or Cham. The 1999 census revealed that 80.8 percent of the population had no religion, 9.3 percent were Buddhist, 6.7 percent Catholic and 3.2 percent followed other religions, namely Hinduism, Islam, Hoa Hao, Cao Dai, and Protestantism (CIA 2005).

With 91 percent the primary school enrolment rate in Vietnam is high. Children attend primary school from age six to ten. About 60 percent of them go on to secondary school. (BAULCH et al. 2002, cited in FELSING and HA 2003,2) However the Research Institute for Marine Products in Hai Phong, Vietnam, notices, that the general education level of fishermen is low, i.e. only 20 percent finish primary education, while 68 percent do not, less than 10 percent go on to high school and only 0.65 percent graduate from vocational schools or universities (RIMP 2005).

The literacy rate in Vietnam was 93.9 percent for men, 86.9 percent for woman and 90.3 percent for the total population in 2002 (CIA 2005).

According to unofficial statistics, 80 percent of households in coastal communities rely on fishing and associated activities (STREAM 2004,1).

4.1.2 Natural Environment of Nha Phu Lagoon

Nha Phu Lagoon lies in the province (*Tinh*) of Khanh Hoa located in South Central Vietnam. The lagoon covers 4 500 ha and is surrounded by 12 villages. The villages lie in two districts (*Huyen*) Ninh Hoa and Nha Trang, representing five municipalities (*Xa*): Ninh Phu, Ninh Ha, Ninh Loc, Ninh Ich and Vinh Luong. The exact location of the 12 villages (*Thon*) is illustrated in Figure 24. The same figure shows the line of demarcation (*Duong Ranh gioi*) between the two capes (*mui*) Mui Ke Ga and Mui Da Chong which represents the official border of the Lagoon's territorial waters according to the directive No. 26 CT/UB dated 01/06/2002. The communities lie north of Nha Trang City along Highway No. 1 and are easily accessible. Dirt roads connect the villages with the highway, whereby Le Cam as remotest village is situated approximately six kilometers from the highway.

Nha Phu Lagoon is fed by the Da Han, Cau Lam and Cai Rivers, and is sheltered from the open sea by the Hon Heo Peninsula. Various islands are scattered across the lagoon and divide the water surface. The mostly narrow coastal plains quickly extend to mountain ranges that are utilized by growing fruit trees like bananas, mangos or cashews. To the southwest of the coast extends a vast salt marsh. The large plains to the west of the lagoon are used for intensive rice cultivation. The entire coastline between the villages Ngoc Diem and Le Cam is converted into shrimp ponds clearly visible on the satellite picture of Figure 24. The shallow waters between Cat Loi and the tourist island Hon Cu Lao are used for lobster cage culture.

The annual average temperature is 27°C, with a maximum in May and June of 28°C and a minimum temperature in January of 23,8°C. The average annual rainfall is about 1500 mm, whereby 70-80% occurs in the rainy season. There are two monsoon seasons: the winter monsoon (rainy season) from the northeast between September and December and the summer monsoon (dry season) from the southwest between January and August. The winter monsoon has strong implications on the fishing sector, as it produces high waves and strong winds that prevent the majority of small boats from going fishing on the open sea. Four fishermen even hold weather changes responsible for the decline of coastal fishery resources and give it a high ranking in the questionnaire, which could be an indication for an increase of extreme weather events in the context of global warming. However inside the lagoon there is less negative impact compared with the open sea and fishing activities remain untainted besides the increasing competition from those fishermen who transfer their fishing activities from the open sea into the lagoon during the winter months. Expressed by the words of a fisherman from Vo Tanh: *"Other boats go fishing inside the bay, because if the sea is rough they can't go outside the bay"* (44:10). A more devastating impact from the winter monsoon affects the villages to the back of the lagoon, namely Tam Ich, Tan Te, Ha Lien, and Le Cam.

Figure 23: Map of Vietnam with indicated study area.

Source: UNIVERSITY OF TEXAS (2005)

Figure 24: Satellite image of study location Nha Phu Lagoon with bordering villages and indicated line of demarcation between the two capes (*mui*) Mui Ke Ga and Mui Da Chong.

Source: adapted and modified from GOOGLE (2005)

These villages are prone to seasonal flooding due to excessive rainfall in the highlands and their location in the river deltas making roads impassable. Yet even worse is the effect on the polyculture of shrimps and crabs cultured in ponds in the area (21:8). Although crabs like low salinity (5-10°), the dilution with rainwater leads to their death (21:6). In addition shrimps are lost to neighboring ponds simply swimming away as the area becomes flooded (21:8). In general the meteorological, oceanographic, and topographic conditions of Nha Phu Lagoon are favorable and suitable for cage mariculture (TUAN, NHO and HAMBREY 2000,2). The tidal regime is irregular diurnal with a tidal height of 1.5-2.0 meters.

4.2 'From Communism to Capitalism'

4.2.1 Political and Economic Change

Vietnam is a socialist republic ruled by the communist party. There is no opposition and attempts to institute a plural party system have been rejected by the communist party. In recent years, attempts have been made to further separate party and state from each other. Since economic reforms started in 1986 (*Doi Moi*)[1], Vietnam has established new foreign policies. The relations to China have been re-established and new relationships developed with other countries in Southeast Asia. A milestone was the resumption of diplomatic contacts with the U.S. and in 2000 both countries signed a trade agreement.

The state economy was founded on the principles of central planning and collective ownership. By the early 1980's the weaknesses of the central planning model began to manifest themselves through stagnating economic growth and rapidly rising inflation. The *Doi Moi* reform in 1986 started a new era with the transition from central planning to market economy with a socialist orientation. Currently the Vietnamese economy is one of the fastest growing economies in the world. The Gross Domestic Product (GDP) has increased from 32.9 billion USD in 2001 to 45.1 billion USD in 2004, growing at 7.5 percent annually. The Gross National Income (GNI), accounted with the Atlas method, has grown from 410 USD per capita in 2001 to 550 USD per capita in 2004. The inflation rate was 8.3 percent in October 2005. Although Vietnam is an agrarian society with 70 percent (2001) of the labor force working in agriculture, fishery and forestry, agriculture accounted for only 21.8 percent of the GDP in 2003 following a declining trend. The largest share with 40 percent came from industrial enterprises. The services industry, namely banking, finance and insurance generated turnovers amounting to 38.2 percent of GDP. (WORLD BANK, 2005)

In order to compare people's livelihood and development economic indicators should be viewed critically, because only economically valued goods are measured. Therefore the Human Development Index (HDI), accounted through the average life expectancy, literacy and the Purchase Power Parity, is a much better indicator. In the HDI classification from 2005, Vietnam ranks 108th out of 177 countries; Germany, in

[1] *Doi Moi* (renovation) is the name given to economic reforms in the mid 1980s and marked by the death of Le Duan in 1986. As a result of *Doi Moi* central planning was abandoned, collectivization gradually abolished, and market oriented reforms, encouraging free-market enterprises, implemented.

comparison, ranks 20th (UNDP 2005,219). The achievements in reducing poverty in Vietnam have been impressive. Poverty fell from well over 70% in the mid-1980s to 37% in 1998. Yet poverty is still a widespread phenomenon in rural areas (IMF 2004,14). For this reason, in September 2002 the prime minister approved the decree No. 825/QD-TTg on poverty reduction following the comprehensive poverty reduction and growth strategy (CPRGS) which includes a 10-year socioeconomic development strategy (2001-2010) and a 5-year socioeconomic development plan (2001-2005) with detailed objectives, institutional arrangements, policies and solutions (IMF 2004,iii).

4.2.2 Values and Belief Systems

The move from a centrally planned economy to what the Vietnamese Government describes as 'socialist-oriented' market economy has led to economic growth, poverty reduction and employment opportunities (DFID 2004,2). However, the underlying policies do not explain fully the ways in which natural resources are used and managed (KINGMA et a. 2001,2). Fishermen and other resource holders do not operate in a vacuum but are influenced by values and institutions (KILPATRICK 2003,3). According to KINGMA et al. (2001,13-14) values and belief systems are one factor affecting the adoption of natural resource management practices and are just as important as contemporary economic issues.

Within the scope of the World Value Survey a representative study conducted by DALTON and ONG in 2001, covering 1 000 respondents all over Vietnam, sheds light on the human, social and political values (DALTON and ONG 2001,13). The following list represents the main findings of the survey (DALTON and ONG 2001,1-14):

- The family is the most important social structure in Vietnamese society (cf. FELSING and HA 2003,vii). Almost all Vietnamese, namely 99 percent, feel that parents are to be respected regardless of their qualities and faults.
- Although many Vietnamese are members in a variety of social groups, their actual activities in such groups is quite limited, averaging only 10 percent among group members.
- Perhaps due to this social disconnection many Vietnamese are skeptical of their fellow man, 59 percent say, that most people cannot be trusted.

  This assertion corresponds to experience within my own studies, where a discussion about the introduction of a community marketing board to sell quality lobster fry for higher prices was doomed to fail, because according to the fishermen's own statements Vietnamese are very deceitful and this would reflect the Asian culture not to trust each other (59:4).

  Yet, according to DALTON and ONG (2001,5) the level of social trust appears higher compared to other nations at Vietnam's level of development.
- The traditional role of women remains strong with 86 percent of respondents specifying, that a woman needs to have children, and that being a housewife is just as fulfilling as paid employment.
- Compared with other countries, e.g. China (41 percent), Japan (17 percent) or the United States (49 percent) the belief in moral absolutes is especially strong among

Vietnamese with 58 percent. Therefore Vietnamese do not believe, that various illegal activities such as bribery, falsifying taxes or illegal claiming government benefits are ever justified.

Contrary to these findings are experiences from my own findings which are reflected in various coding categories such as: *Government fails to enforce fishing regulations*, *Government failure to enforce laws and regulations* and eventually in three categories dealing with *Illegal fishing/dragnet*, *Illegal fishing/electric fishing* and *Illegal fishing/dragnet equipped with electric gear* exemplifying the enormous amount of illegal activities taking place in Nha Phu Lagoon, although people know it is against the current law (cf. 58:2; 65:6; 15:9; 77:3).

- While in Western democracies such ethical and moral beliefs are frequently linked to religious values, only 10 percent of the public in Vietnam view religion as an important part of their life. About 46 percent of Vietnamese say, they do not belong to any religion and 82 percent think, that religious leaders do not provide adequate moral support. Accordingly few believe in heaven, hell, God, life after death, the soul, or other religious concepts.
- Concerning the question government versus private ownership of business the Vietnamese public reflects the economic reforms of the past decade, with the majority of 81 percent favoring privately owned businesses, while 19 percent still support government ownership. Further examples from the survey exemplify the shift in values from a socialist to a market-oriented economy.

  Instead of agreeing that the government should provide for individuals, 67 percent say, that people should take more responsibility for themselves. Three quarters of the public believe, *"competition is good. It stimulates people to work hard and develop new ideas."* Anyhow the work ethic is very strong in Vietnam and the importance of leisure remarkably low namely seven percent. As a result 60 percent tend towards large income differences as an incentive for individual effort instead of giving emphasis to equal incomes.
- 80 percent of citizens are interested in the political process of which 29 percent are members of a political organization, in particular the Communist Party. Only four percent have ever signed a petition and only two percent have attended a demonstration. However, 52 percent are willing to sign a petition and 40 percent expressed their willingness to participate in a demonstration.
- Vietnamese have a strong sense of national identity, respectively 98 percent feel national pride. This level of identification and support of the nation are amongst the highest in the world according to the World Values Survey and on the same level as in the U.S.
- The Vietnamese express exceptional confidence in a wide array of political and social institutions. For example, 98 percent declare confidence in the national government, 97 percent in the parliament, 96 percent in the military, and 93 percent in the police. Vietnamese consistently express greater confidence levels compared to confidence levels averaged across Japan, Korea and Taiwan.

  However the authors suspect, that respondents may not feel, that stating a lack of confidence is a socially accepted answer. Furthermore, the World Values Survey

has identified a tendency for citizens in more developed and open societies to be more willing to question institutions and authorities.

Corresponding to the authors, suspicion I observed a significant lower confidence of coastal commune citizens in local government authorities and executive bodies such as the marine border police concerning the effective enforcement of current fishery legislation (cf. 36:2; 76:4; 81:13; 18:25; 76:6). However, my experience is the result of a carefully established relationship over six months and not the result of the present nonrecurring household survey.

Interestingly Vietnamese confidence towards international organizations is significantly lower, namely 76 percent for ASEAN[2] and only 61 percent for the United Nations. These low evaluations suggest a broad skepticism of international action on issues such as environmental protection, international peacekeeping, guaranteeing human rights, or economic development assistance.

- Reflecting the previous findings, most Vietnamese (96 percent) are satisfied with the current political system. These views are more positive than images of the government ten years ago (84 percent). This is the opposite of what might be expected, i.e. citizens seldom are more positive about current governments than past governments.

  Yet the Vietnamese support further reforms. 54 percent stipulate stronger measures towards societal reforms, 30 percent would like a more gradual approach, and only 16 percent think: *"Our present society must be valiantly defended against all subversive forces."*

  One apparent political reform concerns the democratization of politics and nearly all Vietnamese (97 percent) have appreciated the government's decision to add the concept "democracy" into the national development slogan: *"Prosperous people; strong nation; just, democratic, and civilized society."* Only five percent openly disagree. Most Vietnamese support the concept of democracy. However, one must be cautious about interpreting this endorsement for democracy in Vietnam, as "democracy" has different meanings to different people and has just recently been introduced into the political system.

4.3 Vietnam's Fishery Sector Overview

Aquatic resources provide a valuable source of income and nutrition and generally furnish the largest share of animal protein in the Vietnamese diet (TENENBAUM 1996,1282; NORAD 2002a,13; FAO 2005). The fishery sector after the *Doi Moi* reform in 1986 became the key economic sector of the country. (FISTENET a; NORAD 2002a,11)

Vietnamese marine fisheries are to a large extent multi-species fisheries, i.e. catches typically consist of numerous types of fish and shellfish. Marine capture fisheries are

[2] The Association of Southeast Asian Nations (ASEAN) is a political, economic, and cultural organization of countries in Southeast Asia, founded on August 8th, 1967 by Thailand, Indonesia, Malaysia, Philippines and Singapore and which has expanded gradually to include Brunei (1984), Vietnam (1995) Myanmar and Laos (1997), and Cambodia (1999) with Papua New Guinea as an observer.

primarily small-scale. Coastal fisheries are predominantly of a mixed subsistence/commercial nature, while offshore fisheries have a more commercial character. Aquaculture production ranges from subsistence to highly commercial enterprises. Stakeholders in the fisheries sector are very diverse ranging from households to small-scale production units to large-scale companies. (NORAD 2002a,12)

4.3.1 Fishery's Catch and Trends

The Ministry of Fisheries (MOFI) **characterizes marine resources** as follows. There are more than 2 000 species of fish in Vietnam waters, of which about 130 species have economic value. Latest evaluations estimate 4.2 million tons of fish stock biomass in the entire sea. The total allowable catch (TAC) amounts to 1.7 million tons, including 850 000 tons of demersal fish, 700 000 tons of small pelagic fish and 120 000 tons of pelagic fish. About 600 000 tons of the total allowable catch account for coastal fishery resources in areas of less than 50 meters depth. However, a recent publication from the Research Institute for Marine Products in Hai Phong restates, that fish stock in Vietnam's waters fluctuates from 3.1 to 4.2 million tons, with a total allowable catch of 1.4 to 1.6 million tons annually (RIMP 2005). The sea area of Vietnam is divided into four sometimes five regions, namely the Tonkin Gulf, the Central Sea, the South East, the South West, and the Mid-China Sea. The distribution of fish stock in Vietnam's waters is depicted in Table 4.

Table 4. Fish stock and total allowable catch in Vietnam's marine waters.

Marine waters	Stock (tons)	TAC (tons)
Tonkin Gulf	542 730	256 092
Central	622 494	298 998
South East	908 879	415 952
South West	478 689	223 075
Mid-China Sea	510 000	230 000
All marine waters	3 072 792	1 426 617

Source: RIMP 2005

Besides marine fish there are more than 1 600 species of crustaceans with an annual total allowable catch of 50 000-60 000 tons of particularly high valued species such as shrimps, lobsters and crabs. From 2 500 species of mollusks, squid and cuttlefish are highly valued species and the annual total allowable catch is 60-70 000 tons. Further economic value accounts for macroalgae such as *Gracilaria verrucosa* and *Sargassum*, of which 45-50 000 tons can be harvested each year. (RIMP 2005; cf. THANH 1995,75-80)

As a result of the economic reforms the **number and capacity of fishing vessels** has developed rapidly. 1986 for example there were 31 680 fishing vessels with a total engine capacity of 537 500 hp. In 1998 the number of boats had increased to 71 904 with a total engine capacity of 2 502 020 hp besides the 29 000 artisanal fishing boats. And the latest figures from 2005 revealed 85 430 fishing boats and a total engine capacity of 4 721 701 hp in 2004 (RIMP 2005).

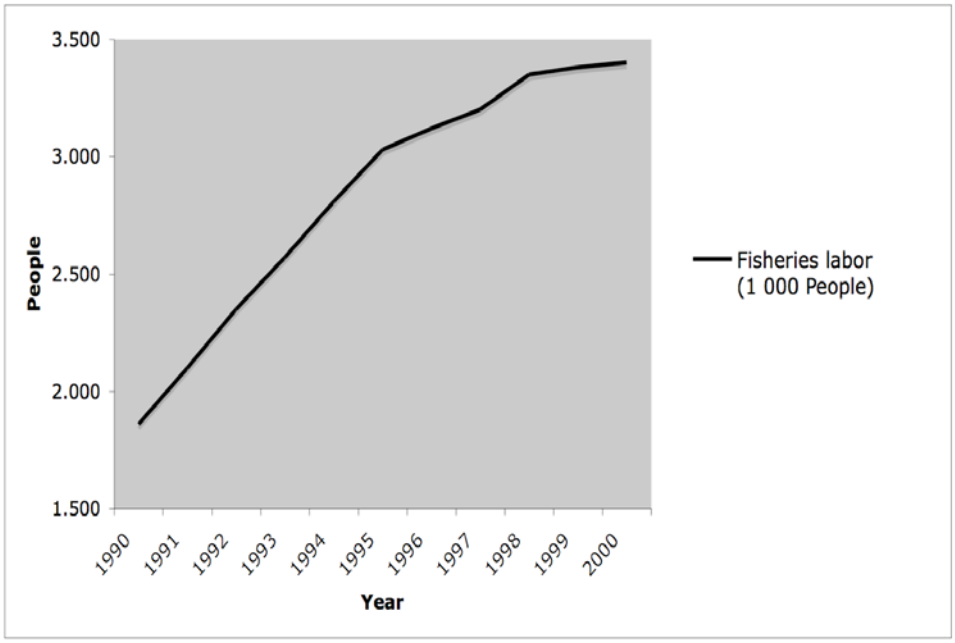
Table 5. Number of fishing boats by engine capacity groups.

Number of boats	Total horse power (hp)	< 20 hp	20-45 hp	46-75 hp	76-140 hp	> 140 hp
71 904	2 502 020	36 250	21 563	8 172	3 052	2 867

Source: RUANGSIVAKUL and SIRIRAKSOPHON 2002,3

Of the total numbers of vessels about 6 000 fishing boats are fitted with engines that are 90 hp or more and which can operate in offshore waters. Most of the fishing vessels are made of wood, only a few state owned trawlers are made of steel. The inshore fishery depends on a fleet consisting of the 29 000 artisanal, non-mechanized boats mentioned above and approximately 45 000 smaller mechanized boats with 1-cylinder diesel engines up to 20 hp (FAO 2005). These vessels operate directly from the beach without using harbor facilities (FAO 2005). In the category of 45 hp or more 33 percent have global-positioning system, 21 percent have echo sounders, 63 percent have walkie-talkies, and 12.5 percent have long distance radio. The composition of the offshore fishing fleet according to engine sizes is shown in Table 5. (RIMP)

Figure 25. Laborers in the fishery sector from 1990 until 2000.

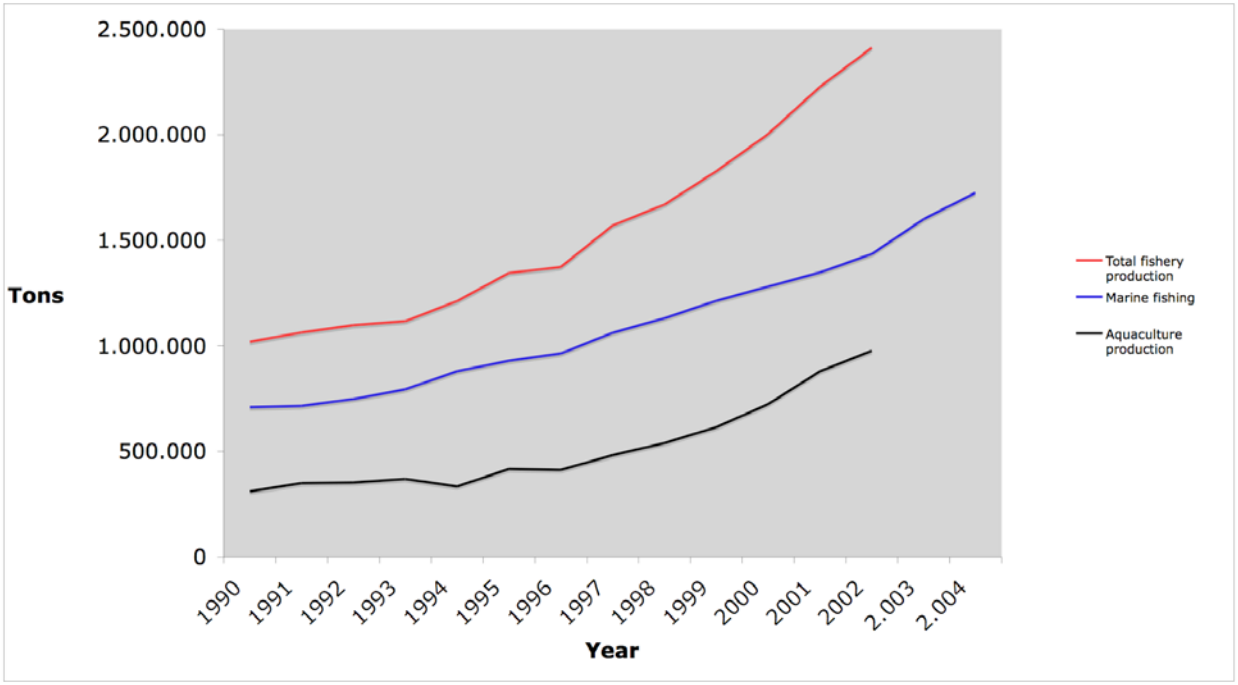


Source: MOFI

Vietnam's fishery sector also provides jobs for the country's **labor** force. By the end of 2000 there were 3.4 million laborers in the fishery sector (Figure 25) of which 484 000 persons were in fishing, 668 000 in aquaculture, 102 000 in processing, and 2 146 000 persons in services. From the 484 000 persons engaged in marine fishing, 73 percent worked in coastal fishing and 27 percent in offshore fishing. (RIMP)

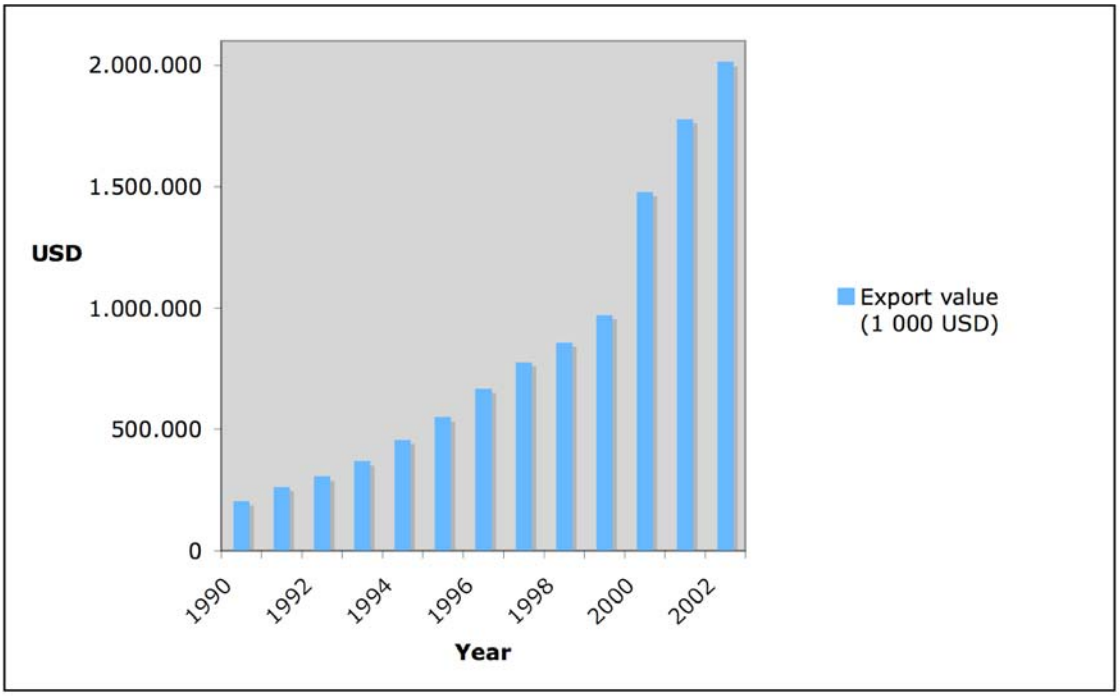
According to the Ministry of Fisheries the **total catch** for 2004 was 1 724 200 tons compared with 746 570 tons 10 years ago (RIMP 2005; cf. Figure 26). In the year 2000 the total catch of marine fish was 1 280 590 tons, of which 832 384 tons were from inshore fishing and 448 206 tons from offshore fishing (Tri 2002,4). The latest figures reveal, that in 2002 the **total fishery's production** had soared to 2 410 900 tons with an export value of little over 2 billion USD (Figure 27). Thereby marine fish landings amounted to 1 434 800 tons and aquaculture contributed 976 100 tons. (MOFI)

Figure 26. Total fishery's production from 1990 until 2002 and latest figures from marine fishing.



Source: MOFI, RIMP 2005

Figure 27. Total export value of Vietnam's fishery sector from 1990 to 2002.



Source: MOFI

4.3.2 Policies and Guidelines

At the national level, the Ministry of Labor, Invalids and Social Affairs (MOLISA) began coordinating the Hunger Eradication and Poverty Reduction (HEPR) program in 1992 as a large focused effort to promote socioeconomic development and eradicate poverty (STREAM 2004,2). Since 2000 the fishery's sector continue to carry out three target programs that are publicly available in all their particulars:

- Decision 251/1998/Q§-TTg issued on the 25th of December 1998 targets the development of fishery's export to the year 2005. Among other things the objectives of the program are as follows:
  - To make the fishery's sector become a key economic sector of Vietnam's economy
  - To create more jobs
  - To increase fishery's export value in order to reach 1.1 billion USD by the year 2000 and 2 billion USD by the year 2005
  - To contribute to improve people's life
  - To develop markets (FICEN a)
- The decision 224/1999/Q§-TTg issued on the 8th of December 1999 targets the development of aquaculture in the period of 1999 to 2010. The objectives of the program are as follows:
  - To develop aquaculture to improve food security and to make 'seafood' become the main export commodity
  - To achieve a total volume of 2 million tons in aquaculture and a total export value of 2.5 billion USD by the year 2010
  - To create jobs for 2 million people
  - To contribute to the economic and societal development of the country (FICEN b)
- The offshore program launched in 1997 targets the development of the offshore fishing fleet. The main objectives are as follows:
  - To create a fleet of around 800 deep sea fishing vessels, which can exploit the exclusive economic zone (EEZ)
  - To provide preferential loans to fishermen to encourage deep-sea fishing by either upgrading boats or newly built vessels with engines larger than 90 hp (STAT-USA 2003)

Other target programs focusing on poverty reduction in the fishery and aquaculture sector include the following:

- Decree No. 224/1999/QD-TTg issued on the 8th of December 1999 and termed Sustainable Aquaculture for Poverty Alleviation (SAPA) strategy targets poor people in rural areas to diversify and improve their livelihoods through aquaculture. The main goals are as follows:
  - To strengthen and build particularly the capacity of local institutions and communities with the incentive to understand and support livelihoods of poor and vulnerable people

  - To improve access to materials, information, financial and extension services and markets for poor people
  - To improve communication among stakeholders through awareness building and knowledge sharing, networking, inter-sectoral/sectoral and donor coordination by means of introducing participatory planning, implementation, monitoring, and evaluation approaches
  - To develop and adopt environmentally friendly, low-risk, low-cost aquaculture technologies and management practices (MOFI 2001,8-9)
- The decree No. 2685/VPCP-QHQT issued on the 21st of May 2002 and termed Comprehensive Poverty Reduction and Growth Strategy (CPRGS) provides a framework for further poverty reduction elaborating all general objectives, institutional arrangements, policies and solutions of the 10-Year Socio-Economic Development Strategy (2001-2010), 5-Year Socio-Economic Development Plan (2001-2005) and Annual Socio-Economic Development Plan into specific action plans (MOFI 2002,2). Thereby the CPRGS recognizes and takes into account the rapid growth of the fishery and aquaculture sector and its role in the national poverty reduction programs. The CPRGS is comprised of six parts with the following fishery's relevant objectives:
  - To promote research and efficient use of natural resources
  - To expand fishery's and extension activities in such a way, that they are well adapted to different site conditions and by demand of the poor
  - To diversify aquaculture
  - To develop comparative advantages in fishery production (diversify fishery production, improve processing capability to raise product quality)
  - To invest in support of fisheries and aquaculture infrastructure, e.g. roads, power transmission lines, national breeding centers
  - To further improve access of poor fishery households to production inputs, information, extension services, finance and markets
  - To invest in mariculture of ocean fish, to develop offshore fishing fleets
  - To achieve an average growth rate of 4-4.5 percent in the fishery sector in the period from 2001 to 2010 (MOFI 2002)

At the provincial level the Khanh Hoa Department of Fisheries, respectively the Department of Fishery Resource Protection, provides the following original copy:

- Documents on Propaganda of Fishery Resource Protection address competent local authorities. The ordinance includes five chapters: Chapter I, Fishery resource protection and development; Chapter II, Functions, duties and powers of Khanh Hoa Department of Protection and Development of Fishery Resources; Chapter III, Organization of implementation of department's functions; Chapter IV, Specific duties of collaborators in fishery resource protection; and Chapter V, The relation between collaborator groups and the People's Committee of the village – Khanh Hoa Department of Fishery Resource Protection. The present ordinance deals with:
  - Activities destroying fishery resources (environmental pollution, destructive fishing gear, i.e. poison, explosives and electricity, destruction of mangrove

forest), exploitation in breeding grounds concerning area and season and precious and rare species

- Propagation of official documents concerning the protection and development of fishery resources and the enforcement of existing laws and regulations
- Responsibilities of different scopes including: (a) Fishery exploitation: check, patrol, control, management of prohibited areas, seasons (mesh size, light sources, size of fish species, electric fishing, poisons, explosives); (b) Aquaculture: check, quarantine, fry, feed, waste water practices; (c) Fish processing: check processed raw material, species, size, seasonal harvest, waste water disposal; (d) Fishing vessel registration: management, safety, newly built and fixed vessels, marine safety instruments, registration and issuance of licenses for fishing (for vessels 20 m or less and engines under 20 hp)
- Organization of the Department of Fishery Resource Protection
- Manner of reporting between competent authorities

4.3.3 Institutional Structure: Existing Laws and Regulations

The following chapter gives a review of the fishery's legislation in Vietnam at national and provincial level. A selection of the most recent and important laws at the national level is mentioned below. The text box on the following page contains laws at the provincial level concerning Khanh Hoa Province and governing fisheries management at Nha Phu Lagoon. The first section represents laws that are publicly available. The second paragraph contains a summary of laws (original copy) that were collected in Vietnam. And the third section refers to translated, original documents.

In collaboration with the Norwegian Ministry of Foreign Affairs and the Vietnamese Ministry of Fisheries an institutional cooperation and technical assistance project was implemented on September 27th 1999, regarding the "*Establishment of Vietnam Fisheries Law and Regulations"* (MOFI 2005a). On the 26th of December 2003 the National Assembly of the Socialist Republic of Vietnam approved the Fisheries Law **No. 17/2003/qh11** coming into effect on the 1st of July 2004. This new law marks a milestone in Vietnams fishery sector providing a future legal framework for fisheries development and management (cf. FAO 2005). The law consisting of 62 articles in 10 chapters contains provisions on capture fisheries, aquaculture, resource management, services and trade, international cooperation, and rights and responsibilities of parties involved in the sector (MOFI 2003). In more details these provisions deal with aquaculture, mariculture, ecosystem preservation, protection of fish and the environment, and regulations for fishing vessel navigation, docking and transportation (FAO 2005). Further particulars govern the conduct of fishermen, the fishing gears and methods, the season and size of catch, and the functions and responsibilities of the competent authorities (FAO 2005). In addition to the fisheries law two further laws were adopted recently and are listed in the annex.

The decree **No. 70/2003/ND-CP** issued on the 17th of June 2003 regulates sanctions of administrative violations in the fishery domain including:

- Specification of general regulations
- Detailed sanction levels (fines) for violation of regulations on fishery resources protection, fisheries exploitation and fishing vessel management
- Powers and formalities of authorities to administer sanctions

Further, the directive **No. 01/1998/CT-TTg** issued on the 2nd of January 1998 deals with the prohibition of explosives, electricity and poison to exploit marine resources by means of prohibiting production, market sales and possession of explosives as well as electric fishing equipment and poison. It also promotes educational advertising via mass media, organizing the cooperation of all concerned branches, sections and local authorities, administering the implementation and enforcement, and planning the coordination of associations, e.g. Women's association, to encourage people to take part in the protection of fishery resources.

At last, directive **No. 26 CT/UB** issued on the 1st of June 1994 in Nha Trang by the People's Committee of Khanh Hoa Province is concerned with the protection and development of fishery resources in Nha Phu Lagoon. Nha Phu Lagoon shall be *"protected, preserved and developed for all fishery resources."* After a brief definition of the lagoon and its territorial waters the directive determines the boundary line between the two promontories Mui Da Chong and Mui Ke Ga and its adjacent buffer zone expanding 1 000 meters to each side, where exploitation and anchoring is prohibited. Nha Phu Lagoon shall be exploited by fishing boats with engines of 10 hp or less, using fishing techniques such as crab net, traditional shrimp net and silk thread net with mesh sizes in compliance with current regulations. Aquaculture development without building ponds shall be encouraged and particular emphasis paid to waste water treatment of existing ponds and that new ponds are built according to existing directions. The two People's Committees in Ninh Hoa District and Nha Trang City are called upon to instruct fishermen in the area to comply to this directive and at the same time direct and organize People's Committee of villages in the area to coordinate management, monitoring and development of fishery resources in Nha Phu Lagoon.

During this study, the notification **No. 101 TS/BVNL** issued on the 9th of September 2003 in Nha Trang by the Khanh Hoa Department of Fisheries was released. The notification termed *"conclusion on the meeting of dissolving the deep-water trap net and light trap net practice at Than Thuy Village in Ninh Loc Municipality"* informs about the outcome of a hearing with the following attendants: Leader of the Department of Protection of Fishery Resources in Khanh Hoa Province, Fishery Resources Protection Station of Ninh Hoa District, Marine Border Patrol 368, the People's Committee of Ninh Loc Municipality, Village Authority of Tan Thuy and 15 of 26 households practicing deep-water trap net and light trap net. The participants agreed on the following:

- The owners who occupy the water area of the estuary and block the passage for navigation will have to dismantle their traps
- The proposal of owners asking for permission to use mesh sizes smaller than in the regulations is beyond the power of Khanh Hoa Department of Fisheries. Therefore the department shall consult the Ministry of Fisheries. As long as there is no response from the Ministry of Fisheries, all owners have to make sure to use mesh sizes of 18 mm or above
- The practice of deep-water trap net and light trap net fishing is not prohibited, however they are prohibited, if they obstruct the navigation passages and the flowing current
- The People's Committee of Ninh Loc Municipality shall advise owners where to practice deep-water trap net and light trap net fishing with mesh sizes of 18 mm or above

The above regulations are enforced through a fisheries inspection scheme involving some 50 vessels nationwide. Due to the increasing importance of fish exports particular emphasis is paid by the National Fisheries Inspection and Quality Assurance Centre (NAFIQACEN) to assure quality and hygiene in processing facilities for export. (NORAD 2002a,14)

In coherence with the establishment of a new fishery law in Vietnam the Vietnamese Department of Legislation from the Ministry of Fisheries has recently launched a website offering a wide and comprehensive selection of international and national legal documents concerning Vietnam's Fisheries. The downloadable decrees, laws, circulars, and code of conducts are available in English on the Ministry's website (MOFI 2005c).

4.3.4 Organizations and Structures

The **People's Council** (*Hoi Dong Nhan Dan*) is the highest government authority in a province. The citizens elect the People's Council representatives. Each People's Council has a standing committee which in turn is elected by the representatives. Besides the standing committee there are a number of other committees, such as the Economic and Budgetary Committee or the Social and Cultural Committee. Furthermore, the People's Council assigns a People's Committee which acts as the administrative arm of the provincial government (45:2; 41:18). This arrangement represents to a certain extent the national government. Provincial governments are subordinate to the national government. (WIKIPEDIA 2005)

As mentioned before, the **People's Committee** (*Uy Ban Nhan Dan)* is the executive arm of a provincial government. It is responsible for implementing legislative decisions (45:2). A president, who is assisted by a vice-president and nine or eleven ordinary members, heads the People's Committee. In addition to the People's Committee on province (*tinh*) level there are People's Committees on two more administrative levels, namely district (*huyen*) and municipality (*xa*) level (13:11). On village (*thon*) level there are no People's Committees. (WIKIPEDIA 2005) The levels of administration in Vietnam are depicted in Figure 28.

Figure 28. Administrative levels in Vietnam (English/Vietnamese).

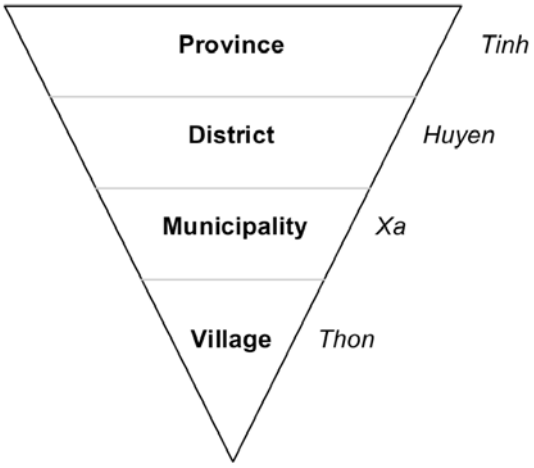
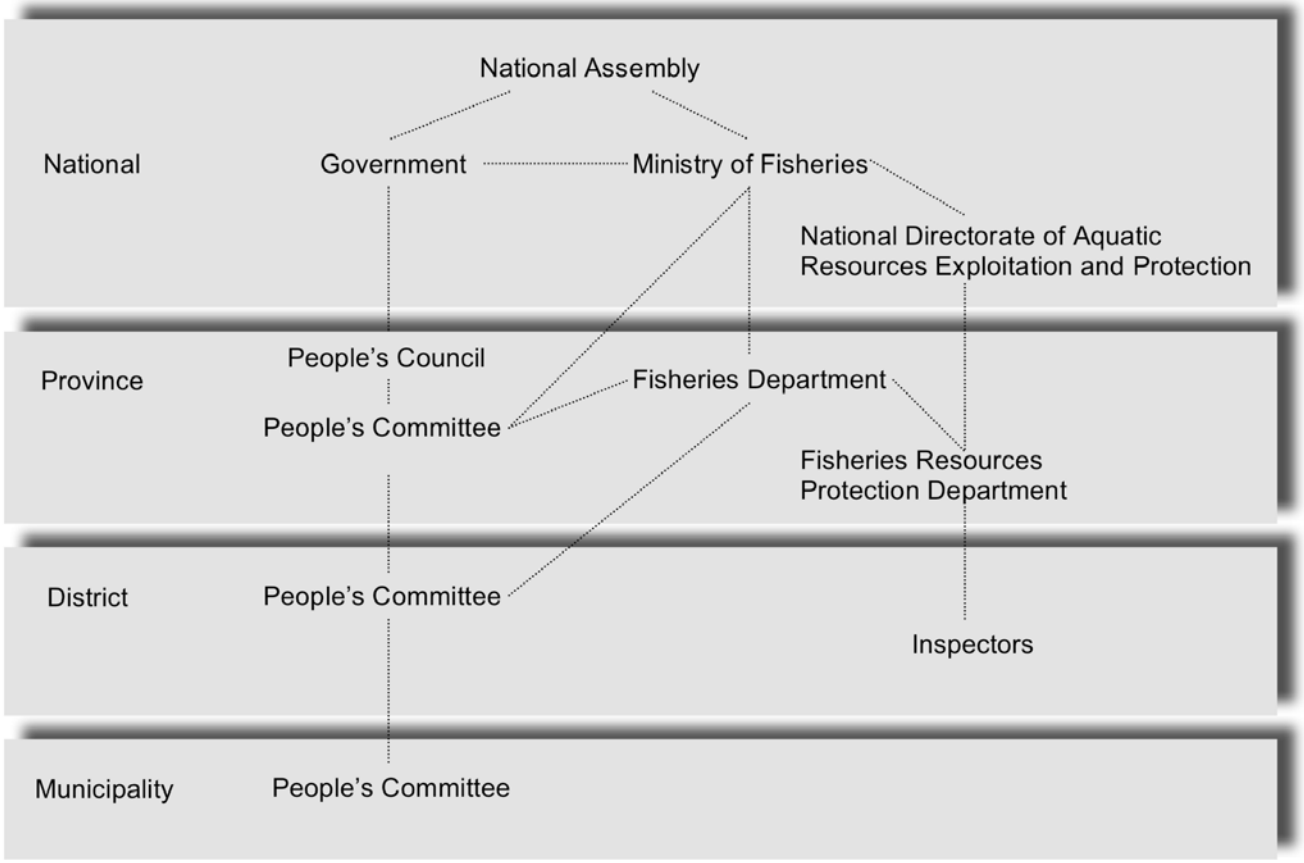


Figure 29. Organization of the fishery sector jurisdiction and administrative levels with particular emphasis on the management of coastal fisheries resources.



Source: Representative of the Fisheries Resources Protection Department, Nha Trang (25.11. 2003)

Vietnam's **Ministry of Fisheries** (*Bo Thuy San*) has ten advisory departments and is headed by a Minister of Fisheries, who is assisted by four vice-ministers. The current departments are:

- Administration Department
- Finance and Investment Department
- Department of Science and Technology
- Personnel and Labor Department
- Inspection Bureau
- International Cooperation Department
- Legislation Department
- Department of Aquaculture
- National Directorate of Aquatic Resources Exploitation and Protection (NADAREP)
- National Fisheries Quality Assurance and Veterinary Directorate (NAFIQAVED) (FICEN c)

The Ministry of Fisheries was restructured after the approval of the Government Decree No. 43/2003/ND-CP issued on the 2nd of May 2003. It outlines the main functions, duties, authorities and organizational structure of the Ministry of Fisheries (MOFI 2005d). While

the overall mandate of the Ministry of Fisheries remains unchanged, the decree has led to significant internal restructuring and the renaming of departments. The most prominent case is the nowadays so-called National Directorate of Aquatic Resources Exploitation and Protection, formerly known as Fisheries Resources Protection Department and sometimes termed National Directorate of Fisheries Resources Exploitation and Protection or Department of Fisheries Resources Protection (cf. 45:4). Unfortunately no general diction exists and mutually the FAO and the official website of Vietnam's Ministry of Fisheries both use old and new terms (cf. FAO 2005). Despite the Vietnamese habitual language use and the fact that the names of the sub-departments of the Ministry of Fisheries on provincial level remain unchanged, I refer to the new terminology, i.e. the National Directorate of Aquatic Resources Exploitation and Protection (NADAREP).

The National Directorate of Aquatic Resources Exploitation and Protection constitutes a department with enforcement mandate and is responsible for the management of fisheries in Vietnam. Its role is stipulated in decree No. 08/2003/QD-BTS issued on the 5th of August 2003, which regulates in general terms, the management and protection of fisheries resources, the development of fishing operations, and navy safety (MOFI 2005e). The 37 sub-departments of the National Directorate of Aquatic Resources Exploitation and Protection called the Fisheries Resources Protection Departments (*Chi cuc Bao ve nguon loi Thuy San*) are responsible for policy promulgation, direct management, inspection, and protection of the fisheries resources (FAO 2005).

The National Directorate of Fisheries Quality Assurance and Veterinary Directorate main office and six branches are the national competent authority for fisheries food safety assurance and quality control (FAO 2005).

The **National Fisheries Extension Centre** and its system of fisheries and agricultural extension units nationwide is responsible for transferring experiences, technologies and information to fishermen and farmers (FAO 2005).

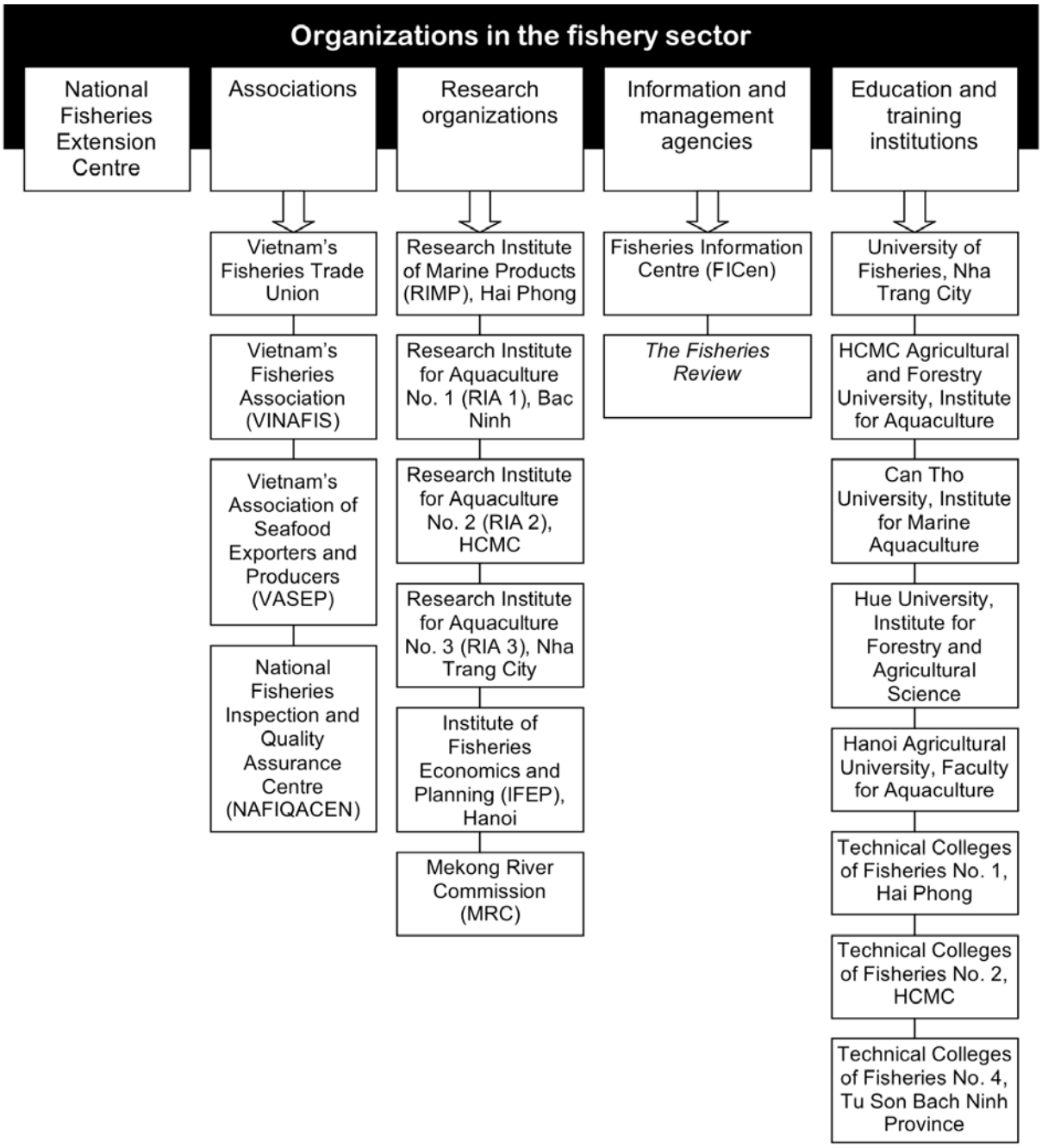
In 26 of the 28 coastal provinces there is a **Provincial Department of Fisheries** (*So Thuy San*) that reports to the Ministry of Fisheries while remaining under the jurisdiction of the Provincial People's Committee. At the provincial level the Fisheries Resources Protection Department is represented as a sub-department of the National Directorate of Aquatic Resources Exploitation and Protection in the Ministry of Fisheries (Figure x; 45:4). This sub-department is also under the control of the Provincial People's Committee but receives supervision and reports to the Fisheries Resources Protection Department in the Ministry of Fisheries (Figure 29).

In inland provinces with no Department of Fisheries the Department of Agriculture and Rural Development carries out the fisheries administration mandate. (FICEN c)

The district level is the lowest administrative level with professional staff, i.e. represented by a few staff from the Provincial Department of Fisheries. At the lowest administrative level, the municipality level, there is no professional staff. (NORAD 2002a,13)

Organizations in the fishery sector of Vietnam are depicted in the following organization chart (Figure 30). Further more detailed information concerning these organizations and their functions can be found in the appendix.

Figure 30. Organizations and structures in the fishery sector of Vietnam.



4.3.5 Management of Fishery Resources

As marine fisheries in Vietnam developed somewhat *"spontaneously"*, authorities *"stayed out of control for a long time"* (RIMP 2005). Since the total catch in Vietnam exceeded the total allowable catch in 2002, the Ministry of Fisheries is called upon to take effective management measures (RIMP 2005)

Nevertheless fisheries management strategies exist that regulate mesh sizes of trawl cod-end[3], purse seine bunt[4], trammel net, etc. Minimum mesh sizes in marine fishing gear are set for five species, namely sardine, anchovy, mackerel, shrimp, and lobster (FAO 2005). In addition the engine power of fishing vessels affects the minimum mesh size (FAO 2005). The following Table 6 gives an overview of the minimum mesh sizes for certain fishing gear types in Vietnam.

Table 6. Type of fishing gear and minimum mesh size.

No	Type of fishing gear	Minimum mesh size (mm)
1	Sardine gillnet	28
2	Mackerel gillnet	90
4	Shrimp trammel net	44
	Shrimp gillnet	44
5	Lobster gillnet	120
6	Anchovy seine net; Anchovy purse seine	10
8	Fish trawl:	
	- vessels with engines < 60 hp	28
	- vessels with engines 60 to 150 hp	34
	- vessels with engines > 150 hp	40
9	Shrimp trawl:	
	- vessels with engines < 33 hp	20
	- vessels with engines > 33 hp	30
10	Stationary net	20

Source: MOFI, cited in FAO 2005

Fisheries management also depends on regulations concerning limitations on access to fishing grounds, gears and methods restrictions on fishing seasons and closed areas (NORAD 2002a,14). Forms of closed areas are marine parks. The government aims to establish 15 marine protected areas of which three are under implementation, namely Hon Mun, Cu Lao Cham and Con Dao (CEN 2004). The long-term goal is to conserve two percent of the countries sea area by 2010 (CEN 2004).

[3] Trawl nets are cone or funnel shaped nets towed along or near the bottom of the sea by a trawler to catch both finfish and shellfish. The cod-end is the rearmost and narrowest part of the trawl net, where the catch is collected.

[4] A purse seine net is used to catch large aggregations of pelagic fish by surrounding them with a deep curtain of netting which is supported at the surface by floats and weighted down by lead weights on the underside. Along the bottom are a number of rings with a rope passing through them which when it is pulled, draws the rings together and traps the fish inside.

The bunt is a section of a smaller mesh sewn into the net in the middle or at either end which forms a bag-shaped pocket for trapping fish during hauling.

Other forms of fisheries management aim at developing aquaculture through the allocation of use rights in coastal waters (NORAD 2002a,13).

A system for fishing vessel registration exists, yet there are no restrictions to enter any fishery (NORAD 2002a,14). Fishing licenses are granted on the basis of submitting a number of supporting documents such as vessel inspection and registration papers (FAO 2005). In 1999 more than 60 000 fishing vessels carried a license (NORAD 2002a,14).

As mentioned before the total allowable catch is set for five different sea areas.

4.4 Natural Resources of Nha Phu Lagoon: Management, Trends, and Users

4.4.1 Agro-ecosystems and Socioeconomics

The area around Nha Phu Lagoon comprises a range of agro-ecosystems, which people's livelihoods depend on. Orchards in which bananas, mangos, jackfruit, dragon fruit, coconut, and cashews are produced characterize the mountain slopes (24:4; 27:17). In the better accessible areas on the lower slopes sugarcane, pineapple, and corn is produced (37:2). The lowlands are mainly used to cultivate rice. Exceptions are the fields next to highway No. 1 to grow various vegetables that are harvested daily for local markets. Moving further towards the coast the rice fields merge seamless into shrimp ponds.

The shrimp ponds are not only used to culture shrimp (*Tom su*) but also mud crabs (*Cua*), and grouper (*Ca muh*) (31:21; 33:14; 30:21; 72:3).

Figure 31: Small-scale animal husbandry of pigs in Ha Lien.

Extending this bird's eye view over the water surface of the lagoon, further agro-ecosystems emerge. Large areas are occupied by cage culture structures producing lobster (*Tom hum*) and Babylon Snail (*Oc houng*) (48:1; 70:10; 49:1). Natural enclosed areas around the islands are used to culture grouper (75:5). And last but not least there are areas where Green Mussel (*Vem xanh*) is cultured on wooden pillars in the lagoons shallow waters (16:3).

Animal husbandry is very extensive and only developing slowly (56:13; 93:1). The main species in random order are goat, beef cattle, pigs, water buffalos, ducks and chicken. The water buffalos are exclusively reared for their draft power to work in the rice fields and exported to the Mekong area in the South of Vietnam. Small flocks of goats graze the few wastelands and every now and then one can see a small group of beef cattle that graze on the harvested rice fields (30:3). Few families keep one or two pigs to utilize household waste products (Figure 31). More common is poultry production with ducks and chicken (Figure 53, Annex).

However livelihoods seldom rely on only one of these agro-ecosystems (26:21; 30:3). In general each household pursues several livelihood strategies to make a living combining agriculture, aquaculture, and trading activities with either one or more fishing techniques (26:21; 27:17; 27:3).

The survey conducted with 72 households around Nha Phu Lagoon revealed the main characteristics of coastal communities as followed:

- On average a household had four children, whereby the number of children varied from zero to nine persons.
- From each household one to six family members (average 2,3) work in fishing or aquaculture.
- The average household head's age is 43 years, ranging from 19 to 75 years.
- The main occupations are fishing, aquaculture, agriculture, and trading.
- On average respondents had worked 20 years in their job.

Table 7: Major characteristics of studied villages.

District	Municipality	Village	Population	Households	Occupational structure (%)			
					Fishing	Aquaculture	Trading, etc.	Agriculture.
Nha Trang	Vinh Luong	Luong Son	3398	650	31	-	46	23
		Vo Tanh	2751	453	30	20	-	50
		Van Dang	4212	798	31	34	-	35
		Cat Loi	1040	223	58	14	-	28
Ninh Hoa	Ninh Ich	Tan Thanh	1000	220	55	-	-	-
		Ngoc Diem	1813	410	6	45	-	49
		Tan Dao	-	-	-	-	-	-
	Ninh Loc	Tan Thuy	1433	243	90	10	-	-
		Tam Ich	1240	225	65	35	-	-
	Ninh Ha	Tan Te	800	154	70	30	-	-
		Ha Lien	-	220	-	-	-	-
	Ninh Phu	Le Cam	316	61	-	-	-	-

The majority of households are involved in some form of aquatic resource use either as a primary occupation or as a component of wider livelihood strategies. In general the occupational structures of coastal communities around Nha Phu Lagoon can be divided into five main categories:

- Nearshore fishing
- Offshore fishing
- Aquaculture
- Agriculture
- Trading and others (cf. THUONG 2000,48).

After the reunification in 1975 many people left as boat people and settled in the USA (cf. STREAM 2000,15). Many of them have been back to visit and provide family remittance to relatives living in Vietnam often serving as a perpetual source of income for households in some communities (19:27).

The educational level in the coastal communities of Ninh Hoa is low, i.e. mostly primary school level with a fair amount of illiteracy (THUONG 2000,50). Own experience lead to the decision that the questionnaire was to be filled out together with the research assistant, since many respondents where not able to read the questionnaire. Access to higher education is restricted as the two high schools in the area are in Ninh Hoa and Nha Trang and there is neither transportation service to the schools nor could families afford to pay for it (31:24). Only villages in close proximity send a few of their kids to school. Moreover, children help with the household work and other labor, e.g. repairing of fishing nets and hence do not go to school (44:7).

Housing facilities vary considerably from the richer households in the district of Nha Trang and the rather poor households in the district of Ninh Hoa. Concrete houses and tiled roofs characterize the former, houses made of clay and bamboo mat walls, coconut leaf roofs and at best concrete floors characterize the latter. In between one can find any possible combination depending on the household income (Figure 52, Annex). That housing conditions allow income classification is justified by the local perception of two fishermen in Ngoc Diem who define rich as owning a *"nice house"* and living a *"balanced life"* (25:25).

The average household income is about 1 million VND (63 USD) per month (18:7; 25:5). The poorer household's average is about 600 000 VND (38 USD) per month (31:14; 47:4) and the richer households approximately 4.2 million VND (264 USD) per month (33:13; 23:3). These figures are approximations, because the higher the income the more obscure are the answers to the questions concerning monthly incomes.

4.4.2 Coastal Livelihoods: Utilization of Natural Resources

Based on a livelihood assessment from the STREAM (Support to Regional Aquatic Resources Management) initiative (2000,14) carried out in several areas including the districts of Ninh Hoa and Nha Trang, 80 per cent of the households in coastal communities rely on fish capture and aquatic resource use. A fisherman in Vo Tanh expresses this finding: *"Every job in town is related to fishing"* (23:10) see also Table 7: Major characteristics of studied villages. To receive an impression of the habits and everyday life in Nah Phu Lagoon I went on a three-hour boat trip with the village leader and several fishermen from Tam Ich Village. A full description of this trip is found in the following text box.

In fact there are several types of fishing gears that are used in the communities around Nha Phu Lagoon. The types and common practices differ from village to village and their location in the lagoon. The majority of households use small, unmotorized boats to go fishing (30:2). In general these are the villages situated in the back of the lagoon which engage in gill net fishing (24:5). The villages situated towards the front of the lagoon, i.e. in closer proximity to the open sea, use medium to large motorized ships equipped with engines between 45 to 210 hp and engage in trawling, while small boats equipped with engines between 12 to 20 hp use gill nets and hook and line for fishing (38:5; 38:6). The fishing areas also vary considerably, i.e. some fishermen only go fishing in the shallow waters of the lagoon, others go offshore fishing. Yet dependent on the season and the weather conditions fishermen with small boats will drive all the way to Nha Trang to set their nets close to the harbor and offshore fishermen with large boats will trawl the lagoon's interior (25:9; 6:1; 23:4).

Tam Ich **18.11. 2003**

We drive to the island of Hon Coc (this is the small island visible on the satellite image directly above Tan Dao) and back in a circle coming close to Ha Lien. For the first time I see the new fish traps (*Nghe dang day*), that they have built and there are many. Maybe 100 or so cover the entire shallow area of the bay or better the long side of it. The traditional traps (*Giang*) are very different and with the boat you can easily drive through them. Besides all the other negative effects it has on the fishery resources, this is another one to be considered.

On the way we also meet a fisherman using electric fishing equipment. There are plenty of fishermen setting and controlling crab nets and traps. Later on the way back the tide is down further and we see many people using rakes to collect mussels. Around Hon Coc Island is a lot of Green Mussel culture and the positive side effects cannot be overseen. Big ships cannot pass the area easily because of the many underwater constructions growing the Green Mussels. A fisherman uses a cast net between the wooden polls and catches a large number of big sized fish with one cast. We purchase Green Mussels from one of the fishermen there and observe many small fish schools moving in between the wooden stilts used to support the Green Mussels.

There is a considerable amount of mangroves around the sides of the shrimp ponds and on the seaside of Hon Vung. Nevertheless, one can imagine what large numbers of them have been cut to create the large area covered with shrimp ponds. There are quite a few sites, where we see replanting efforts of mangroves. However, in some places the shoots look very good and seem to develop well, while in other places they look weak and are stagnating in growth.

The shallow area has been 2.5 meter deep in the past, now it is only about 1.5 meter deep. Overall the lagoon is bustling with people and everybody is pursuing some sort of fishing method using small, unmotorized boats. Indeed, we are the only motorized boat on the water for three hours. The area covered with the new fish traps is not suited for dragnet fishing because it is too shallow. Interestingly the old men tell me, that dragnet fishing is not done anymore in the back of the lagoon because the villagers got angry with the violators and forced them out of the area. Nowadays the dragnet fishermen only fish until the island of Hon Thi and not further. Big fish like porpoise* (*Ca heo*) were plentiful in the past, also in the back of the lagoon, but now are only found around Hon Thi.

* The fishermen actually used the Vietnamese word *Ca nuoc*, which translates into Dugong. This would be a scientific sensation, as Dugongs once common along Vietnam's coast are nowadays nearly extinct and less than 10 animals are believed to live at Con Dao Island in the South of Vietnam.

The fishery resources comprised of several species[5], listed in the following Table 8 and including other snails, oysters and cockles that were not identified closer.

Table 8: List of fish and invertebrate species exploited in Nha Phu Lagoon.

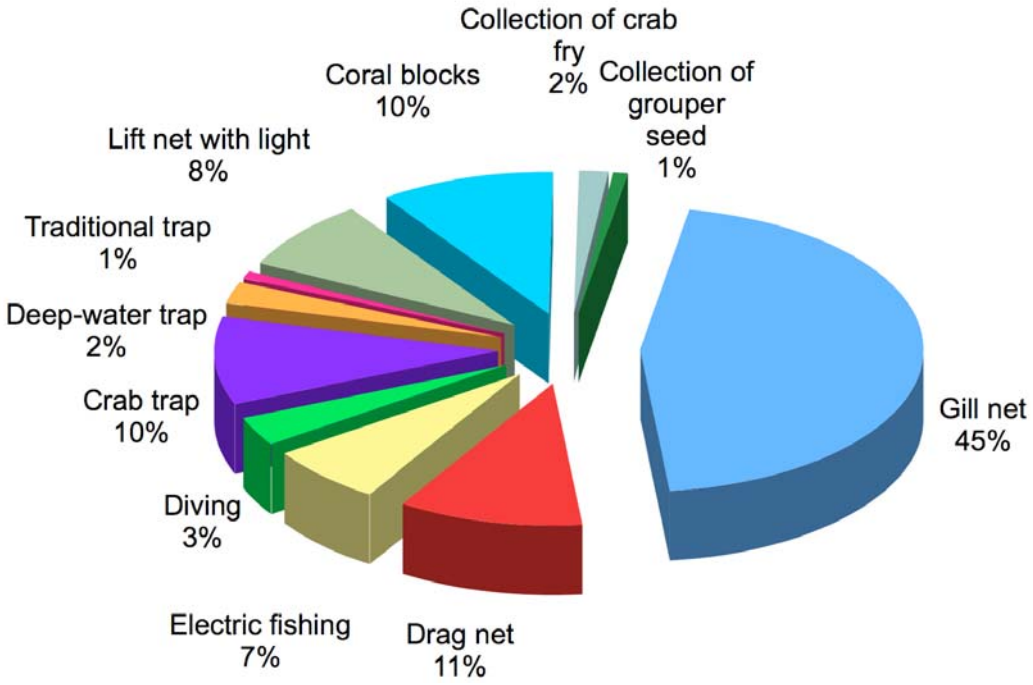
English name	Vietnamese name	Latin name or classification
Mullets	*Ca doi, Ca la*	*Mugil sp.*
Rabbitfish	*Ca dia*	*Siganus sp.*
Ponyfish	*Ca liet*	*Leiognathus sp.*
Herring	*Ca trich*	*Clupeiformes*
Goby	*Ca bong*	*Oxyurichtys sp.*
Butterfish	*Ca chim*	*Psenopsis sp.*
Lizardfish	*Ca moi*	*Synodus/Saurida sp.*
Cardinal fish	*Ca son*	*Apogonidae*
Croaker	*Ca du*	*Sciaenidae*
Anchovy	*Ca com*	*Stolephorus sp.*
Eel	*Ca chinh*	*Anguilla sp.*
Flounder, Sole	*Ca bon*	*Pleuronectiformes*
Grouper	*Ca muh*	*Epinephelus sp.*
Shark	*Ca map*	*Carcharhinus sp.*
Mackerel	*Ca thu*	*Perciformes*
Tunny	*Ca ngu*	*Euthynnus sp.*
Tuna	*Ca thu long*	*Thunnus sp.*
Hairtail	*Ca ho*	*Trichiuridae*
Bream	*Ca dong*	*Nemipteridae*
Bigeye	*Ca thoc*	*Pricanthidae*
Squid	*Muc ong*	*Teuthoidae*
Cuttlefish	*Muc nang*	*Sepia* and *Sepiella sp.*
Black tiger shrimp	*Tom su*	*Penaeus monodon*
Greasyback shrimp	*Tom dat*	*Metapenaeus ensis*
Mantis shrimp	*Tom tit*	*Squilla sp.*
Other shrimps	*Tom*	*Penaeus sp.*
Lobster	*Tom hum*	*Panulirus sp.*
Swimming crabs	*Ghe*	*Portunus sp.*
Mud crabs	*Cua*	*Scylla sp.*
Green mussel	*Vem xanh*	*Perna viridis*
Blood cockle	*So huyet*	*Anadara granosa*
Babylon snail	*Oc huong*	*Babylonia areolata*
Diphos sanguin	*Phi*	*Hiatula diphos*
Half-crenate Ark	*So long*	*Anadara subcrenata*
Undulating venus	*Ngheu*	*Paphia undulata*
Suminoe oyster	*Hau*	*Crassostrea rivularis*
Scallop	*Diep*	*Pectinidae*

Source: (55:1; 77:1; 40:7; 18:2; 18:4; 18:5, 44:3;14:19; 70:14; 3:2; 75:4; 49:1; 92:2)

[5] The presented list of aquatic resources is preliminary in the sense that it only consists of the species respondents mentioned in interviews, during market visits or observations. The findings rely on the translation of Vietnamese names. Further verification and additional information concerning scientific, Vietnamese and English common names follow FishBase (www.fishbase.org), Squidfish.net (www.squidfish.net), Fistenet (www.fistenet.gov.vn), Blue Sea (www.bluesea21.com/marineproduct/marineproductshell.htm), BRZESKI and NEWKIRK'S (2000,218-223) *"Lessons from the Lagoon – Research towards Community Based Coastal Resources Management in Tam Giang Lagoon, Viet Nam"*, and TUAN, NHO and HAMBREY'S (2000,1-8) *"Status of Cage Mariculture in Vietnam" (All websites accessed on 10.11. 2005)*. The classification refers to order, family, genus or species depending on the available information.

Fishing is the main pillar of aquatic resources utilization. The questionnaire revealed that 82 percent of the coastal fishery households engage in some sort of fishing activity. Fishing gear can be classified as nearshore and offshore fishing techniques. Regardless of this classification and with respect to what has been said earlier, fishing gear is used in near and offshore conditions. The following diagram gives an overview of the various types of fishing techniques and their respective use in percent. The presented figures include fishing techniques used in near and offshore fishing and are described in further detail below. Please note that several fishing techniques are not included in the diagram, because they were identified separately. From the 72 respondents in the questionnaire 54 percent of the fishermen apply more than one fishing technique.

Figure 32. Various gear types and fishing techniques and the percentage of their use in Nha Phu Lagoon.



Source: Questionnaires

The following fishing methods are used in nearshore fishing:

- Gill nets (*Luoi cuoc, Luoi can, Luoi mai, Luoi ben, Luoi Thai, Luoi ba mang, Luoi cua/ghe/tom*) are most commonly used among the fishermen in Nha Phu Lagoon after all 45 percent of the fishermen use them (20:4; 19:6; Figure 32). They are either operated from small, unmotorized boats or from boats equipped with engines between 12 to 20 hp (30:2; 38:6). The small, unmotorized boats are mainly used in the municipalities of Ninh Phu, Ninh Ha, Ninh Loc, and Ninh Ich (30:2). The motorized boats come mainly from the villages situated in Vinh Luong Municipality (38:6). There are two types of gill nets. One is the one-layer net and the other is the three-layer net or trammel net (Figure 32). Nowadays the one-layer

net is only used in Vinh Luong Municipality to catch *Ca mai*[6], herring and various shrimp species (63:6; 71:8). These gill nets typically consist of a single wall of netting, attached to a headline and a footrope, so that the net hangs vertically in the water column. The headline is supported with floats whose number and spacing depend on the floatation required. The footrope is weighted with lead and designed to rest on or just above the seabed. The trammel net was introduced to Nha Phu Lagoon about 10 years ago and has nearly replaced the one-layer gill net (91:1; 91:2). Trammel nets are three layered nets, which can be used to catch a much wider variety of species. The net consists of three layers of netting in which a small fine meshed inner net is sandwiched between two outer layers of netting. Just like the gill net the three layers of netting are attached to the floated headline and weighted footrope so that all three hang vertically in the water. Slack netting ensures that fish, shrimp and crabs become entangled. During the questionnaire 33 percent of the fishermen reported using trammel nets with inner net mesh sizes below the 18 mm regulated by law. Trammel nets ensure that bigger shrimps and swimming crabs entangle themselves making the net more efficient (91:3). The trammel net is the direct answer to declining catches reflected in the response of a middleman in Ngoc Diem saying: *"1994 one could catch a lot with a one-layer net, but nowadays you need three layers"* (75:10). Various small pelagic fish are caught with the trammel net such as mullets, rabbitfish and ponyfish but also black tiger shrimp and swimming crabs, whereby the latter two are the main target species (55:1; 77:1; 73:9; 30:9). On average the nets are 600 meters long and 2 meters wide but they can reach a length of up to 2 kilometers (71:10; 25:27). The nets are set for about one to one and a half hours, before they are hauled back in (54:3). Fishing takes place according to the tides. The fishermen cover about 20 kilometers per fishing trip with small, unmotorized boats (35:11). The fishing time varies but is usually up to 14 hours (77:1). Fishing with gill and trammel nets requires specific knowledge of the fishery resources, habitats and natural behavior, so this is an important aspect fishermen consider when choosing their fishing method (79:13).

In the municipality of Vinh Loung there are an estimated 250 small boats equipped with engines that engage in gill net fishing (63:6; 62:7). The fishermen here are organized in self-formed groups depending on the engine size. For example, there is a 8 hp group and a 15 hp group that go fishing at the same time and search for the fish schools together (81:1). When a member sees a lot of fish, he calls the others over radio to share the fish (81:1). Fishermen from Nha Trang (Bon Bridge or Dung De) listen to the same radio frequency and also report frequently over the occurrence of fish or shrimp schools and then gather together to fish according to their perception: *"The fish are for everyone"* (81:3; 81:4).

Ngoc Diem 22.12. 2003

We meet a fisherman who just came back from fishing. He was out for 6 hours and caught crab and shrimp worth 45 000 VND, which he sells to a middleman. He also keeps back a small portion of the catch, mainly fish and some shrimp. These he sells for another 30-40 000 VND, so he totals about 80 000 VND (5 USD) a day.

[6] Unfortunately only the Vietnamese name could be found. It is a small fish for export and sells for 12 000 VND per kilogram (6:8).

- Dragnets (*Gia cao*) are also commonly used in Nha Phu Lagoon and come second, with 11 percent of fishermen using them although their use is strictly prohibited (18:1; 18:23; 23:4; 23:5; Figure 32). The dragnet is a cone-shaped net that is dredged along the sea floor with a motorized boat (Figure 33). The fish and shrimp are scooped up and collected in the cod end of the dragnet. To all appearances the mesh size of the cod end and often of the entire dragnet is about 10 mm. A 30 hp engine is required to pull a dragnet (64:12). The size of the dragnet varies according to the size of the boat (44:11). Approximately 300 small boats go trawling in Nha Phu Lagoon every day (64:12; 62:5; 65:3; 25:16). Additionally, as soon as the weather is bad the big offshore trawlers go fishing inside the Lagoon as well (58:2). The dragnet fishermen come mainly from Vinh Luong Municipality and the village of Tan Thanh (4:4). They go fishing in the entire lagoon, although fishermen distinguish between intensive dragnet fishing areas and the back of the lagoon, where they go fishing irregularly due to the higher risk of getting punished (6:1). According to a village leader the main fishing time is during the night between eight o'clock at night and four o'clock in the morning (29:3). The main catch consists of croaker, goby, cardinal fish, grouper, butterfish, black tiger shrimp, mantis shrimp and swimming crabs (70:14). Sometimes the fishermen catch adult black tiger shrimp which are sold as broodstock to the nearby shrimp hatcheries for prices between five and 10 million VND per individual (70:17).

Figure 33: Dragnet for nearshore fishing.

- Electric fishing (*Xiec dien*) is another fishing technique widely practiced in Nha Phu Lagoon, although it is illegal (14:15; Figure 32). Seven percent of fishermen engage in electric fishing. Since electric fishing is carried out by wadding in the water it is restricted to the tidal zone in the back of the lagoon (20:31; 10:2; 53:16). Today electric fishing is still very common and approximately 100 to 200 fishermen operate electric fishing equipment (4:3; 14:15; 20:17; 20:31; 50:8; 75:15; 76:1; 83:2). Violators come from almost every village (10:3; 11:2). However, mainly they come from Hang Doi, Tan Thuy, Phu Huu, Tan Dao, and Ngoc Diem of which the villages Hang Doi and Phu Huu lay inlands (11:2; 50:8). Electric fishing was introduced to the area about four to seven years ago (20:17; 56:18; 50:6; 73:12). The electric fishing equipment is made of a huge wooden scoop net with a mesh size of 4 millimeter (56:5). At the end of the Y-shape structure there are two electric poles that transmit the voltage into the water (Figure 34). A transformer is used to transform the 9 volts from the battery to 300 volts (16:8). Electric fishing gear stuns small fish and shrimp, which then are scooped up by the net. Acquisition costs vary between 500 000 to 600 000 VND (16:8). This gear is operated through wading in the shallow water of the lagoon (53:16). The fishing time is relatively short approximately four hours and depends on the tides (56:12; 53:16). The main target specie is Greasyback shrimp of which two to three kg can be caught daily (56:10). However, the size of the Greasyback shrimps fishermen catch are relatively small (2-3 cm) and is reflected in the lower price he receives, namely 10 000 VND per kg instead of the usual 40 000 VND per kg (56:11; 56:10; 16:4). In addition, about 40 to 50 juvenile fish (1-2 cm) are caught which are sold as duck feed (56:4). Remarkable is that black tiger shrimp are not caught with electric fishing gear, because they jump out of the water and thus escape the net (56:3).

Figure 34: Electric fisherman in Nha Phu Lagoon.

A modification of electric fishing is called *Gia nui*, where electric fishing equipment is attached to a dragnet to enhance its efficiency (25:17; 10:3). Villagers in Tan Te hold fishermen from Tan Thanh and Ngoc Diem responsible for using this fishing technique (10:3). Another technique is called *Gia tiep*, where they fish with electric poles between two boats and close to the sea floor covering a huge area (20:18). This technique is even more effective and can be used in deep water (20:18). The Marine Border Patrol has been vigorously fighting the development of

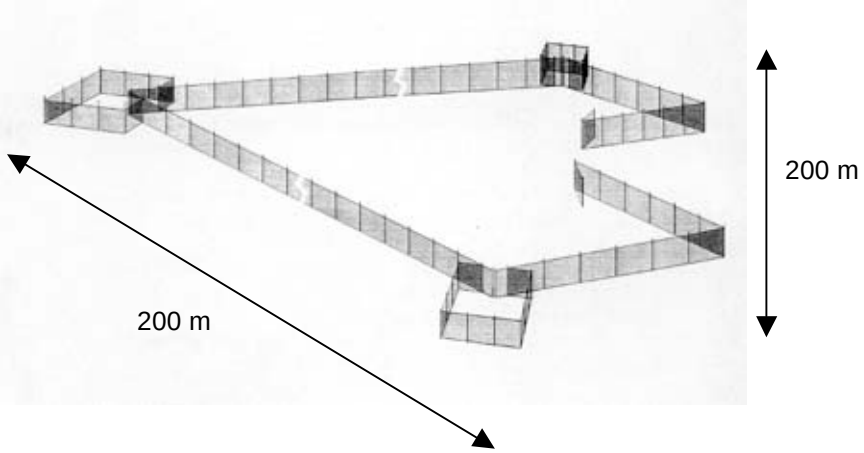
this new fishing method with exemplary success (75:17; 20:19). Yet, the enforcement was not easy and on one occasion a policeman got injured (75:17).

- Diving (*Lan*) is not very common in Nha Phu Lagoon, although a few fishermen engage in this fishing technique (Figure 32). During the questionnaire only four divers were identified, whereby three of them go diving to catch lobster seed, which is a seasonal activity carried out from November to February. Only one of the interviewed divers goes diving as described below. Diving is carried out from boats with the use of a hookah, a small diesel engine with two attached lines that delivers compressed air to the divers. The divers wear wetsuits and masks. The main species targeted are lobster and grouper (43:1). From May to July grouper move from the open sea to the inshore reefs, where divers use cyanide to stun them and catch them alive (80:6). The use of cyanide is quite simple. When divers go fishing underwater, grouper and other fish take cover in holes and cracks of coral reefs. After locating them the divers squirt some cyanide into their hiding place, stunning the fish and making it easy to catch them. The interviewed diver reports that when he uses too much cyanide, he feels drunk for a short time (80:8). Live grouper makes about 200 000 VND per kg, dead only 100 000 VND (80:6). The questionnaire revealed the following catch rates per day:
  - 25 kg of grouper,
  - 50 kg of fish,
  - 25 kg of squid and cuttlefish, and
  - 1,5 kg of lobster.

  Particular fish and squid are caught with help of spear guns, lobsters by hand and grouper by use of cyanide.
- Crab traps (*Rap ghe*) are an alternative to gill nets and are used to catch swimming crabs (86:4). They are quite popular in Nha Phu Lagoon and 10 percent of the fishermen use them (Figure 32). The crab traps are of circular shape and made of wire, nylon rope, and plastic floats (Figure 54, Annex). Small pieces of chopped eel are used as bait and tied with the help of wire to the middle of the trap. The traps are set in one line, one by one for a period of time and collected daily. Crab traps are particularly popular in the shallow waters of Le Cam, Tan Thuy, and Tam Ich (3:4; 19:7; 83:5). The average catch is about 3 to 5 kg of crabs per day (cf. 52:7). Big swimming crabs are about 30 000 to 40 000 VND per kg (52:12). The smaller ones are used as lobster feed and sold to middlemen for about 6 000 VND per kg (52:12; 86:5).
- The deep-water traps or fish corals (*No dang day*) used in Nha Phu Lagoon were introduced only one month before this study was carried out, i.e. September 2003 (25:20). This new technology was brought in by newly settled outsiders from Ba Ngoi, Cam Ranh, Dong Bo and Binh Tri Thien (Tam Giang Lagoon) and is mainly operated by villagers from Than Thuy, Tan Dao, and Ha Lien (19:14; 32:23; 30:17; 50:8; 52:3). Within one month approximately 100 of the new traps were installed in the shallow waters of the tidal zone close to the river mouths (19:5). For exemplification, alone in Tan Thuy 40 to 50 people operate this new trap (32:23). The trap structure consists of wooden poles and a very fine mesh net with a mesh size between 0.5 and 4 millimeter (19:8; 30:17; 53:3). Since current regulations stipulate a minimum net size of 1.8 centimeter this makes deep-water trap fishing

an illegal activity (19:8; 53:3). Figure 35 shows a shallow stake trap from Nam Dinh Province in the North of Vietnam that is very similar in design to the deep-water trap used in Nha Phu Lagoon (cf. RUANGSIVAKUL and SIRIRAKSOPHON 2002,246). Since the traps are totally enclosed by fine mesh, it is impossible to drive through them by boat (3:1). The construction costs are about 3 million VND (189 USD) (52:5). Interestingly both rich and poor people engage in trap fishing (52:6). The operation of the trap is simple and easy and does not require any specific knowledge (32:22). The tapered sides of the trap guide fish and shrimp towards the end of the trap, where a cod end traps the catch. This principle of the fish coral is increased through its position in the intertidal zone and the current of

Figure 35. Shallow stake trap with measurements according to the deep-water trap used in Nha Phu Lagoon.



Source: adapted and modified from RUANGSIVAKUL and SIRIRAKSOPHON 2002,246

the off running waters passing through it. The trap catches mainly Greasyback shrimp but also small fish like Ponyfish, Goby, and Cardinal (32:19; 53:2). Up to 4 kg of Greasyback shrimp can be caught daily (52:14). The average income per night is between 70 000 to 200 000 VND but can reach 500 000 VND (31 USD) (52:4; 32:22).

Due to the fine mesh nets used the traps require a lot of maintenance, i.e. the small netting clogs up quickly and needs weekly cleaning (32:29). In addition the wooden poles decompose quickly in the silty sea floor and need replacement every three months (53:7). The high labor requirement and maintenance cost has lead to a decrease in the numbers of deep-water traps in Nha Phu Lagoon (52:13; 53:7).

- Traditional traps (*Giang*) have been around for 50 years and about 10-12 traps operate in the area today (90:1; Figure 32). Their eye-catching wooden structure houses the winch that pulls the net and the fisherman that operates it and is situated in the river mouths of Nha Phu Lagoon (Figure 36). In contrast to the new deep-water traps their sides are not enclosed by fine mesh nets but made of wooden poles that are set close to each other to form a boundary. In addition the sides of this V-shaped trap possess small openings, so boats can easily pass through (3:1). This is extremely important, because they are set with the predominant current, i.e. the opening of the fish trap is near the river mouth, while the trap end is down current. As mentioned before the structure is made of wooden poles set close to each other into the silty lagoon bottom and guiding fish and shrimp towards the point of the V, where a stationary or fixed lift net catches the fish and invertebrates. The net itself is square-shaped made of fine minnow net, which is then lowered to the bottom of the lagoon for a period of time and lifted again catching all the marine life that settled on it (BRZESKI and NEWKIRK 2000,216).

Figure 36: Traditional fish coral with fixed lift net at the end.

- Cast nets (*Chai*) are used very little. Only on one occasion could I observe the use of a cast net close to aquaculture structures at Tan Dao (3:5). In consideration of the fact that I never met a fisherman that reported using a cast net and that none of the 72 respondents from the questionnaire used one either, I believe that the number of fishermen using this method is very small in comparison with other fishing techniques.

- Lift nets with light (*Manh*) are widely used in the municipalities of Ninh Ich and Vinh Luong to catch lobster fry, whereby alone in the town of Tan Thanh 100 boats use this fishing technique (13:7). Altogether eight percent of fishermen engage in this seasonal activity (Figure 32). The season for catching lobster fry is from November to February and many fishermen engage in this fishery during that time (18:5; 51:3). Due to the significantly higher income from lobster fry fishing, other fishing activities nearly stop completely during this four-month season (51:2). Lift net fishing with light is carried out from boats (Figure 55, Annex). The net is of triangular shape and anchored to the ground (51:3). To all appearances the mesh size used is between 4-5 mm. At two ends it is lifted to the surface by buoys. A strong light is used to attract the juvenile lobsters that settle on the netting and after some time the other end of the net is lifted from the bottom and the lobsters trapped (51:3). I could not determine the exact number of juvenile lobsters that can be caught per night. However, five fishermen in Vo Tanh stated that up to 50 million VND (3 146 USD) could be made per night (23:8). Juvenile lobsters caught this way are reported to be less healthy and suffer some eye damage from the strong lights used (51:4). This is also reflected in the price which is 5 000 to 10 000 VND below that of lobster fry caught with drilled coral blocks (51:6; 47:10).
- Coral blocks with drilled holes are the second technique used to catch lobster fry in the wild. Just like lift net fishing with light this is a seasonal fishing technique that is carried out from November to February (47:2). The juvenile lobsters are caught when settling in the drilled holes in the coral blocks hung from wooden structures in the shallow waters (47:1; Figure 56, Annex). The coral blocks are checked daily and the lobsters collected. Sometimes juvenile grouper are caught this way (43:2). The construction covers about 40 square meters and is enough to support the livelihood of one fisherman (47:8). Material cost is about 1,5 to 2 million VND and together with labor costs totals about 3 million VND (47:8). Inside Nha Phu Lagoon approximately 200 to 300 fishermen use this fishing technique (47:3). Due to the lower initial investment cost, particular boat and lighting, this technique is more common than lift net fishing with light, namely 10 percent (Figure 32). In the village of Ngoc Diem the same construction to catch lobster fry is used to culture green mussels (72:2). On average they catch one juvenile lobster per day and make about 500 000 to 700 000 VND per month (47:3). However, another fisherman catches about 5 to 10 small lobsters a day (43:2). A group of six lobster fry fishermen from Van Dang sell their lobster fry to middlemen who re-sell to the fishermen culturing lobsters (47:3). The reason for the fishermen to sell to the middlemen is that they have too few lobsters to sell to the lobster farmers directly (47:6). One juvenile lobster sells for about 60 000-130 000 VND depending on the market (47:5).
- Collection of juvenile mud crabs is combined with catching adult shrimp and crabs (88:1). However, some fishermen make most of their income through catching and selling mud crab fry (88:6; 86:1). This fishing technique is very simple and usually carried out at night using a headlamp and a small hand net wading in the shallow water (88:1). It is particularly common among fishermen in the town of Tam Ich (88:1). The interviewed fisherman catches about 5 to 50 juvenile mud crabs per night, the average is about 25 to 30 (88:2; 86:2). Generally they are sold for 1 000 VND per crab but prices vary depending on size between 500 and 2 500 VND per

individual (86:7; 88:4). The fishermen sell their catch to middlemen who come to their houses daily and re-sell to pond owners (86:2).

- Collection of grouper seed (juveniles) is carried out throughout Nha Phu Lagoon, as there is considerable grouper cultivation taking place (30:21). I conjure up a conversation with a fisherman in Le Cam who was fishing for grouper seed. He constructs small stone pyramids close to the shore to attract juvenile grouper. From time to time he encloses the stone pyramids with a fine mesh net, removes them and catches the juvenile grouper. Another fisherman reported to use the same fishing technique as for catching lobster seed, i.e. hanging blocks of coral with drilled holes in which the juvenile grouper settle and can be collected. A middleman culturing grouper reported that one juvenile grouper can be bought for 1 000 VND (75:6). However, the availability of grouper seed is low, one only manages to buy 2 to 3 a day (75:6).
- Collection of bivalves is another livelihood strategy carried out in nearshore waters. Especially in the tidal zone in the back of Nha Phu Lagoon family members engage in the collection of mussels, shells and snails, in particular Half-crenate Ark, with the use of rakes (3:2). An interviewed fisherman's wife and son go and collect about 5 to 6 kg of Diphos sanguin during low tide every day (54:4; 54:6). This species is used for lobster feed and sold to middlemen for 3 500 VND per kg (54:6). Another collected species traded in substantial amounts is Undulating venus (75:4).

In contrast to nearshore fishing there is offshore fishing. The following fishing methods are used in offshore fishing:

- Dragnets (*Gia cao*) are one of the most important types of fishing gear used for offshore fishing in Vietnam (RUANGSIVAKUL and SIRIRAKSOPHON 2002,17). In contrast to nearshore trawling offshore dragnet fishing requires bigger engines. The design of the dragnet is the same as for those used in nearshore conditions. The main differences are the bigger mesh size of the wing and the use of otter boards made of wood or steel that prop open the mouth of the net horizontally, which is why this method is also called bottom otter board trawl (RUANGSIVAKUL and SIRIRAKSOPHON 2002,17). In the municipality of Vinh Luong alone 300 big boats engage in offshore trawling (64:11; Figure 57, Annex). Trawling has a long tradition in the area and has been around for 70 years according to a fisherman's testimony who has been dragnet fishing since 40 years (64:4). The engine size of the vessels ranges from 45 to 210 hp (38:5). The bigger trawling boats are worth 350 million VND (24 000 USD) each (23:1). Small boats go fishing for 1 to 5 days depending on the weather and the availability of money for gasoline (44:3). However, even boats that go on one-day trips go outside the lagoon to Hon Cha La Island (44:3). Big boats go on fishing trips that last up to 10 days and to fishing grounds located about 160 km off the coast (23:6). Basically they catch everything (23:6). Yet the main species are hairtail, ponyfish, bigeye, bream, squid and cuttlefish (44:3). During short fishing trips (3 days) the average catch is around 70 kg, whereby 50 kg are trash fish, 2 to 3 kg are shrimp and the rest are marketable fish for human consumption (64:2). The trash fish are used as shrimp and lobster feed and sell for about 3 000 VND per kg (64:2). Middle sized boats with engines

of 45 hp and during longer fishing trips (10 days) average catches of 800 to 1 200 kg, whereby 200 to 800 kg maybe trash fish, 20 to 50 kg are crabs, 130 to 300 kg are shrimp, 75 to 150 kg are squid and cuttlefish, and about 150 to 400 kg are fish for human consumption.

In addition to the bottom otter board trawl mentioned above there is bottom pair trawl, i.e. two boats pulling one dragnet (6:5). During the questionnaire two from 13 interviewed dragnet fishermen were identified using this method. Findings from group discussions and house visits revealed that the trash fish landings from this fishing operation could be up to 100 plastic bags, equaling between 300 to 400 kg (6:5; 70:19). However, the two interviewed pair trawl fishermen pursue two different strategies. Both of their fishing trips last 10 days. One of them discards all trash fish he catches (approximately 600 kg) because of lack of ice, i.e. to ensure the quality of the captured fish. He catches 60 kg of crabs, 100 kg of shrimp, 1000 kg of fish and 100 kg of squid and cuttlefish. The other fisherman catches a similar amount, i.e. 100 kg of crabs, 110 kg of shrimp, 1000 kg of fish and 60 kg of squid and cuttlefish. In addition, he catches 600 kg of trash fish, which he keeps.

- Hook and line (*Nghe cau*) fishing is used in the deeper waters of Nha Phu Lagoon and the open sea (18:2). The main target species are shark and tuna (18:2; 40:7). According to the target species the construction of the longline gear is different but mainly consists of a continuous mainline supported by float lines with regularly spaced leaders that end with baited hooks (cf. RUANGSIVAKUL and SIRIRAKSOPHON 2002,189). This fishing technique is common in Luong Son and Tan Thanh (63:7; 18:2).
- Gill net fishing (*Luoi can*) is particularly labor intensive and involves many family members (18:4). In addition, offshore gill net fishing requires a lot of experience to allocate fish and thus is not very common. A fisherman in Tan Thanh catches mainly mackerel this way (18:4).
- Diving is not really carried out in offshore conditions but in close proximity to islands off the coast, like Hon Tre Island situated in the Hon Mun Marine Protected Area (18:3). Just like other offshore fishing techniques this is seasonal and only pursued six months a year (18:3). An interviewed fisherman in Tan Thanh for example swaps to gill net fishing, when the sea is too rough during the winter months (18:3).

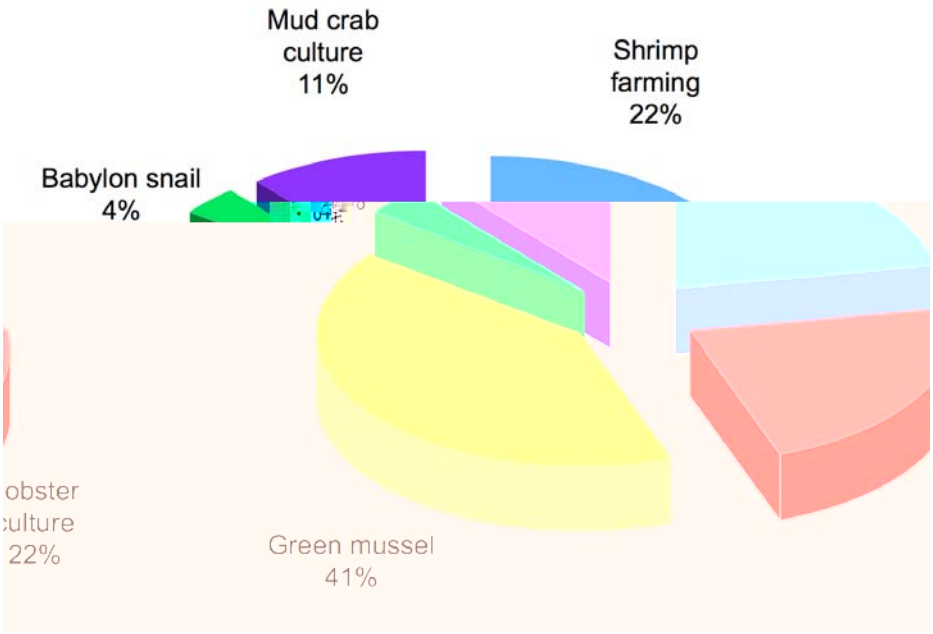
Table 9 summarizes the type of fishing gear used in Nha Phu Lagoon and in offshore waters. Further particulars include the time of fishing, the type of fish caught and the spatial distribution of the fishing gear. Although most of the fishing activities are carried out all year-round, there are some restrictions attributed to the stormy weather conditions during the winter months (Nov.-Feb.). Yet, some fishing activities are strictly seasonal such as lift net fishing with light and hanging drilled coral blocks in the water, due to the temporal occurrence of the targeted juvenile lobsters. The most important fishing gears gill net and dragnet are used in the entire lagoon with exception of the tidal zone in case of the dragnet. Other type of fishing gear is used more in the back or the front of the lagoon or around certain villages according to the targeted species, locality and customs.

Table 9. Fishing gear used in near and offshore conditions, seasonality, type of fish caught, and spatial distribution in Nha Phu Lagoon.

Fishing gear	Time	Type of fish	Spatial distribution
Nearshore: Gill net	All year (restricted from November-February)	Pelagic fish/shrimp/crabs	Everywhere
Dragnet	All year (restricted from November-February)	Pelagic/demersal fish (trash fish)/shrimp/crabs	Everywhere excluding tidal zone
Electric fishing	All year	Greasyback shrimp/juvenile fish	Tidal zone
Diving	All year (restricted from November-February)	Grouper/lobster/squid	Around islands
Crab traps	All year	Crabs	Back of the lagoon
Deep-water trap	All year	Greasyback shrimp/juvenile fish	Tidal zone
Traditional trap	All year	Greasyback shrimp/juvenile fish	River mouths
Lift net with light	November-February	Lobster fry	Front of the lagoon
Coral blocks	November-February	Lobster fry	Front of the lagoon
Headlamp	All year	Mud crab seed	Around Tam Ich
Collection of grouper seed	-	Grouper seed	Around Le Cam
Collection of bivalves	All year	Mussels/snails/shells	Tidal zone
Offshore: Dragnet	March-October	Pelagic/demersal fish (trash fish) /shrimp/squid/crabs	Outside lagoon
Hook and line	March-October	Shark/tuna	Outside lagoon
Gill net	March-October	Mackerel	Outside lagoon
Diving	March-October	Grouper/lobster/squid	Around Hon Tre

Aquaculture is the second biggest pillar of aquatic resources utilization. The questionnaire revealed that 18 percent of the coastal fishery households engage in aquaculture. In reference to the differentiation of financial inputs required for the various production systems in aquaculture a distinction can be made between high-input and low-input aquaculture. The following diagram shows the frequency of occurrence of the various aquaculture activities (Figure 37).

Figure 37. Distribution of aquaculture activities in Nha Phu Lagoon and their frequency.



Source: Questionnaires

The following high-input aquaculture production systems are pursued in Nha Phu Lagoon:

- Shrimp farming is a widespread and most profitable livelihood strategy in aquaculture (cf. marginal costing). 22 percent of the aquaculturists interviewed in the questionnaire are culturing shrimp (Figure 37). Yet, group discussions and house visits revealed that several hundred households engage in intensive and semi-intensive forms of shrimp farming (15:2; 33:2; 78:4; 78:8). In addition, 47 shrimp larvae hatcheries are situated on the coast between Luong Son and Cat Loi. These hatcheries not only supply the shrimp farmers in the area but also deliver their shrimp larvae all the way to shrimp farms in the Mekong delta in the South of Vietnam. Shrimp farming is carried out in ponds of various sizes. On average one shrimp farmer owns about one

Figure 38. View towards Nha Phu Lagoon with shrimp ponds in the foreground, Ninh Ich Municipality.

for 90 000 VND per kg, although she usually only makes 60 000 VND per kg (75:5). Then again in Le Cam prices were as low as 37 000 VND per kg during the time of the field study (October 2003) (30:21). Nevertheless, grouper culture seems very suitable for Nha Phu Lagoon (75:8).

- Babylon snails are cultured just like lobsters in submerged cages, although it is not very common the questionnaire revealed that four percent of the interviewed aquaculturists culture Babylon snails (Figure 37).

Low-input aquaculture is characterized through significantly lower capital requirements for initial investment. The following low-input production systems were identified:

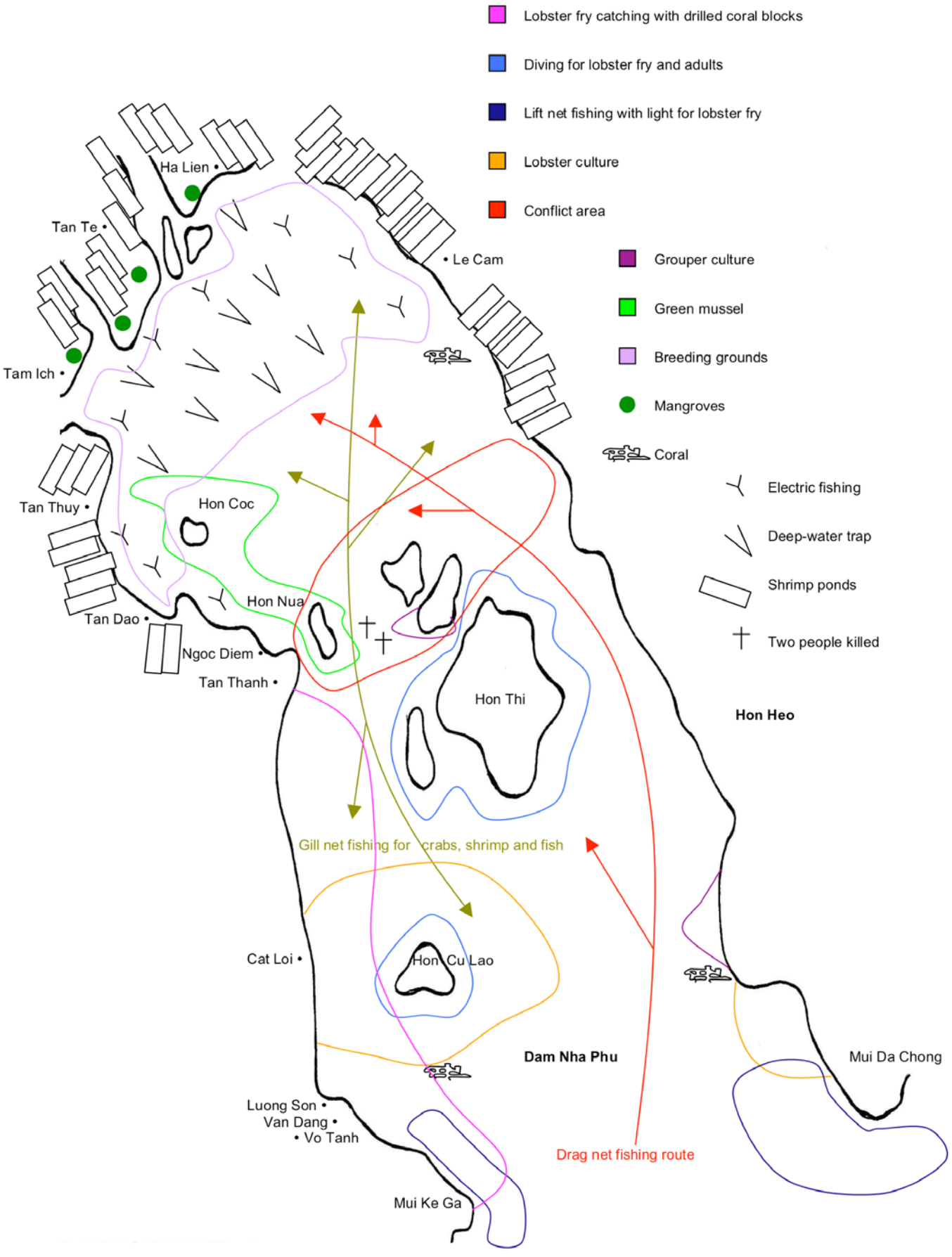
- Green mussel culture is very common in Nha Phu Lagoon, with 41 percent of aquaculturists culturing them (16:3; Figure 37). The main area is between Ngoc Diem and Tan Thuy, including Tan Dao Village (32:18). The best quality is said to come from Tan Dao because of the right salinity (32:18). Green mussels are not only cultured for their flesh but also for their shells, which are used to produce nacre handicraft (13:8). The price for 1 kg of green mussels is between 4 000 VND and 6 000 VND, their shells sell for 10 000 VND per kg (13:8; 31:18; 32:13). Green mussel fry can be purchased for 10 000 VND per kg with each kg containing about 20 mussels (16:3). Green mussels settle naturally on the culturing facilities and in general need not be purchased (32:18). The culturing facilities to grow green mussel are simply wooden or concrete pillars that are embedded in the sea floor. Eight pillars are positioned on one square meter (32:18). The dense construction assures that green mussels settle naturally on the pillars (32:18). The village leader of Tan Dao reported that currently 300 square meters of green mussel culture are enough to make a living (32:18). Every day one can harvest 10 kg of mussels to take to the market and make about 40 000 to 60 000 VND each time (32:13).

  A variation of green mussel culture is culturing oysters (*Hau*) that use the same culturing facilities (92:2). However, only one fisherman culturing oysters could be identified. He buys small oysters for 3 000 VND a piece and sells them for 6 000 VND each after culturing (92:3).
- Mud crab culture is another livelihood strategy that utilizes shrimp ponds and requires relatively low-input compared to the high-input requirements of intensive shrimp farming. Mud crab culture is usually the consequence of total losses in shrimp farming (31:21). Mud crabs are often polycultured together with black tiger shrimp (21:6; 87:4). After all 11 percent polyculture mud crabs, whereby one man included in this figure solely cultures mud crabs (Figure 37). There is no season for mud crabs but rather they are cultured all year around (87:4; 86:1). Juvenile mud crabs are continuously brought in to stock the pond (87:4). On the other hand I observed how adult mud crabs were continuously trapped with baited crab traps and selected for their size, i.e. the ponds are not drained regularly to harvest the crabs, instead mud crab culture is a permanent utilization of ponds. I further observed how shrimp were captured with conventional cast nets in the pond and also selected for their size. However, a respondent in Tam Ich polyculturing mud crabs and shrimp dries out his pond every two years to provide a *"good environment"* for the shrimp (87:4). The same man reported how shrimp and crab

> are fed together from the start and later when crabs develop further are fed an additional 2 to 3 kg of chopped fish daily (87:4). The juvenile mud crabs are purchased for 2 000 VND each (33:14). Stocking densities vary, a man in Tam Ich for example polycultures 4 000 crabs in a 13 000 square meter pond (33:14). Three months are required to raise mud crabs to marketable size (33:14). About 15 big mud crabs make 1 kg, which sells for 25 000 VND (86:7). Big crabs are sold to wholesalers and exported to China (21:7).

The following map visualizes the majority of livelihood strategies in fisheries and aquaculture in Nha Phu Lagoon (Figure 40). It is also a reminder of the complexity of the resource system. Additionally, it is an expansion of Table 9 to further illustrate the spatial distribution of certain fishing gear, areas of aquaculture, resource distribution, and critical locations. This includes major fishing gear routes, coral reefs and breeding grounds and areas known for illegal fishing and conflict. The map is a synthesis of 12 resource maps drawn in each of the villages bordering Nha Phu Lagoon. Please see the Appendix for the detailed resource maps of each village. Comparing the resource maps from different villages it is striking to note that five villages display the lagoon as a circle, including only villages in close proximity. Hence, the maps are an expression of the different forms of perception in each village. This effect is validated when looking at the villages Tan Dao and Cat Loi for example, who characterize confined areas in the immediate vicinity of the village (Annex). Despite the differences there are similarities particularly concerning fishing areas, areas of conflict and local knowledge on breeding grounds. These findings are especially important for the introduction of integrated management strategies for the sustainable use of coastal fishery resources. Interesting is that likewise, violators using illegal fishing techniques and fishermen fishing with legal fishing gear are both aware of the respective fishing areas, conflict areas and breeding grounds. This underlines the fact that local resource users are especially aware of the multitude of fishing areas and capable to develop management strategies that encompass the multiple interests of the stakeholders.

Figure 40. Resource map of Nha Phu Lagoon with indicated areas of fishing, aquaculture, resource distribution, and critical locations.



Agriculture is another major livelihood strategy adding stability to household incomes (47:13). Some families in Van Dang, for example, supplement their daily income with 30 000 to 40 000 VND from agricultural activities (47:13). The following production systems are common in the vicinity of Nha Phu Lagoon:

- Rice is the major crop in the area. However, only few households in the coastal communities engage in rice farming, first and foremost Ngoc Diem Village (25:19).
- Fruit trees are more commonly cultivated encompassing bananas, mangos, jackfruit, dragon fruit, and coconut (26:21; 24:4; 27:17).

  In Le Cam Village cashew nut trees are popular (27:17; 30:3; 83:4). This cash crop sells for 7 000 VND per kg and one tree produces about 7 kg of nuts (30:3; 27:17).
- Sugarcane, pineapple, and corn are cultivated in more favorable areas (37:2).
- Animal husbandry is the least common agricultural activity and often only carried out for subsistence by keeping a few ducks (Figure 53). Only one household breeding cows could be identified (30:3; Figure 58, Annex).

Trading and other forms of alternative incomes include:

- Middlemen and traders in particular trade fish, fish products, and products related to aquaculture and fishery (20:2; 20:3; 25:7; 52:9; 56:8; 78:10, 19:3).
- Day laborer work in the sugar cane processing plant, the Hyundai ship building, or the seafood processing company No. 17 (21:9; 27:11; 31:13). A considerable amount of laborers work in shrimp farming, especially cleaning out and preparing shrimp ponds (15:4; 27:11; 28:4). The rest find jobs on fishing boats (42:5).
- Private entrepreneurs run food stalls, cafes, small shops, drive busses, repair and manufacture fishing nets, and produce charcoal (25:7; 30:4; 36:5; 42:2; 63:3).
- Artisans work as mechanics, carpenters and construction workers (42:6; 43:4; 56:9; 61:8).

4.4.3 Organization of the Fishery Sector: Processing and Marketing

According to the Ministry of Fisheries the percentage use of the marine finfish landings in Vietnam is as follows: 20 percent go into export, 20 percent are for fresh human consumption, 25 percent are used as animal feed and fish meal, and 25 percent are used for the manufacture of fish sauce (EDWARDS, TUAN and ALLAN 2004,23). The missing 10 percent account for waste because of poor storage (cf. EDWARDS, TUAN and ALLAN 2004,23). The marketing of fish, shrimp, crabs and other capture and culture products, including shrimp fry or grouper fingerlings is complex (FAO 2005). Various species, product forms, marketing channels, and markets exist both in the public and private sector.

The **private sector** in the different sub-sectors of fisheries consists of very different entities. The smallest form is the fishery household. Fishery households not only engage in fishing but also market their catch and other fishery products (32:13; 47:5). Either the catch is sold directly to middlemen or members of the fishery households, namely women market the catch on local markets (44:4; 40:1; 20:5). Apart from formal local markets there are informal markets near roads and bridges, where consumers purchase fish and fishery products directly. Some of these markets are specialized, e.g. a woman at Bong Bridge in Nha Trang sells only crabs and bivalves and is one of the biggest buyers of shellfish and mussels from Nha Phu Lagoon (75:4; Figure 59, Annex). On one occasion, I witnessed an informal market under Kai Bridge in Nha Trang that was trading shark, tuna, and sailfish from offshore fishermen under poor hygienic conditions, unloading fish parts in the contaminated water and applying chemicals to recondition some of the apparently decayed fish (Figure 60, Annex).

The middlemen who collect large quantities of fishery products resell to wholesalers, who in turn sell to the fishery processing factories, e.g. the state-owned processing factory No. 17 (75:3; 75:4; 74:1). The underlying reason for this behavior is that, first of all, only few merchants have established business ties to the processing

Informal and formal markets

According to the International Labour Organisation (ILO), **informal markets** are characterized as follows: Easy market access, i.e. no or only little entry barriers exist; family businesses dominate; preferred local resources are used; small-scale enterprises dominate; use of relative labor intensive adapted technologies; acquisition of necessary skills outside the formal education system; utilization of unregulated markets that are subject to open competition and; occasionally illegal economic activities are used as identification criteria.

The main advantage of the informal market is its ability to respond quickly to changes in general conditions. Furthermore, it is characterized by an enormous improvisation and innovation capacity. In general, market partners in the informal sector abandon formal agreements. Nowadays, informal market systems are recognized and seen as transformative step to formal market systems.

However, the informal sector does not exist isolated from the formal sector but rather is connected with it through product and factor markets.

In contrast to the informal market, the **formal market** is characterized by political and economical institutions. Thereby, product hygiene is of particular importance, i.e. the conversion of informal channels of distribution to capture, handling, collection, processing, and packaging subject to a continuous cold chain. However, one must bear in mind that the formalization of the informal sector neglects the economic interests of the poor, if they are not organized in cooperation's for example. For this reason, the infrastructural and institutional access to supply and sales markets is considered as the essential element of this process.

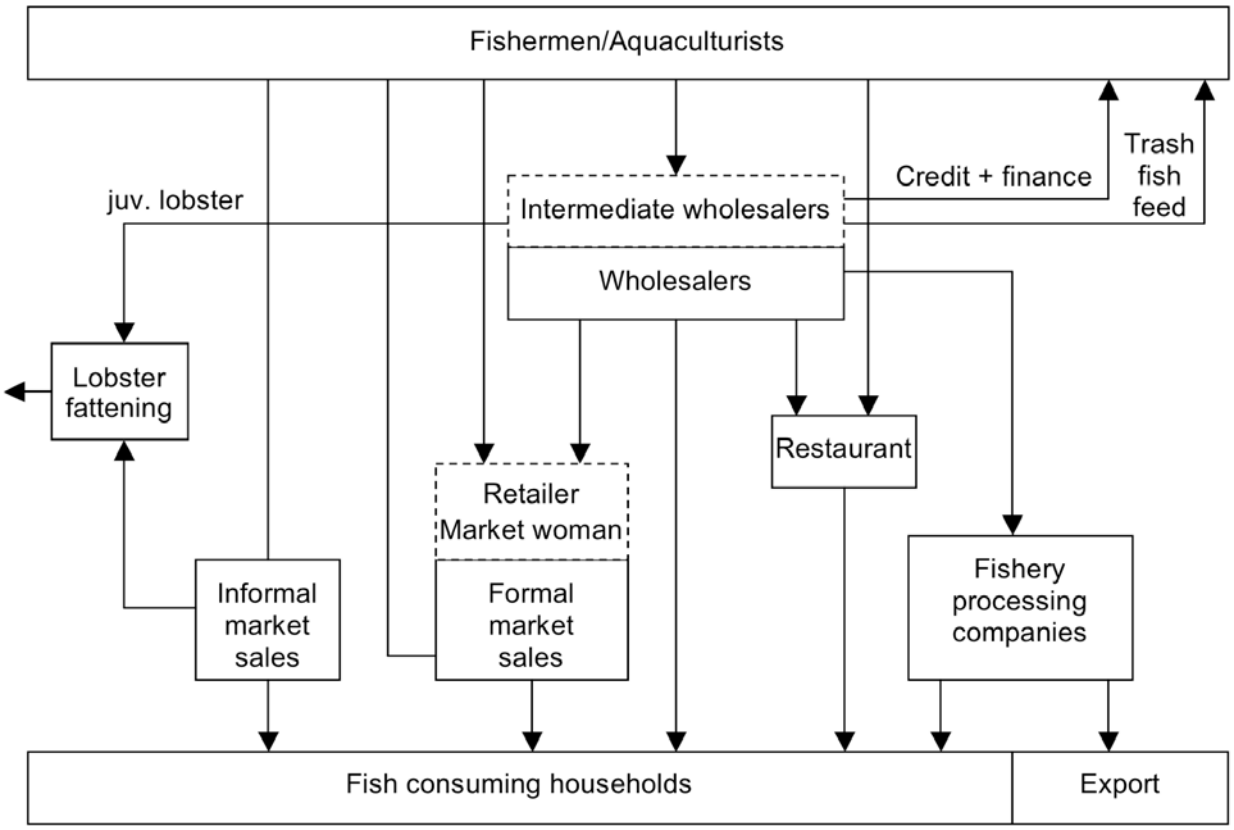
(BMZ 1999)

company and no other salesmen are allowed onto the company premises and, second of all, that the company only pays suppliers once a month, a business practice only few middlemen can afford as they need immediate payment to cover their expenses (75:3). However, the middlemen also provide the fishermen with credits for supplies, finances for off-season needs or assistance with vessel purchase, with the obligation that the fishermen have to sell their catch to them at a lower market price (30:23; 75:12; 65:7; 82:7; 91:4). For example in the town of Ngoc Diem, few middlemen own almost all of the fishing boats and control the majority of fish, shrimp and crab trade (75:12; 72:4; 74:1). Moreover, middlemen have constructed shrimp ponds and have rented them out to shrimp farmers (72:7). But the middlemen not only control the fresh fish sales, they also purchase cockles, trash fish and lobster seed, which enables them to supply lobster farmers with the demanded quantities of feed and seed (47:3; 86:5; 47:6; 54:6; 82:1; 82:7). Intermediaries also control the mud crab market, i.e. they supply shrimp pond owners with mud crab fry and purchase the fattened crabs (86:1; 21:7). In terms of economic growth the lobster farmers and particularly intensive shrimp farmers mark the biggest production units in the private sector (LEM et al. 2004,98; 48:5; 33:13). Accordingly large-scale are the 47 shrimp hatcheries that border Nha Phu Lagoon and which purchase broodstock from fishermen, while producing large quantities of shrimp fry for local area sales and further distribution to the Mekong Region (24:9; 70:17). The majority of processed aquaculture production (96 percent) is destined for export, although some fish from aquaculture is sold live to local or city restaurants, particularly grouper that is consumed raw in traditional Vietnamese dishes (FAO 2005; cf. 80:6; 75:5).

The **public sector** is dominated by state-owned processing plants and export companies. In the past the government involvement extended across the production and distribution of aquatic products, through fishing cooperatives, state and provincial fishing fleets, and processing industries (NORAD 2002b,12). Although the role of the government in the fishery sector has changed after the introduction of Doi Moi in 1986, the state and Provincial People's Committees are still strongly involved in the processing industry (NORAD 2002b,12). However, it is expected that this might change in the next ten years as a result of the ongoing restructuring of the industry (NORAD 2002b,12). In Khanh Hoa Province this is the processing factory No. 17 (24:7; 25:4). The usual public sector role, i.e. the responsibility of the state is concerned with fisheries management (Fisheries Resources Protection Department and the Marine Border Police 368), research (Research Institute for Aquaculture No. 3 and the Institute for Oceanography in Nha Trang), education (Fisheries University in Nha Trang), extension (Fisheries Promotion Center in Nha Trang), as well as providing infrastructure services for harbors and market place facilities in the area (41:19; 58:1; 39:1; 46:1; 57:1; 57:10; 94:5).

As mentioned before, the main **fish marketing channels** used by fishermen and aquaculturists are direct sales to customers, sales at local markets, sales at landing sites and farm gates to intermediaries, and sales to restaurants (47:6; 80:9). In the questionnaire 80 percent of the respondents declared middlemen (intermediaries/wholesalers) their main marketing channel. Second came sales at formal local markets with 15 percent. The remaining five percent accounted for direct sales of small lobsters to lobster culturists outside Nha Phu Lagoon, who fatten them to market size (Figure 41).

Figure 41. Main marketing channels for fishery products.



Fish wholesalers operate through several channels with the most important being the supply of the fishery processing companies in Nha Trang, who sell the finished products on domestic and international markets (75:4; 72:4; 74:1; 21:7). Furthermore, the wholesalers and intermediaries supply markets, restaurants and sometimes sell directly to consumers (56:8; 75:4; 40:2; 40:3). Specialties are the intermediaries, who obtain fish from fishermen and sell to wholesalers who finally sell to the processing companies (74:1; 75:3). These last-stage wholesalers take advantage of their information surplus concerning market access and prices. The main marketing channels of fish products are depicted in the following diagram (Figure 41). Table 10 provides a selection of fishery products and their consumer

Table 10. Selection of fishery products and their consumer prices.

Product		Consumer prices
Vietnamese	English	VND/kg
Ca com	Anchovy	15-20 000 VND
Ca liet	Ponyfish	15 000 VND
Ca chim	Butterfish	15 000 VND
Ca ho	Hairtail	15 000 VND
Ca thu	Mackerel	30-35 000 VND
Ca thu long	Tuna	30-40 000 VND
Ca ngu	Tunny	30 000 VND
Muc nang	Cuttlefish	25 000 VND
Muc	Squid	30 000 VND
Tom su	Black Tiger Shrimp	40-50 000 VND
Tom dat	Greasyback Shrimp	30 000 VND

Source: (40:9) 16 585 VND = 1 USD (20.03. 2006)

prices. The diagram includes channels for the provision of credits, trash fish feed from trawl fishermen via intermediaries to lobster culturists and the supply with juvenile lobsters (10 cm) via intermediaries and direct sales to lobster farmers outside Nha Phu Lagoon.

The markets of fish and fishery products have gradually improved over the past 20 years and many fishermen recall that although there were more fishery resources in the past, there were no markets to sell the fish (24:7; 25:3). Nowadays new market opportunities have led to a diversification in the shrimp dominated aquaculture industry including new species such as lobster, mud crabs, blood cockle, oysters, green mussel, Babylon snail, and grouper, which is also reflected in its own coding category *"New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)"* (92:2; 80:6; 75:9; 14:9; 14:3).

Contrary to the development of new markets, aquaculturists claim that some products, particularly green mussels and grouper, have no or only poor developed markets (30:22; 19:26; 25:21). Developing new markets and searching for new customers or perhaps appointing someone from the village to act as an intermediary of their own choice seems impractical to consulted aquaculturists, because first of all they depend on intermediaries who borrow money to them, second of all they would not have the time to market their products, and third of all they would never trust anyone in money matters (30:24; 35:14). These findings reflect the high transaction costs associated with the marketing of fishery products, particular the limited access to market and price information and the domination of the market by few intermediaries and fish wholesalers (LEM et al. 2004,91,98; 59:3).

Vinh Hai Market **06.11 2003**

A market visit to Vinh Hai Market in Nha Trang revealed that from nine interviewed saleswomen dealing with fishery products, three bought their products in Luong Son, two in Ninh Hoa, and one in Ha Lien (40:2). Only three saleswomen bought their products in Nha Trang, which is an indication that most of the fishery products marketed at Vinh Hai Market come from Nha Phu Lagoon (40:2). The saleswomen buy directly from fishermen, only one very old woman buys from an intermediate wholesaler (40:3; 40:4). The quantities of stock turnover range from 10 to 100 kg of fish (40:5). According to the saleswomen most fish is caught by dragnet, only tuna is caught by hook and line and gill net (40:6; 40:7; 40:8). Table x presents a selection of fishery products and their consumer prices.

4.4.4 Financial Institutions Providing Credit to the Fishery Sector

Credit institutions in the fishery sector in Vietnam can be differentiated into formal and informal ones (LEM et al. 2004,135 ff.). Unfortunately the proceedings of credit provision could not be identified in detail for all relevant institutions. Important sources and institutions for credit used by coastal fishery communities in Nha Phu Lagoon are:

- Formal: - The Bank of Investment and Development in Vietnam[1] (BIDV) borrows 50 percent of a customer's capital asset value for the maximum duration of 5

[1] Since 1990 Vietnam's banking sector has undergone considerable transition from a state bank monopoly to a two-tier banking system. Today there are six state-owned commercial banks, 36 joint stock banks, four joint venture banks, 27 foreign banks (with more than 60 representative offices of foreign banks), and about 900 credit cooperatives termed People's Credit Funds (PCF). (GTZ 2004)

years and an interest rate of 10.2 percent per annum (67:1; 67:4). A land title is required to apply for credit (67:6). Bank customers include fishermen (67:7).

- Agribank[1] borrows 80 percent of a customer's capital asset value, if he/she has a land title, and up to 50 percent if not (68:1). Yet without a land title one must have lived in Khanh Hoa for a long time, have a good business idea, a business plan and low risk (68:4). Without any assets it is possible to get a credit up to 20 million VND for a maximum of 5 years and an interest rate of 13.2 percent per annum, provided that my business plan is excellent (68:3). Two dragnet fishermen received loans between 50 and 150 million VND (66:9).

- Foreign Trade Bank[1] (66:9)

- The Women's Union is largely involved in micro-finance disbursement of several Banks, particularly to encourage fishery households to engage in agriculture or trading (58:8; 61:10). Specialties are the Women Credit Union in each village that hand out small credits to households (58:8).

- The Farmer's Union can borrow money easily from the Agribank but only up to 10 million VND (68:5). Just like the Women's Union, the Farmer's Union is responsible for providing credits to households, especially those willing to change their occupation from fishing to agriculture or trading (61:10; 30:26).

- Informal: - Middlemen are the most important source of informal credits (30:23; 65:7; 75:12; 91:4; cf. Figure 41). However, these credits are rather small,

  e.g. 500 000 to 800 000 VND and constitute working capital for artisanal fishermen (75:12). Credits for investments are not provided. Rather middlemen carry out these investments themselves, e.g. constructing shrimp ponds and renting them out to others (72:7).

  - Family members and friends are an important source of credit for all types of fishermen (92:5; 79:6). These informal credits are often used to make an investment (92:5).

Access to these credit institutions is a crucial factor in the development of the fishery sector in Nha Phu Lagoon and finds its expression in the coding category *"Access to credit is constrained"* (62:2; 26:20; 24:8; 27:9). Thereby, poor households seem more disadvantaged than richer households to obtain credit (41:15; 26:4; 61:3). Although the government is encouraging fishermen to invest in offshore fishing and aquaculture, the provision of credit remains a bottleneck (62:2; 86:3). In addition, the required investment costs of 50 to 200 million VND do not correspond with provided financing from banks or government organizations in the region of 3 to 10 million VND (31:17; 31:16; 28:5; 26:19; 68:5; 69:3). Furthermore, the payback period of many credits is only one year and repayment scheduled on a quarterly basis (31:16; 31:17; 70:16). Thus the availability of long-term credit remains one of the biggest problems (95:8).

However, one of the biggest constrain to acquire credit is the submission of a land title (68:4; 30:25; 67:6). The "red paper" (*So Do*) guarantees the legal ownership of the land the family home is built on (26:12). In order to obtain a *So Do* the family household must have been living on the land for some time and pay a certain fee (26:15). Further the

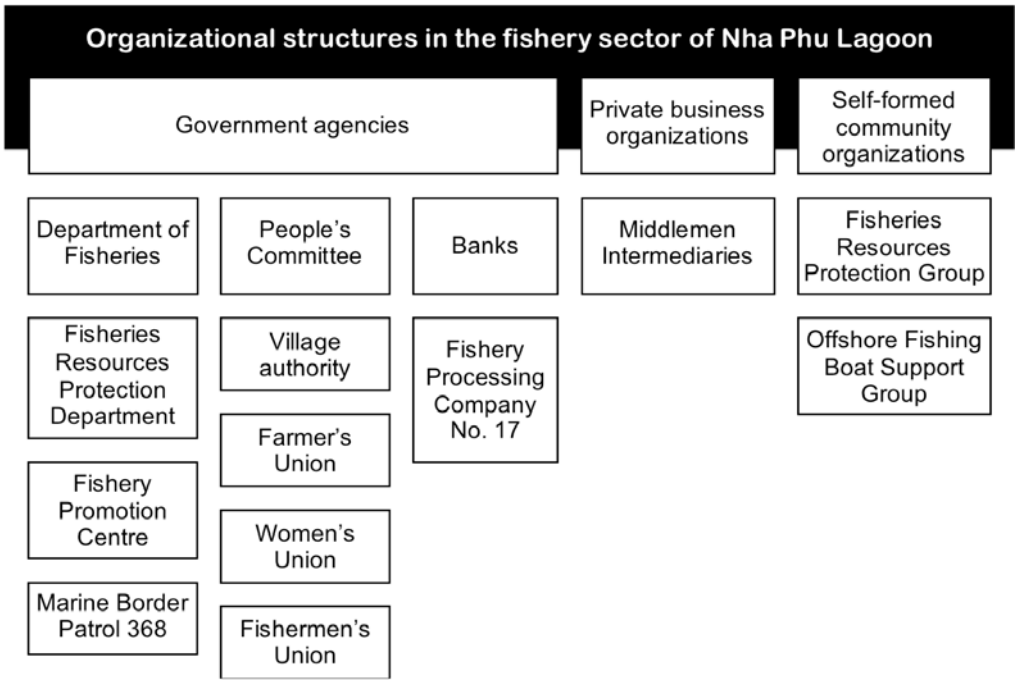
bureaucratic procedure implies to contact the District People's Committee and the Department of Land (67:6). However, the process of house and land registration lacks transparency and is susceptible to corruption, as the following example demonstrates. A few fishermen in Van Dang Village reported that last year the *So Do* cost 120 000 VND (81:11). This year the price had gone up to 5 million VND per paper (81:11). Apparently the reason was that many people had chosen to register their house at the same time (81:11). Yet, costs include measuring of the house and garden but also bribes for government officials (81:12). A new resident, who wanted to buy land for example, will need a *So Do* right away to prove his ownership (81:13). He will have to pay a sort of middleman to help him organize the *So Do* and this person will pay the "right" people money to get the paper quickly (81:13). The amount of money that will have to be spent depends on how rich the person is and lies between 2 to 5 million VND (81:13). Trying to get the legal document oneself would be much cheaper but the process might take one year or longer (81:13).

The lack of compiling adequate business plans is the second biggest constraint on the provision of credit (69:2; 68:4). Households willing to lend money are required to set up a business plan that describes the intended investment and its costs and benefits with particular emphasis on the payback period and the capital recovery rate (68:3; 68:4). Inadequate education and limited help to consult households in this matter prevents fishermen from obtaining formal credit (69:8). Along these lines is the statement of a member of the Fishermen's Union in Van Dang: *"Generally the knowledge of fishermen is really low and they just go fishing in Nha Phu Lagoon without thinking"* (62:9).

4.4.5 Decision-making Structures and Processes: Actors and Goals

The following **organizational structures** in fishing communities around Nha Phu Lagoon represent the findings from the stakeholder analysis conducted in connection with the Venn diagrams.

Figure 42. Organizational structures in the fishery sector of Nha Phu Lagoon.



Structures include government agencies, private business organizations, and self-formed community organizations. . The organizations chart gives an overview of the various structures in the fishery sector of Nha Phu Lagoon (Figure 42). A description of the identified stakeholders and a brief description can be found in the following list:

- Public: The **Department of Fisheries** is located in Nha Trang and responsible for the implication and dissemination of national fishery law in Khanh Hoa Province. The Agriculture and Fisheries Department of the District People's Committee is the executive arm of the Provincial Department of Fisheries and controls the Municipal People's Committees (45:3; 45:1).

  The **Fisheries Resources Protection Department** is responsible for fishery management and the enforcement of fishery laws and regulations in Nha Phu Lagoon (70:7; FAO 2005). There is a small outpost of the Fisheries Resources Protection Department in Tan Than Village in the municipality of Ninh Ich (57:10). The department is also responsible for the restocking of 1 million Black Tiger Shrimp Larvae annually in Nha Phu Lagoon (57:2). This practice is widely questioned by fishermen who make jokes about the *"fish feeding"*, since the department releases the shrimp fry in deep water (57:3).

  The enforcement of fishery laws, e.g. illegal fishing techniques is a major task of the Fisheries Resources Protection Department and many fishermen, particularly dragnet fishermen, have had encounters with personnel from the department and were fined (73:7; 71:8; 70:7; 70:1; 55:3).

  The **Fishery Promotion Centre** also situated in Nha Trang is responsible for the dissemination of knowledge and the organization of training courses in the fishery sector in Khan Hoa Province (76:2; 94:1). Its focus lies in the development of aquaculture particularly shrimp and lobster culture (94:4). However, they also organize training courses for green mussel, blood cockle and oyster culture (94:3; 94:2). One objective is to enable fishermen pursuing illegal fishing techniques to change to another job (94:1). Training courses are conducted three times a year in the Municipal People's Committees (94:1). Further, fishermen interested in culturing green mussels, for example, can ask their village leader to invite someone from the Fishery Promotion Centre (94:5).

  The **Marine Border Patrol 368** is situated in the urban district (Tanh Pho) of Nha Trang in Vinh Luong Municipality and reports to the headquarters in Nha Trang (39:2). The Marine Border Patrol 368 controls all the boats in Nha Phu Lagoon (39:1). They work together with the Fisheries Resources Conservation Department to catch violators using dragnets in Nha Phu Lagoon (58:1). In general, they try to convince fishermen to stop illegal fishing activities before imposing a fine (58:10; 58:6). However if fishermen are caught a second time, their fishing gear is confiscated and a fine imposed (58:11; 58:12). In the past there had been conflicts between the Marine Border Patrol and the illegal fishermen (58:4). Nowadays, these conflicts are decreasing, because they place emphasis on educating and informing fishermen about their illegal action (58:6).

The **village authority** includes the village leader (*Truong Thon*) and the village management (*Ban Quan ly Thon*). The Municipal People's Committee elects the village leader from the Village People's Committee (13:13). Besides the village leader there is also one police officer in each village (13:15). The village leader in Tam Ich has between two and five meetings at the Municipal People's Committee in Ninh Loc per week (33:17).

The **Farmer's Union** is the most powerful union in the villages (60:1). It exists on every administrational level, i.e. village, municipality, district, urban district and province (60:1). One of the main duties of the Farmer's Union is to disburse micro-credits from the government to enable the diversification of household incomes from coastal communities through alternative incomes outside the fishery sector (61:10). Moreover, the Farmer's Union can easily borrow money from the banks up to 10 million VND (68:5).

The **Women's Union** is next to the Farmer's Union the most powerful union in coastal communities (60:2). Just like the Farmer's Union it is responsible for the disbursement of micro-credits from the government to encourage fishermen to change their job to agriculture or trading (61:10).

The **Fishermen's Union** is the least powerful union in fishing communities and like a branch of the Farmer's Union (60:3). Members of the Fishermen's Union share experience and exchange ideas, for example how to feed lobster or how to invest in a bigger boat (60:3; 62:1). This organizational structure is eroding and nowadays several villages have no Fishermen's Union anymore (95:1; 98:3).

The **People's Committee** exists on every administrational level, i.e. village, municipality, district, and province (13:11; 13:13). The President of the Municipal People's Committee is responsible for taxation, land sales and so forth (13:17). On the other hand, there is the political leader on municipality level, who is elected by the People's Committee and approved by the District People's Committee (13:16). He is responsible for the *"protection of land and sea"* and in charge of residence affairs, such as passports, registration, etc. (13:16). The People's Committees are responsible to the next higher People's Committee (45:1). In general, the People's Council makes the law and the People's Committee enforces it (45:2).

The **Fishery Processing Company No. 17** is situated in the suburbs of Nha Trang and is the only commercially run processing company mentioned by fishermen and wholesalers (cf. 72:4; 74:1; 24:7). The company is mainly responsible for the development of the fishery sector through providing new market opportunities for fishermen to market their products (24:7; 25:29). Moreover, the company is a major employer in the area providing low qualified jobs for coastal community members (31:13).

Several **banks** in Nha Trang and Ninh Hoa provide credit to fishermen from coastal communities situated around Nha Phu Lagoon (31:17; 44:8; 66:9; 67:7). (see chapter 5.4.4 for further information)

- Private: **Middlemen** or intermediaries for nearly every commodity are present in every village (cf. 74:1; 80:7; 82:1; 86:2). Strong, interdependent business ties link fishermen with middlemen and different markets (30:23; 47:6; 59:3; 74:1; 75:3).

  The **Fisheries Resources Protection Group** is a self-formed group founded in 2002 and unique to Ha Lien Village (16:5; 55:5; 97:2). The group was formed to fight electric fishing, since electric fishing had gone out of control after its introduction to the area a few years ago and is authorized by the local government authority (55:6; 16:5; 16:6).

  The **Offshore Fishing Boat Support Group** is a self-formed group identified in Van Dang Village (95:1). Several of these groups are said to exist (98:4). However, none could be detected (98:4). Government authorities do not recognize the Offshore Fishing Boat Support Group (98:2).

There are great variations in how active these organizations and groups are and their occurrence varies from village to village (96:2; 97:2; 97:3; 97:4; 98:2; 98:4; 98:3). In a next step participants were asked to rank the identified stakeholders and informal groups according to their influence on the local coastal fishery sector in Nha Phu Lagoon. Thereby, bigger numbers express a stronger influence of that organization on the coastal fishery sector and vice versa. The results of the ranking are presented in the following Table 11.

Table 11. Stakeholders and their relative influence (ranking 1 to 10) on the local coastal fishery sector determined by participants from three villages.

Stakeholders		Village		
English	Vietnamese	Tan Dao	Ha Lien	Van Dang
Department of Fisheries	So Thuy San	8	9	5
Fisheries Resources Protection Department	Chi cuc Bao ve nguon loi Thuy San	3	2	10
Fishery Promotion Centre	Trung tam khuyen ngu	9	-	10
Marine Border Patrol	Bien Phong	3	8	7
Village authority	Chimh quyen Thon	7	10	4
Women's Union	Hoi phu nu	8	5	7
Farmer's Union	Hoi nong dan	8	8	7
Fishermen's Union	Chi hoi nghe ca	8	-	-
People's Committee	UBND	5	10	10
Bank	Ngan Hanh	4	10	8
Middlemen	Nguoi trung gian	8	9	6
Fishery Processing Company	Cong ty che bien Thuy San	6	5	9
Fisheries Resources Protection Group	To bao ve nguon loi Thuy San	-	10	-
Offshore Fishing Boat Support Group	To ho tro danh bat xa bo	-	-	3

Source: (93:3; 96:1; 97:1; 98:1)

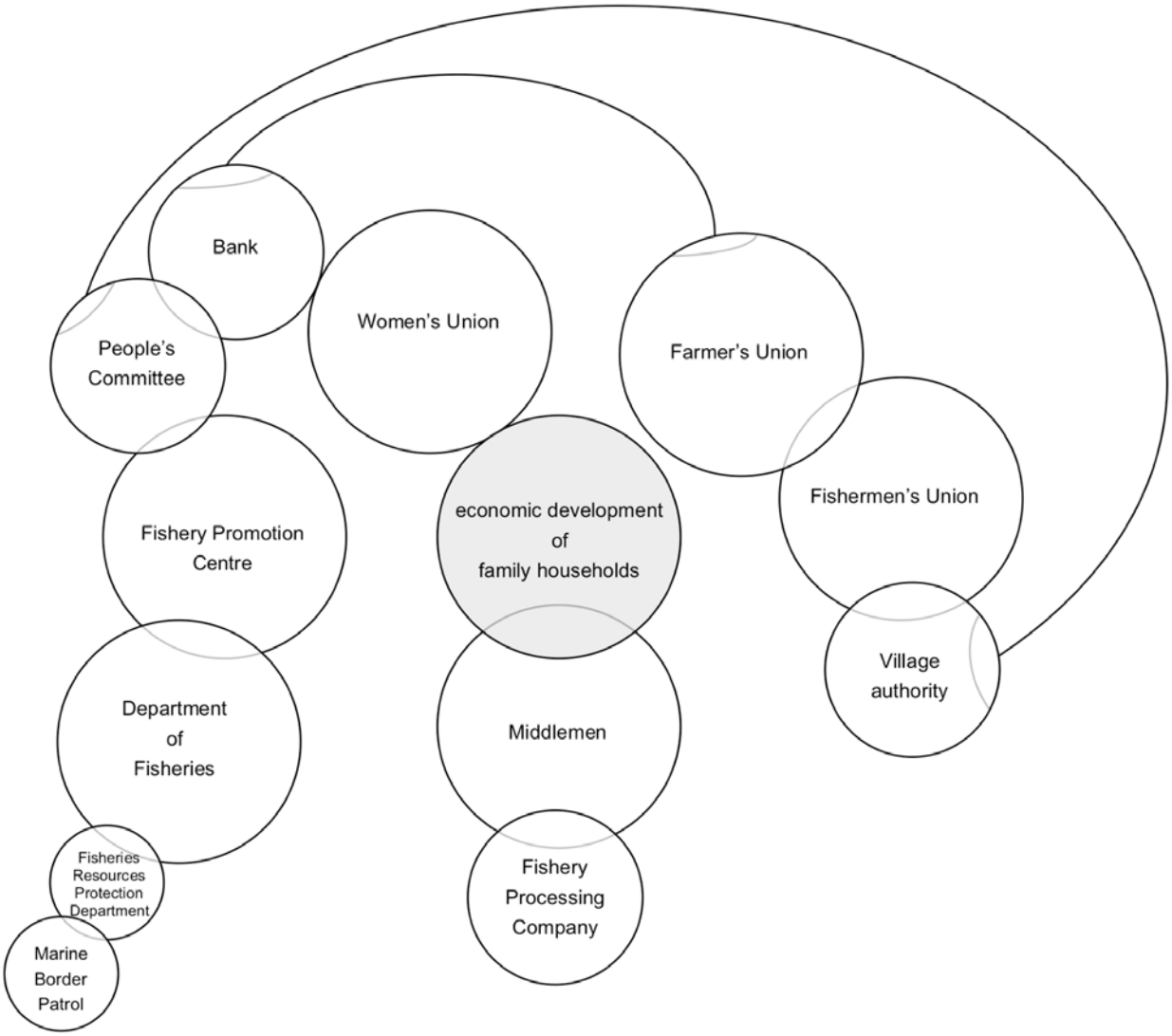
The ranking order varies considerably between the three villages. To identify the relationships between the organizations and the fishery households and to expose potential conflicts between stakeholders and possible key intervention points, participants were asked to conduct Venn diagrams. The arrangements of stakeholders and groups allow assertions about the **decision-making structures** depending on the positions of the circles, e.g. overlapping circles can indicate joint decisions and great distances between circles can be a sign for a lack of stakeholder participation in decision making (DFID 2000,3.5). The results of the three villages are as follows:

- Tan Dao lies next to highway No. 1 in a sheltered bay of Nha Phu Lagoon (cf. Figure 24). It borders salt marshes to the East and shrimp ponds to the West. There are only a few areas with mangroves, which remind the observer that they used to be plentiful (31:12). The sea area between the shoreline and the island of Hon Coc is famous for its green mussel culture and many villagers depend on it for a living (32:18; 91:5). Most people use small, un-motorized boats and trammel nets to fish for shrimps and crabs, but electric fishing is also prevalent in Tan Dao (31:2; 31:15; 35:11; 91:1; 73:6). Others, own shrimp ponds and culture shrimps, mud crabs and grouper (73:1; 31:22). Again others do agriculture (32:8; 31:18).

  The most important stakeholder groups in Tan Dao according to their influence on the fishery sector are: the Fishery Promotion Centre, Middlemen, the Farmer's, Women's, and Fishermen's Union, and the Department of Fisheries (96:1). Self-formed groups are absent and both the enforcement organizations, the Marine Border Patrol and the Fisheries Resources Protection Department, play virtually no role (96:1). The importance of the Fishery Promotion Centre lies in its success of a training course conducted in Tan Dao to induce 10 electric fishermen to culture green mussels, of which seven families changed to this new job (96:2). Middlemen are an important credit source and the Unions are involved in the disbursement of government loans in line with the poverty reduction program (91:4; 31:16).

  The Venn diagram differentiates clearly between private and public sector organizations. Hereby, the closest relationship is between the middlemen and the economic development of family households. The second closest relationship is between the Women's Union and the family household. The Marine Border Police and the Fisheries Resources Protection Department expectedly have no affiliation with the economic development of family households.

Figure 43. Venn diagram of Tan Dao Village representing stakeholder groups, their influence on the local coastal fishery and relationships between them.



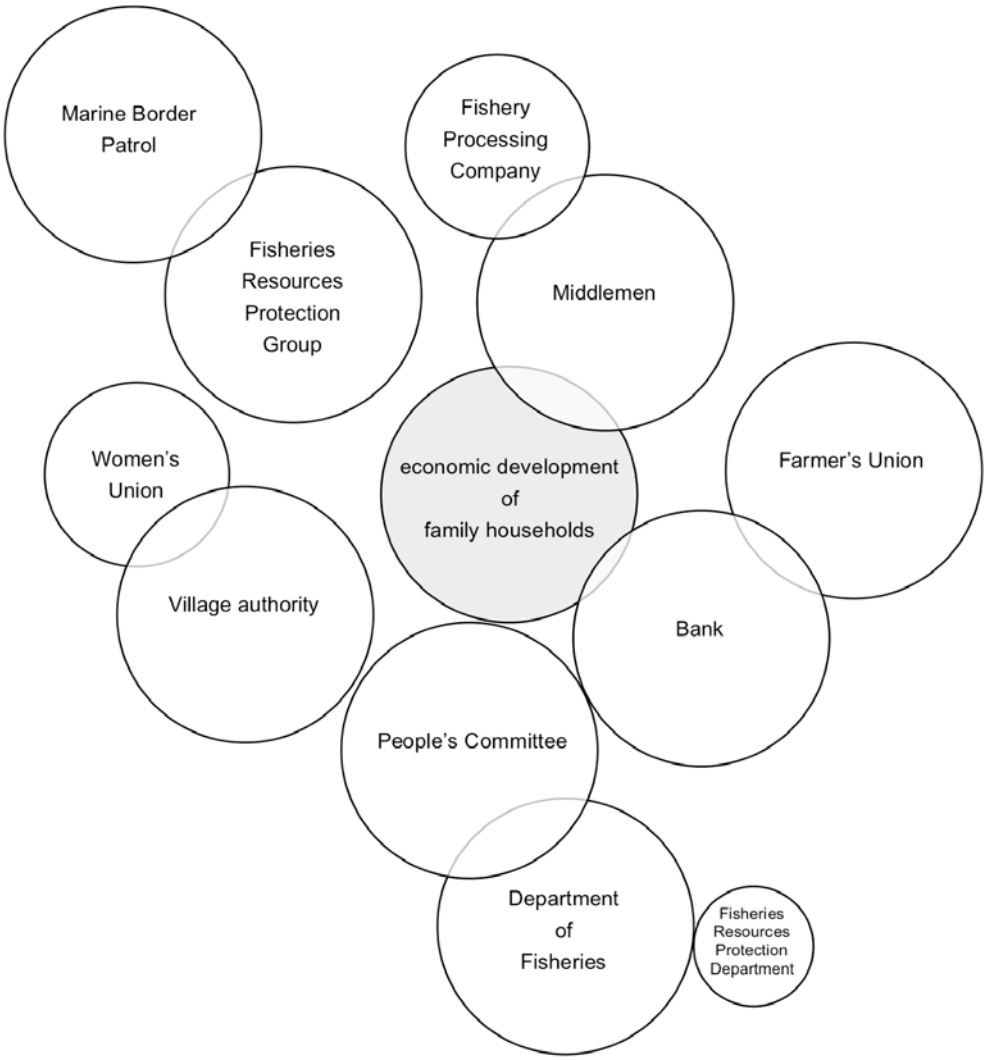
- Ha Lien lies about four kilometers off highway No. 1 between several river mouths that enter Nha Phu Lagoon. Shrimp ponds cover the entire area interrupted only by a few scattered patches of mangroves (cf. Figure 24; 54:21). Hence, many livelihoods depend on shrimp culture (78:4). However from the previous 60 percent of the population farming shrimp, many are indebted and have returned to their original job, continuing shrimp culture on an extensive level (78:4). Many households go fishing with small, un-motorized boats for crabs, shrimp and fish (54:1; 54:3). Other household members collect shells during low tide (54:4; 55:2). Electric fishing has virtually disappeared completely, although many fishermen engaged in it in the past (54:19; 55:7). This circumstance is owed to the fact of a self-formed group called Fisheries Resources Protection Group that confiscates electric fishing equipment in the area (55:4; 55:5; 16:5; 16:7).

  The village authority, the People's Committee, banks, and the Fisheries Resources Protection Group have the strongest influence on the fishery sector (97:1). The Department of Fisheries and middlemen come close second, while the Marine

Border Patrol and the Farmer's Union rank third (97:1). The Fisheries Resources Protection Department has virtually no influence and has been replaced by the self-formed Fisheries Resources Protection Group. The Fishery Promotion Centre and the Fishermen's Union are not present in Ha Lien.

The Venn diagram reveals that several stakeholder groups are interlinked with the economic development of family households in Ha Lien. Strong relationships (business ties) exist between middlemen and banks, followed by the People's Committee, the village authority and the Fisheries Resources Protection Group. Remarkably, these organizations are characterized by maintaining stakeholder relations among themselves. Noticeable is also the relationship between the public and the private sector, i.e. the Marine Border Patrol and the self-formed community organization Fisheries Resources Protection Group.

Figure 44. Venn diagram of Ha Lien Village representing stakeholder groups, their influence on the local coastal fishery and relationships between them.

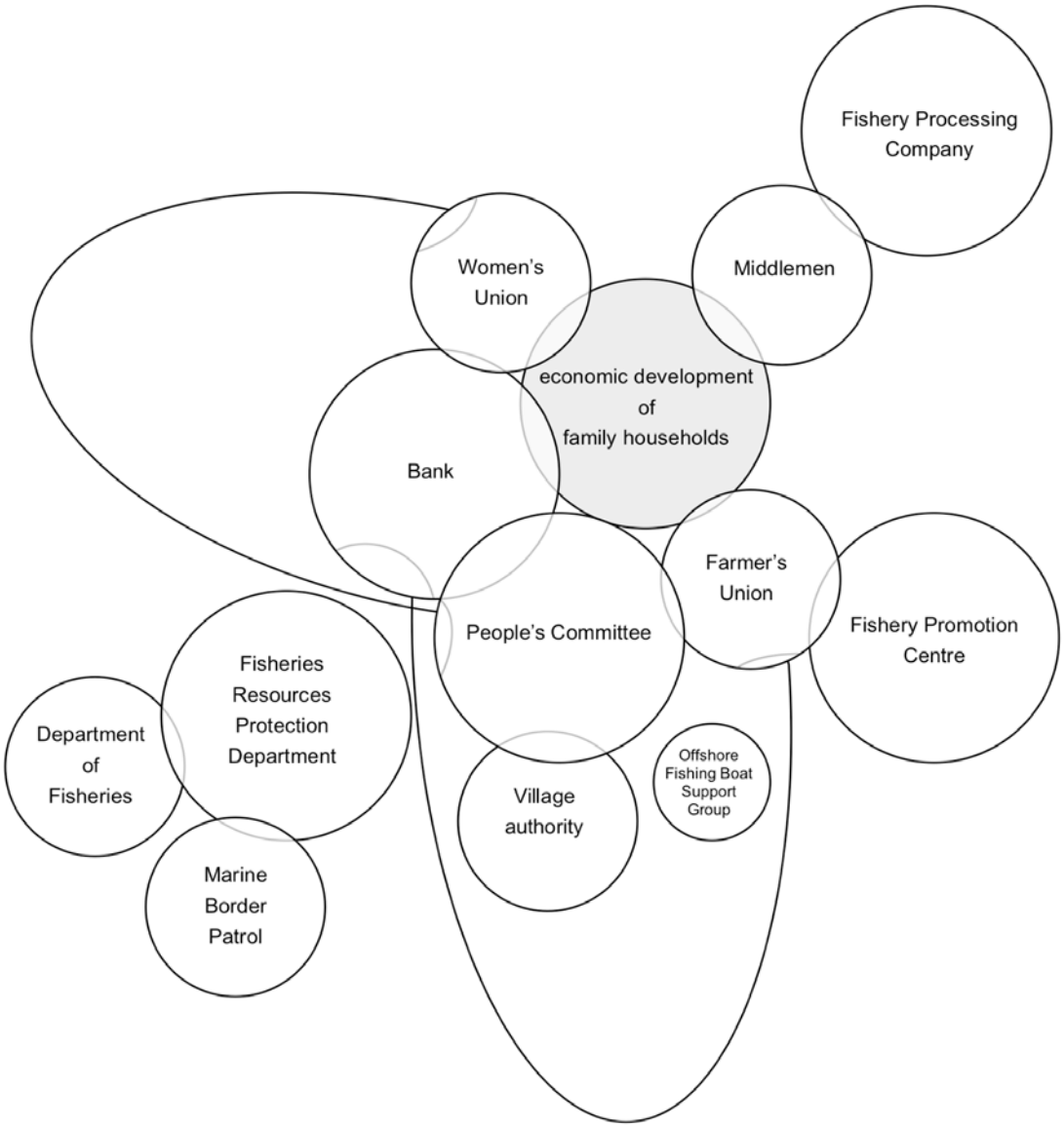


- Van Dang is one of three close-knit villages in Vinh Loung Municipality (cf. Figure 24). It lies right off highway No. 1 in close proximity to Nha Trang. The area is densely populated and covered with buildings. Many households live from agriculture in the nearby foothills, while others practice trading (38:2; 47:13). From the 250 households engaged in fishing about 50 use large boats with engines between 45 to 210 hp for offshore dragnet fishing (38:5; 38:11). The other 200 households use small boats, with engines between 12 to 20 hp and go fishing with gill nets in Nha Phu Lagoon (38:6; 38:11; 71:1). Other sources of information classify further and affirm that from 200 boats 100 use standard nets and the others go dragnet fishing in the lagoon (62:5; 95:4). Five households culture shrimp and a majority of the shrimp hatcheries in the area, about 30 to 40, belong to villagers in Van Dang (38:7; 38:8). An undetermined number of households catch lobster fry (47:15).

  The Fisheries Resources Protection Department, the People's Committee, and the Fishery Promotion Centre are said to have the strongest influence on the fishery sector (98:1). The fishery processing company is seen to be second in importance by villagers from Van Dang closely followed by banks. Unique to Van Dang but with little influence on the fishery sector is the Offshore Fishing Boat Support Group. And just like in Ha Lien the Fishermen's Union is absent.

  The Venn diagram displays a complex network of connections between the stakeholder groups and the economic development of family households. The Farmer's Union, the bank, the People's Committee and the Women's Union take up key positions. Striking is that the government body consisting of the Fisheries Resources Protection Department, the Department of Fisheries and the Marine Border Patrol is strictly separated from this network and has no relationships with other stakeholder groups.

Figure 45. Venn diagram of Van Dang Village representing stakeholder groups, their influence on the local coastal fishery and relationships between them.



The **analysis of the Venn diagrams** from the different villages visualizes the unique structures and relationships between the multiple stakeholders in the fishery sector. For example, in Van Dang the fishery households are characterized by strong business ties to several of the stakeholders illustrated by the overlapping circles (Figure 45). These interconnections are also represented in the many overlapping circles between the various stakeholders (Figure 45). In Tan Dao the only overlapping exists between the fishery households and the middlemen, who at the same time represents the connection between the private and the public sector (Figure 43). Yet, at the same time Tan Dao stands out with many interconnections between the stakeholders themselves (Figure 43). Ha Lien represents a totally different picture. Although the stakeholders all have a relative strong influence on the fishery sector, depicted in the large circles, they all remain relatively detached

from each other, i.e. unincisive relationships illustrated by the few interconnections (Figure 44).

On the other hand there are some similarities between the different Venn diagrams concerning stakeholder arrangements. Most striking is the connection between the fishery households, the middlemen and the fishery processing company, which is exactly the same in each of the three villages. Another distinct arrangement is the one including the Department of Fisheries, the Fisheries Resources Protection Department and the Marine Border Patrol, although only present in Tan Dao and Van Dang. In Ha Lien, the self-formed Fisheries Resources Protection Group cooperates with the Marine Border Patrol and extends the arrangement of the fisheries management institutions, while the Department of Fisheries and the Fisheries Resources Protection Department allegorize a structure of its own (Figure 44). And last but not least, the People's Committee together with the bank, the Women's and the Fishermen's Union represents an arrangement that exemplifies the provision of credits to the fishery households. This arrangement is most distinct in Van Dang and least developed in Ha Lien.

4.4.6 Trends and Consequences: Sociological, Ecological, and Economical

The following **sociological trends** influence the local coastal fishery in Nha Phu Lagoon. The migration from agricultural areas to the coastal zone has consequences on resource exploitation, resource conflicts and on the management of coastal fishery resources. Some in-migration comes from Phu Yen Province in the North (44:16). On the other hand there is some out-migration to Ninh Loc Municipality and other areas (31:7). Newly settled outsiders are responsible for introducing new fishing techniques to Nha Phu Lagoon such as the deep-water trap (19:14; 19:5). This new trap has not only led to conflicts over blocking boat passageways but is said to have negative consequences on the fishery resources (33:6; 54:23; 12:2; 29:5; 33:4; 50:7; 54:23). As a result, notification No. 101 TS/BVNL issued on September 9th 2003 by the Provincial Department of Fisheries in Nha Trang regulates and manages the use of the deep-water trap.

The lack of alternative income and insufficient education is forcing more and more young people to engage in fishing as a last resort. If in the past maybe 10 percent of the population went fishing, nowadays 50 percent go fishing (31:10; 31:11). Of these young and inexperienced fishermen many are unsuccessful (69:4). *"In the future the resources will be destroyed further"*, is the direct answer to this development expressed by a village leader and three fishermen, who see a sharp increase of people going fishing since 1975 (35:2; 35:3; 35:18). They attribute this to a lack of alternative jobs and population growth (35:20; 35:19; 35:18).

Several discussions with groups of different aged women revealed, that today more women are choosing to have only one or two children and exercise birth control using contraceptive coils and sterilization (31:6; 27:5). *"More children make poor"*, is the conviction uttered by eight interviewed women in Van Dang, who each only have one or two children compared to the average five to seven children per family (42:8; 42:7; 42:1; 25:26; 27:5; 31:5).

Several **ecological trends** were identified in the coastal fishery sector. Ten years ago Nha Phu Lagoon was rich in fishery resources like shrimp and fish (41:3). Porpoises were abundant and one could see many crabs and fish swimming in the water of the lagoon (41:5; 67:2; 3:13). At that time the fishermen used small rowing boats in the municipality of Vinh Luong (67:2). Since then, the introduction of new fishing techniques and the increasing fishing pressure have led to a decline of coastal fishery resources (14:2; 23:7; 27:6; 30:10; 41:4; 54:11; 91:1). The vice village leader of Ha Lien expresses this development: *"10 years ago there were 100 percent resources, today there are two percent left"* (16:1). Several examples mark the different stages in the decline of coastal fishery resources.

The rise and fall of the blood cockle is one of them. According to the village leader from Tan Thuy 500 fishermen were fishing for blood cockle in 2001 (14:9). Harvesting was easy but after two years stocks had disappeared completely (14:9).

Another example is the availability of grouper seed from natural collection. Seven years ago a woman culturing grouper could buy 70 juvenile grouper per day; now she only manages to buy two or three grouper seed a day (75:6; 75:7).

Despite negative ecological effects there are also positive ones. In 1997 green mussels were completely wiped out in Nha Phu Lagoon and were reestablished by the Research Institute for Aquaculture No. 3 in Nha Trang (52:1). Since then green mussel cultivation established itself in the lagoon. Several positive ecological externalities can be attributed to green mussel cultivation:

- The pillars used to culture green mussels serve as hiding place for shrimp and fish (32:7; 3:5). Fishermen catch shrimp and fish only around the pillars but nowhere else (32:9; 3:5).
- The structures used to culture green mussels serve as barrier against dragnets (32:10; 3:5).
- Fishermen in Tan Dao attribute good results in shrimp farming to the good water quality from green mussels filtering activity (32:4).

Shrimp culture is responsible for the deforestation of large areas in Nha Phu Lagoon's tidal zone (3:8; 20:8). Yet this trend cannot be further perpetuated, because there is virtually no mangrove left (33:11; 35:6). However, the destruction of mangroves has led to an increased sedimentation and several water areas around Tam Ich that have been deeper in the past, i.e. 2.5 meters, are only 1.5 meters deep today (3:9; 32:5). In front of Tan Dao this phenomenon is even more distinct. The water that used to be more than two meters deep now only measures 70 centimeters (35:4). Citizens attribute this to inland deforestation and therefore more erosion and the destruction of mangroves that hold the sediments back (35:5).

Another trend with negative impacts on coastal resources is the increasing environmental pollution exemplified by the code: *"Environmental pollution as reason for the decline of coastal fishery resources"*. Pollution stems from aquaculture, agriculture, urban and rural settlements, and companies. In aquaculture polluters are shrimp ponds and hatcheries using large amounts of chemicals, medicine and feed (35:7; 22:5; 25:22; 18:15; 78:16). In agriculture polluting surface run-off from arable land containing nutrients and pesticides contaminates coastal waters (66:3; 66:2). Urban sewage originates in Ninh Hoa and

further inland and enters Nha Phu Lagoon through the Cai River (92:6). Peri-urban and rural settlements contribute to domestic sewage discharge into Nha Phu Lagoon. In addition, rural waste from coastal communities litters the water body and the shoreline (35:8). It results from the local practice of waste disposal by dumping it on the beach, a practice I frequently observed during my field studies. Industrial wastewater originates from several companies including fish and sugar cane processing (25:22; 42:9; 92:6; 21:9).

Last but not least are some trends in coastal fisheries with an ecological implication. The introduction of new and more efficient fishing techniques and the increasing fishing effort leads to indiscriminate fishing regarding catch composition and size (33:4; 33:8; 14:2; 14:20; 19:9; 25:20; 29:5; 50:7; 58:17; 58:20; 64:7). Moreover, the development of mud crab and grouper culture supplied by natural seed collection is increasing the pressure on natural resources, so that today every size crab is caught (16:10; 86:1).

In accordance to Vietnam's rapid economic growth and the increasing economic activity in fisheries and aquaculture several **economic trends** were identified in Nha Phu Lagoon. Even though the coastal communities still are considered poor according to international standards, the abundant resources of Nha Phu Lagoon have led to economic wealth in some of the municipalities surrounding the lagoon (41:7). *"Dam Nha Phu made me rich"* a fishermen states, explaining his economic development and that within 10 years he has changed from owning a small boat to three big offshore fishing vessels (41:8; 41:7; 41:1). Further emphasis comes from a fisherman in Luong Son, who over the last 20 years has made so much money from fishing that he has been able to buy a bigger boat every five years (66:6). Together with his son they now own four trawlers worth 200 million VND (12 600 USD) each (66:6).

Economic development is not limited to offshore fishermen but is also expressed by artisanal fishers and the code: *"Local perception of livelihoods/Lives have improved"*. A fisherman in Ha Lien, for example, perceives that life is getting better, i.e. income raises and kids go to school (54:9). In Ngoc Diem 150 of the 500 households are considered rich (25:25). Yet, all too often monetary rewards benefit only a small share of the population from coastal communities and are associated with high-input productions systems such as shrimp and lobster culture (79:5; 19:16; 21:5). The associated high entry costs into aquaculture prevent alternative income development (79:8; 79:7). In Cat Loi lobster culture (rearing) has improved lives a lot and many people have jobs related to the lobster industry (48:5; 48:6). However, villagers are experiencing that social structures are eroding and that with increasing income *"people are no longer working together"* and *"(…) hate each other for high income and possessions"* (48:8; 48:9; 48:10). Only people culturing lobster close to one another might care and look after each other (48:11).

4.5 Problems of Maintaining Coastal Livelihoods

During the field study I collected reasons for the decline of fishery catches from fishermen. Towards the end of this study I conducted a questionnaire with 72 fishery households situated around Nha Phu Lagoon. In a section of the questionnaire I ask fishermen to specify the amount they catch less today compared to the past. The answers varied between zero to 70 percent less catch according to qualitative statements (cf. 16:1; 23:7; 27:12; 54:11; 64:5; 71:2). On average, the 72 respondents mentioned that catches had declined by 55 percent in recent years. Later I asked the fishermen to rank the collected reasons from one to 10 according to their influence on decreasing catches, with 10 having a strong influence and one having little influence. The findings of this problem ranking are listed in Table 12. Next to the eight reasons listed in Table 12 participants mentioned other reasons that were not previously collected. Weather changes were noted four times and ranked 7.5 indicating, that these fishermen held them responsible for declining catches (cf. 64:5; 64:6). The second reason was dynamite fishing noted by two fishermen who gave it a high ranking (9). The following reasons of declining catches were only noted once; the associated rank is given in brackets. The strongest effect was assigned to the introduction of sonar (10). The negative effect caused by siltation came second (7). Outsiders that go fishing in the coastal waters of Nha Phu Lagoon were also seen as a cause (6). The introduction of headlamps used for crab and shrimp fishing at night ranked the same (6). Having no money was another reason mentioned (5). And last but not least was littering with the lowest rank (2).

Table 12. Reasons of declining catches, identified by fishermen and ranked according to their relative importance.

Reasons	Rank
Drag net	7.7
Population increase	7.0
Pollution from agriculture and cities	6.8
Electric fishing	6.6
Destruction of mangroves	6.2
Pollution from shrimp ponds	6.2
No alternative jobs	6.1
Deep-water trap	5.7

Source: Questionnaires/Problem ranking
Order: 1-10 (1 = < influence & 10 = > influence)

Comparing quantitative with qualitative results an ample group discussion with the village leader and five fishermen in Tan Te yielded the following reasons for the degradation of fishery resources (20:21; 20:22; 20:23; 20:24; 20:25):

1. Destruction of mangroves
2. Dragnet fishing
3. Electric fishing
4. Population increase
5. Environmental pollution

A group discussion with gill net fishermen in Van Dang produced a totally different picture (71:1). As reasons why they catch 40 percent less than five years ago they identified (71:2):

- Today more people go fishing than before (71:3).
- Fishing makes more money than alternative jobs (agriculture), sometimes they can make 1 million VND a day (71:4; 71:5).

- Jobs are inherited from their parents (71:6).
- They only go fishing three hours a day (71:7).

In the following chapters I will go into details about the most relevant reasons for the decline of coastal fishery resources and address the issue of their origin.

4.5.1 Illegal Fishing

In Vietnam three common destructive fishing techniques are banned: (i) explosive fishing, (ii) cyanide fishing, and (iii) electric fishing (14:14). In addition, trawling is prohibited in coastal waters less than 25 meters in depth and in every lagoon nationwide (18:23; 65:23; 13:4). In general the municipal leader is responsible for the enforcement of fishing laws (57:8). The next responsible person is the leader of the District People's Committee. If the fine for illegal fishing activities exceeds 500 000 VND, the municipal leader has to report to the district level and is not responsible anymore (57:9). For comparison the national fishery law No. 70/2003/ND-CP stipulates that:

- 100 000 to 300 000 VND fine shall be issued for use of net with the mesh smaller than regulations (Section B, Article 10.2 b)
- 2 to 4 million VND fine shall be levied for building underwater constructions that alter the places of habitats, without license (Section A, Article 8.2)
- 1 to 3 million VND fine shall be levied for use of electric equipment (Section B, Article 10.5 b)
- 2 to 4 million VND fine shall be levied for use of poisonous chemicals to exploit fisheries (Section B, Article 10.6)
- Supplementary punishment includes the confiscation of all gear, catch and the destruction of equipment (Section B, Article 10.8)

Table 13 summarizes the negative effects that originate from pursued livelihood strategies. Some of these livelihood strategies are illegal in the first place such as trawling, electric fishing and cyanide fishing. Others are carried out violating the law, such as forcing broodstock to spawn early and producing weak shrimp fry that causes economic losses for shrimp farmers. Or fishing for lobster fry with lift nets and light that is beyond the permitted wattage and that damages the lobster fry causing low survival rates and economic losses for the lobster culturists. Opposed to the violations Table 13 illustrates the existing government decrees and directives that are described in more detail in chapter 5.3.3. More detailed information concerning the negative effects of the pursued livelihood strategies can be found on the following pages.

Table 13. Livelihood strategies violating government decrees and directives and their associated negative effects on the coastal environment and its inhabitants.

Livelihood strategy	Violation	Negative effects	Decree/directive
Deep-water trap	Too small mesh size	▪ Indiscriminate in size ▪ Destroys larvae & eggs from fish and invertebrates ▪ Blocking boat passage ways	No. 101 TS/BVNL
Trawling	Prohibited in Nha Phu Lagoon	▪ Unselective fishing ▪ Indiscriminate in size ▪ Destroys seabed & Seagrass ▪ Destruction of coral ▪ Causes conflicts	No. 26 CT/UB
Electric fishing	Prohibited in Vietnam	▪ Indiscriminate in size ▪ Destroys larvae & eggs from fish and invertebrates ▪ Erodes social structures ▪ Encourages outsiders to fish	No. 01/1998/cT-TTg
Cyanide fishing	Prohibited in Vietnam	▪ Destroys coral reefs organisms	No. 01/1998/cT-TTg
Shrimp farming	Pollution	▪ Infecting neighboring ponds ▪ Economic losses ▪ Polluting coastal environment (dead fish & crabs, skin infections)	No. 70/2003/ND-CP
Shrimp hatchery	Forcing broodstock to spawn ⇒ weak fry	▪ Economic losses	No. 70/2003/ND-CP
Lobster culture	Too strong light ⇒ weak fry	▪ Economic losses ▪ Eroding social structures ▪ Blocking boat passage ways	No. 70/2003/ND-CP

The incentive to engage in **deep-water trap net** fishing lies in the higher income compared to the usual occupation, i.e. traditional crab net fishing with baited traps (32:22; 52:6; 52:7; 52:4).

Respondents reported that the fine mesh net of the traps not only catches juvenile fish and shrimp indiscriminate of their size and unselective but also and to a bigger effect destroys fish and crab larvae and eggs that are washed against the netting and construction by waves (25:20; 30:17; 50:15; 50:7; 29:5; 33:4; 12:2). According to fishermen from Tam Ich deep-water trap fishing, electric fishing and trawling *"(…) make the fishery resources rare"* (50:12). Moreover, in contrast to other illegal fishing methods the deep-water trap catches at all times (50:11). Furthermore, because some traps are blocking ship passageways, there have been incidents of traps being destroyed by angry fishermen from Tam Ich (33:6).

In the beginning of this study, the municipalities of Ninh Loc and Ninh Ha were watching and monitoring the new development of deep-water trap fishing and then passed notification No. 101 TS/BVNL issued September 9th 2003, that informed about the illegal net size and that offenses will lead to the removal of traps (19:10; 19:12; 19:13). However, only since December is it illegal and the village leader in Tan Thuy has ordered traps to be dismantled although not rigorously (89:3; 89:4).

Trawling or dragnet fishing (*Gia cao*) is one of the biggest problems in Nha Phu Lagoon today (95:4). Of the 200 small, motorized boats in Van Dang 100 use gill nets; the other 100 boats go dragnet fishing in Nha Phu Lagoon (62:4; 62:5; 95:4). *"Many small boats (18 to 20 hp engine) go fishing with dragnet inside the lagoon"* (81:5). The fishermen that go dragnet fishing argue that gill net fishing is more strenuous and less economic; 10 days gill net fishing equal 1 day dragnet fishing (62:6). *"They can't go outside the lagoon and mainly participate in dragnet fishing, because it makes a lot of money"* (81:6). On the other side the gill net fishermen argue, that they do not have to worry about being caught by the Marine Border Patrol or the Fisheries Resources Protection Department (62:7). They prefer going fishing anywhere they choose with a *"good feeling"* (71:8).

In the past many of the small dragnet fishermen were working on big offshore trawlers and then started their own business copying their employees (95:6). Often neglected but of great importance in this context is the fact that a single person can carry out dragnet fishing in contrast to gill net fishing, where two persons are required to set the nets and one person to steer the boat (95:9).

A dragnet for a small boat only costs about 4 to 5 million VND (95:7). For gill net fishing one needs about 22 to 23 gill nets, each costing about 600 000 VND, so the total investment cost is about 14 million VND plus an additional 1,5 million VND per year for net repairs (95:7). In addition, the availability of long-term credit remains a big problem (95:8). The following example demonstrates this. A gill net fishermen in Van Dang can set aside about 3 500 VND daily and save about 110 000 VND a month (95:8). That means the fishermen could repay a loan with 1.4 million VND a year or referring to the initial investment costs above, he would require a retention period of 10 years (95:8). Thus the low entry costs into illegal fishing and the lack of long-term credit and bank loans in general remain one of the biggest reasons for illegal dragnet fishing in Nha Phu Lagoon today (95:5). Further emphasis comes from fishermen in Tan Thanh who pinpoint poverty and inadequate credit schemes to ineffective legislation (18:22). Poverty or the dependence of certain low-income households on a single livelihood strategy, namely trawling, seems quite distinct and is mentioned likewise from involved and uninvolved persons (6:7; 35:22; 36:6; 41:9).

According to the Marine Border Patrol (*Bien Phong 368*) stationed in Nha Phu Lagoon negative effects of trawling are:

- Due to the small net size used, everything is caught (58:17).
- Dredging destroys the seabed and Seagrass (58:18). Fishermen in Vo Tanh reported that five years ago pearl oyster culture disappeared, because of turbid water from trawlers stirring up the seafloor (6:4; 79:9). Furthermore, the assertion: *"The maintenance costs are quite high, because the dragnet often gets damaged on the coral"* is an indication that coral is destroyed as well (70:13).
- 75 percent of the catch is small fish and used as animal feed (trash fish), only 25 percent are of big size (58:19).
- Trawling has a strong effect on the fishery in Nha Phu Lagoon because of its high extraction level (58:20).

Strikingly the Marine Border Patrol Officer finishes his list with the statement (58:22):

"If illegal fishing can be controlled, it will increase the fishery in Dam Nha Phu again".

However, the enforcement is difficult and there have been occasions where dragnet fishermen got help from other big trawlers and tried to sink the vessel of the Marine Border Patrol exemplifying the powerlessness of the authorities (25:15). But the conflicts are not limited to the authorities and dragnet fishermen. Fishermen in the back of Nha Phu Lagoon operating mainly small, un-motorized boats with gill nets have strong antipathy against fishermen from the more developed villages towards the front of the lagoon operating mainly medium, motorized boats with dragnets (6:2; 8:1; 15:7; 25:14; 62:8; 65:10). In Ngoc Diem dragnet fishermen have intimidated gill net fishermen, on the other hand, dragnet fishermen from Vo Tanh do not dare to go trawling in the back of the lagoon anymore (25:14; 65:5; 3:12). Today they usually only fish until the Island of Hon Thi (3:12). Between 1994 and 1997 the tension rose and in 1996 the situation escalated and two people were killed, a small boy and his father, who was drowned *"but since then everybody lives in peace"* (14:21; 13:5; 13:19). This is not quite right, since fishermen from Tan Te complain about excessive dragnet use in the past (15:7). In 1998 this led the Department of Fisheries to sink old tires filled with concrete in front of Tan Dao to stop trawling (32:11; 15:7). Yet the attempt failed and fishermen remember this action as a *"waste of money"* (32:11; 32:12; 15:7). Today the conflict persists and fishermen from Tan Thuy see no change (4:1; 4:2).

The same fishermen point out, that if the Fisheries Resources Protection Department would impose the proper fines, they could not make any money in the future, an assertion that highlights the incidence of corruption (4:6; 15:9; 76:4). From the Marine Border Patrol's point of view the action they take depends on how poor the dragnet fishermen are, i.e. what financial resources they have (58:13; 58:25). According to the Marine Border Patrol and the Fisheries Resources Protection Department the usual fine imposed is between 2 and 5 million VND (44:9; 57:6). However fishermen caught the second time will be punished in general the Marine Border Patrol talks with dragnet fishermen and informs them of their illegal action (58:10; 58:11). In the year 2003 the Marine Border Patrol reported four cases where dragnet fishermen were caught twice and fined; *"5-8 nets"* were confiscated (58:12). In a group discussion on the beach at Vo Thanh I met a man who was just caught by the Fisheries Resources Protection Department and was fined 1 million VND (65:6). It is the second time in a row for him that he is fined (65:6). A dragnet fisherman in Luong Son has been fined three times by the Fisheries Resources Protection Department and has paid 4 million VND each time (70:1). This man likes to fish in the buffer zone between the two capes and has also been abused by officials (70:7). The maximum fine of 20 million VND would never be imposed, because it will *"drive people against the wall"* (58:24). This concept is also shared by the president of the People's Committee in Vinh Luong Municipality who specifies, that many lives are so poor, they cannot borrow money from the bank, so *"we can't enforce strictly, because it will drive poor people against the wall"* (61:13; 61:17).

Next to corruption there are other reasons why enforcement is not working. One is the use of radio between dragnet fishermen who contact each other when police boats appear

(25:12; 4:5). Although this action is obvious, the authorities seem unaware of it. *"Every boat has radio onboard"*, the fishermen agree and endorse that the Fisheries Resources Protection Department comes about every 10 days from Nha Trang to control fishing activities between 11 p.m. and 3 a.m. (65:9; 65:8).

Electric fishing is next to trawling an illegal fishing method that has great impact on the fishery resources and the social structures in coastal communities around Nha Phu Lagoon (4:8; 20:23; 30:10; 33:8; 53:11; 53:12; 55:8; 56:6; 83:1). Electric fishing was introduced to Nha Phu Lagoon about four to seven years ago (56:18; 50:6; 20:17; 73:12). For several reasons given below this illegal fishing practice was soon widely adopted by small-scale fishermen, although they were violating Article 6 of Resolution No. 17/2003/QH11 of the National Fisheries Law. Lack of alternative jobs and lack of specific fishing knowledge are one reason why fishermen engage in electric fishing (73:11; 73:12). Poverty is another often mentioned reason (73:6). The acquisition of electric fishing equipment is also comparatively inexpensive (16:8). In other words the incentive to engage in electric fishing is the low initial investment cost and that no specific knowledge is needed compared to traditional fishing methods, where nets cost a substantial amount of money and require experienced fishermen to know where and when to go fishing (71:4; 73:11; 73:12). In addition electric fishing is less labor intensive and the income slightly higher than from traditional gill net fishing methods (56:2; 56:12; 79:2). Fishermen using traditional methods, for example, will go fishing for about 12 to 14 hours a day (77:1). A fisherman using electric fishing gear will take only 3 to 4 hours daily (56:12; 77,2). These reasons have led to not only residents engaging in electric fishing but also outsiders coming to Nha Phu Lagoon by motorbike hereby emphasizing the open-access[2] situation (27:8).

Consequently electric fishing destroys social structures in the coastal fishing communities; fishermen using traditional fishing gear, like gill nets and crab traps versus fishermen using electric fishing gear (75:15; 78:3; 56:6; 55:8; 53:12; 11:3). According to many fishermen another great disadvantage of electric fishing is that it kills small fish, eggs and larvae (83:3; 56:11; 53:11; 33:8). Besides being indiscriminate in size, an interviewed electric fisherman admitted that small fish are often used as duck feed (56:4; 14:20). Resource maps unfortunately show that the electric fishing areas are congruent with the areas participants indicated as breeding grounds and nursery areas of marine invertebrates and fish (cf. 10:1; 10:2; 12:2).

As mentioned earlier electric fishing is still prevalent in Nha Phu Lagoon today. Alone in Tan Te about 40 fishermen go electric fishing (76:1). A training course held by the Fishery Department on the negative effects of electric fishing and with high attendance from the fishermen, led to a temporary stop of electric fishing for one and a half months but after that activities returned to their current levels (76:2). A training course offer in Tan Te from the Fishery Promotion Centre about blood cockle culture produced no interest and nobody registered (94:6). In Tan Dao the concept to enable fishermen

[2] Of course this obsolete term fails to express, that these coastal resources (such as any other resources) are far from open-access as BÉNÉ (2003,960) states but require certain costs of entry to exploit.

pursuing illegal fishing activities to change to another job was successful (94:2). The Fishery Promotion Centre had trained 10 electric fishermen in green mussel culture and seven abandoned electric fishing and culture green mussels today (94:2; 96:2).

Although the fine for electric fishing is 2 million VND and all equipment is confiscated, few fishermen are discouraged (14:15). But electric fishermen are becoming nervous at present, because apparently enforcement is getting stronger and in addition to the electric fishing equipment (400 000 VND) boats (1 million VND) are also confiscated (53:14). Bigger than the risk of getting caught is the fact that electric fishermen are deprecated by their social environment (53:12; 53:15; 56:6; 75:16; 11:3; 55:8; 78:3). For this reason an interviewed fisherman in Tan Thuy chooses to go fishing at night (56:6). According to the same man the leader of the People's Committee does a poor job (56:15). Although they meet once a year to talk about the electric fishing problem, no action is taken (56:17). Additionally there is a program that provides fishermen who stop electric fishing with credit but nobody has made use of it (56:16).

Lax enforcement seems to be ascribed to organizational and responsibility issues. For example, a village leader reports to the Department of Fisheries that electric fishing is going on (76:3). The department instructs the Marine Border Patrol to act (76:3). As consequence the activities stop but four to five days later reoccur (76:3). Furthermore, the Marine Border Patrol collects money from the violators and puts it in their own pockets while reporting back, that everything was quiet today and no activities could be observed (76:4). For this reason a middleman argues, that *"electric fishing cannot be controlled but only the minds of the people changed through telling them how bad it is"* (75:14).

Cyanide (*Chat doc*) is still used today to catch live grouper (80:2). A diver in Loung Son freely admits that he uses cyanide to catch fish (80:2). Interestingly the fisherman also knows about the devastating effects of cyanide, e.g. that areas where cyanide has been used are not occupied by fish anymore, and refers to it as one reason for declining catches (80:1). He uses cyanide in particular to catch live grouper during the season from May to July, when adult animals migrate from the open sea to the inshore reefs (80:6). At this time middleman demand large quantities of live grouper and pay high prices (80:6). The same middlemen also supply the fishermen with cyanide during this time (80:7). Although the sale of cyanide is illegal in Vietnam and it has become difficult to buy today, the middlemen supply themselves from one province in the North (80:3; 80:7).

Other destructive fishing practices such as the use of dynamite (*Min*) seem to be absent, although it is still a common fishing technique in the coastal waters of Kanh Hoa Province and in particular in the nearby Hon Mun Marine Protected Area around Hon Tre Island (NGUYEN and ADRIEN 2002,62). Strangely enough, a spontaneous statement of a woman in Vo Tanh: *"I hate people that use dynamite or cyanide for fishing"* points out that dynamite fishing is perhaps still an issue in Nha Phu Lagoon (44:13).

The last chapter highlights the role illegal fishing plays in the livelihoods of the coastal communities and its negative impact on the coastal fishery resources. In general the public agenda was dominated by discussions about illegal fishing methods. Summarizing and using the words of the village leader from Tam Ich it can be said, *"illegal fishing only benefits one family but destroys the living of 10 others"* (33:10).

4.5.2 Shrimp farming: 'Riding the Tiger'

As mentioned earlier there are 47 shrimp hatcheries along the coast of Nha Phu Lagoon, all located between Cat Loi and Loung Son (24:9). They supply the demand of the growing shrimp aquaculture in Khanh Hoa Province and other provinces. A shrimp hatchery visit revealed, that annual turnover amounts up to 500 million VND. However large quantities of disinfectants, drugs, and dry algae as well as broodstock account for a large share of the input costs. Consequently the shrimp hatcheries produce large amounts of wastewater, which is discharged untreated. Several conversations in Nha Trang about shrimp hatcheries contained assertions about how effluence water contaminates the surrounding sea and that residents stopped going swimming in the areas where shrimp hatcheries discharge wastewater. In turn, this and the high land prices in Nha Trang were the main reasons, why shrimp hatcheries had relocated and developed in Nha Phu Lagoon.

The development of shrimp aquaculture in Nha Phu Lagoon has been described earlier in this work. Incentives to engage in shrimp aquaculture are the high profit margins within reach, i.e. *"the people only look for the profit before their eyes"* (34:6). Yet the once lucrative business has turned to a losing undertaking. Since the year 2000 the incidence of disease in shrimp aquaculture has risen sharply and many people have been unsuccessful or lost everything they had (15:6, 20:9; 34:2). *"Everybody is one time successful and then again unsuccessful"* (interview with a shrimp farmer from Tam Ich 87:2). In Ha Lien, for example, 60 percent of the population was farming shrimp at some time (78:4). Now they are all in debt with liabilities between 10 and 100 million VND per household (78:4). Many of those have returned to their original jobs, namely fishing and collecting shells, but keep on farming shrimp on a very extensive level (78:4). Renting out the ponds is no option, as there are no potential buyers that want to take the risk to lose money (78:6). Although they have been successful in 2003, the return is little, as they all invested little in the first place (78:6). In the area of Tam Ich, 80 to 90 percent of the shrimp farmers have failed in the last two years (34:2). And just like in Ha Lien most of the people owning shrimp ponds in Tam Ich have debts at the bank (87:3). Analogous in Tan Te the shrimp production is very low, since many disease problems have occurred in the last three years (20:9). Many shrimp farmers have failed a third time and are bankrupt now (20:9). Two men from Ha Lien summarize the crucial point with a Vietnamese proverb:

Taxation

Shrimp pond owners with less than two hectares of pond surface pay no taxes. Any additional hectare costs 300 000 VND tax per year (Classification 1).

A government official owning five ponds, each one hectare big, pays no tax. On the other hand he rents out some of his ponds. However, he reports that in Nha Phu Lagoon there is no classification 1, only classification 2, 3 and 4, i.e. no shrimp farmer pays taxes. (33:18)

Interestingly there are shrimp pond owners with up to 20 hectares (22:4).

"If you sit on the back of the Tiger, you have to follow him" (78:19).

Thereby particular importance is ascribed to shrimp farmers that have made major investments, lost everything and now have liabilities at the bank that can only be amortized by continuing shrimp culture that promises the highest profits.

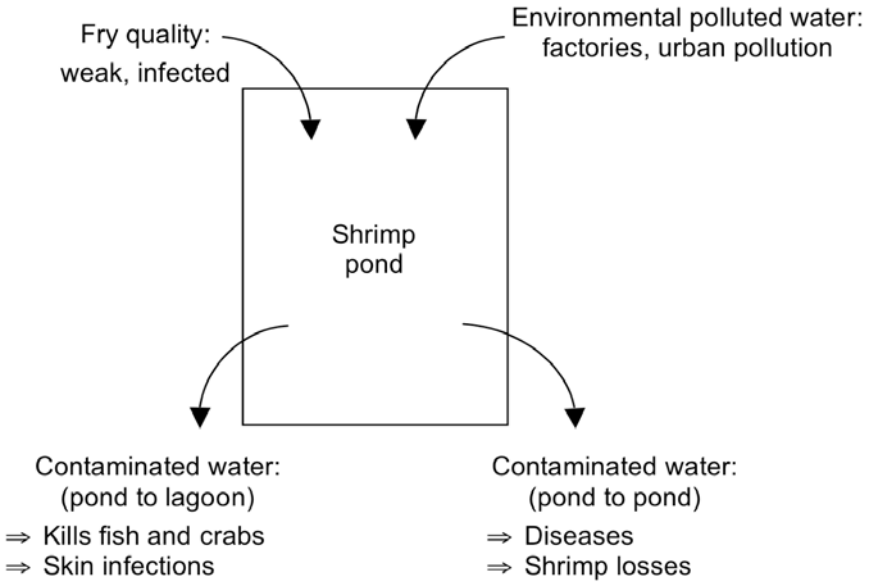
Shrimp farmers mention several reasons for the failure of shrimp culture. One is the weak and disease infected shrimp fry they purchase (78:12; 73:2). An interviewed shrimp farmer blames the hatcheries, which he believes force broodstock to spawn early (73:2). There is no doubt that hatcheries are responsible for poor shrimp fry quality and pond owners are better off, if they have close relatives or if a business connection is established whereby the shrimp fry supplier receives a present, when the harvest was successful (73:3; 73:4).

A second often mentioned reason is polluted water from neighboring ponds that causes the loss of entire shrimp harvests (78:12; 73:2). In this context pollution is used synonymously for water-borne disease (73:2). Since shrimp are prone to disease, the biggest threat comes through contaminated water especially from neighboring ponds that supply themselves from the same channels (73:2; 78:12). Unfortunately, the common practice to farm at different times and release the water from the ponds in case of an outbreak of disease, adds to this threat, because other shrimp farmers take this water to fill their ponds (55:14).

Environmental polluted water poses the next threat to successful shrimp aquaculture and is another often mentioned reason. Several respondents claim factories such as the Hyundai shipbuilding factory in Van Ninh, the seafood-processing factory “Viet Thang” in Ninh Ich and urban pollution from Nha Trang responsible (42:9; 25:22; 92:6; 22:5). Others deem shrimp pond effluence responsible for polluted water and consider it the main reason for unsuccessful culturing (22:5; 20:13; 25:22).

The following Figure 46 displays the previously mentioned reasons for the failure of shrimp culture and exemplifies the negative effects shrimp farming has on the coastal environment.

Figure 46. Reasons for the failure of shrimp culture and impacts on the coastal environment.



Nevertheless, directives exist that govern epidemics, waste water treatment of hatcheries and ponds, quality of shrimp fry, and veterinary and sanitary standards like the government decree No. 70/2003/ND-CP that stipulates:

- 0.5 to 1.5 million VND shall be applied, if hatcheries water treatment system does not comply with environmental protection requirements (Article 12.1 a)
- d), if shrimp fry does not meet the proclaimed quality
- 2 to 4 million VND shall be applied, if drugs, chemicals, dead and waste of infectious fish/shrimp is discharged into natural water and fish/shrimp farming waters (Article 14.2 c)

During this study no practical experience concerning current laws and regulations was made but many individual attempts that attend the highlighted issues in shrimp aquaculture were found. One solution is that everybody starts shrimp farming at the same time, and they announce to each other when they release contaminated water so that in case of a disease outbreak nobody else is using discharged water to fill his or her pond (55:15; 78:13). In Ha Lien the village leader reports, that there have been meetings about this issue and agreements were made but the pond owners decided differently when to start farming (55:16). In response two other men from Ha Lien answer, that if one shrimp farmer is unsuccessful and loses his shrimp, he does not want to see anyone else be successful (78:14).

A side effect of the chemicals and drugs used in shrimp aquaculture is that it kills fish and crabs after pond water is exchanged and the polluted water is discharged into the sea (35:7; 66:2). The practice of water exchange is carried out about two to four hours after shrimp farmers apply drugs (35:25). Fishermen in Tan Dao report that Mullets have skin infections and attribute them to the chemicals used in the shrimp ponds, namely Saponin, Chlorine and Focmon (35:23; 35:25). *"From about 10 fish caught near the ponds, eight have skin problems"* and cannot be sold at the market anymore (35:24; 35:26). Others report: *"When shrimp ponds are prepared, the next day nothing can be caught close to them"* (85:1). A group of fishermen in Tan Thanh emphasizes, that they see major future threats from untreated shrimp pond effluence discharged into the lagoon and specify that some chemicals used are toxic to fish (18:15). And a middleman in Ngoc Diem culturing grouper reports that shrimp pond effluence had killed all her fish (75:8).

These are not the only side effects of shrimp aquaculture. Of high significance is the fact, that before shrimp ponds were built, the land was common property but the government encouraged aquaculture and pond building and participants received legal land titles (20:11). Moreover, in the area of Tan Te some of the land was used for agriculture but salinization from neighboring ponds degraded the soil and the land was converted to shrimp ponds (21:4).

4.5.3 Lobster cage culture

Within the last 10 years lobster culture developed in Nha Phu Lagoon with the effect that livelihoods improved a lot (48:5; 48:7). However, lobster culture is restricted to two favorable areas, each counting about 100 lobster farmers (48:1; 70:10). Cat Loi is the

village foremost in lobster cage culture and many residents have jobs related to lobster culture (48:6).

The reasons why former fishermen engage in lobster culture are the expected profits and the fact that the government is encouraging aquaculture particularly illegal dragnet fishermen to change their jobs (58:7; 61:6; 65:25; 79:9).

The most striking consequence of lobster culture is its consumption of water surface, i.e. the lobster cage structures cover large areas and thus block boat passageways (26:2). At present, there is only limited space left suitable for lobster culture (26:2). In order to avoid further conflicts concerning the use of the water surface the Provincial People's Committee of Khanh Hoa has decided to divide the water surface of the surrounding waters in Cat Loi into sectors and hand out land titles to persons pursuing lobster culture (24:11). A discussion with people from Cat Loi about the coming law was charged with emotions (26:22). One person admitted that this is an appropriate way to go, others got very angry, because they fear that water space will be taken away from them (26:1). This suggests that the latter mentioned lobster culturists must occupy large areas today (26:1). The allocation of rights is ambiguous, i.e. it is not clear if the water surface will be divided equally among the residents from Cat Loi, as one angry man fears who is upset, that poor people without any money for investments will live from renting out their lots (26:3). On inquiry, he admits that poor people have little access to credit, land or water space (26:4). This example highlights the already discussed consequence of antisocial greed associated with rising incomes and lobster culture (cf. 48:8; 48:9; 48:10; 48:11).

Although lobster culturists also catch lobster fry with drilled coral blocks to supply themselves, their catch does not reach their requirements and hence they make additional purchases of lobster fry (26:16). The mortality of lobster seed is relatively high, e.g. one farmer reported that six from 10 lobsters die (59:2). As the main reason for the low quality of lobster seed lobster fry fishermen and lobster farmers identify light fishing, which is said to cause irreparable eye damage and weaken juvenile lobsters (82:6; 26:17; 51:4). Unfortunately the middlemen mix their healthy lobsters from drilled coral block fishing with weak ones caught by strong light lift net fishing so the customer has no choice (47:7; 59:2). In addition lobster farmers cannot purchase directly from lobster fry fishermen, because the latter borrow money from the middlemen with the obligation to sell their catch to them (82:7). The second reason identified affecting the vigor of the lobster fry is long transports applicable for lobster seed from different provinces (82:6).

A discussion among lobster culturists from Cat Loi dealt with the idea of introducing a brand that trades quality lobster fry from Cat Loi as a counterbalance to the three middlemen (59:4; 59:3). The underlying assumption was to guarantee, that lobster fry are only caught by drilled corals and are not mixed with fry caught by light fishing to assure healthy lobster seed and being able to sell them for a higher price (59:4). However, the respondents arrived at the conclusion that this cannot be realized, because the Vietnamese are very deceitful, an allusion that it is inherit in the Asian culture not to trust each other (59:4).

4.5.4 Devolution of Natural Resources Management: Community Action to Protect Fishery Resources

In an attempt to protect natural resources in Nha Phu Lagoon the example of Ha Lien Village demonstrates the formation of a community self-help organization to initiate natural resources management (97:2). A short historical retrospect recapitulates some of the effects of illegal fishing that lead to the establishment of the Fishery Resources Protection Group (*To bao ve*).

Soon after electric fishing was introduced to the village of Ha Lien seven years ago, 50 percent of the fishermen engaged in this new technique (55:6; 55:7). Strong social tension between traditional versus electric fishermen led to conflicts and fights within the community (55:8; 11:3; 78:3). This went so far, that the village leader could not move freely in his village anymore, because of the many arguments he would get into (55:8). Although no internal leadership was detectable and no external efforts reported, there was a shared understanding of the situation, as fishery resources declined and conflicts grew (STREHLOW and PETERS 2004,4; cf. 55:10). In 2002 collective action led the villagers to organize a village meeting where they agreed unanimously to ban electric fishing (16:5; 55:10). A self-help organization was formed, the Fishery Resources Protection Group (97:2). Later this group even got the authorization from the local government authorities (16:6; 54:19). Today 20 group members patrol and confiscate electric fishing equipment in the area (16:7; 55:4).

The outcome is remarkable. The number of electric fishermen in the area has declined significantly (54:19; 78:3). In the village of Ha Lien only two families using electric fishing equipment remain (11:5; 78:3). In addition, outsiders from other villages are punished and their equipment confiscated as well (16:7; 54:19; 55:4). Of course there have been fights and arguments, when electric fishing equipment is confiscated but the Fishery Resources Protection Group has staid persistent (55:5). In Ha Lien Village strong communal ties have formed and fish catches have stabilized (55:9;). Last but not least awareness among fishermen has developed which is expressed in (i) individual mangrove reforestation projects and (ii) discussions among fishermen about a ‘good code of practice in fishing’, e.g. adoption of minimum mesh sizes in order not to catch undersized fish (55:11; 16:9; 54:18; 54:16). A fisherman from Ha Lien expresses the former: *“Replanting would be very important to restore the environment for many generations later”* (54:15). Another fisherman from Ha Lien expresses the latter: *“The net size also needs to be right, so it catches the fish with the right size. Now they use any technique to catch fish of any size.”* (55:13).

4.6 Summary

In the previous case study I presented the findings of selected participatory methods applied in an integrated natural resources management context in a coastal fishery environment. The research location Nha Phu Lagoon has been introduced and its natural, cultural, political, institutional, and organizational environment of the fishery sector described. Further empirical findings of the NRM system are characterized concerning

stakeholders, resource management strategies, marketing, financing, decision-making, trends and consequences, and problems in the implementation of institutions.

Particular emphasis is paid to the comprehensive visualization of the multi-stakeholder system, community and government organizational levels, as well as the multitude of livelihood strategies and their combinations. Reasons for the degradation of coastal fishery resources were gathered during group discussions and then ranked by local resource-users during the questionnaire. Illegal fishing practices and shrimp culture especially its negative consequences, i.e. pollution and mangrove deforestation, considerably contribute to the degradation of coastal fishery resources. These reasons also offer good examples how national and local governments fail to enforce current fishery laws and regulations.

In conclusion I present the case of Ha Lien Village that establishes a self-help organization and succeeds in enforcing state law themselves.

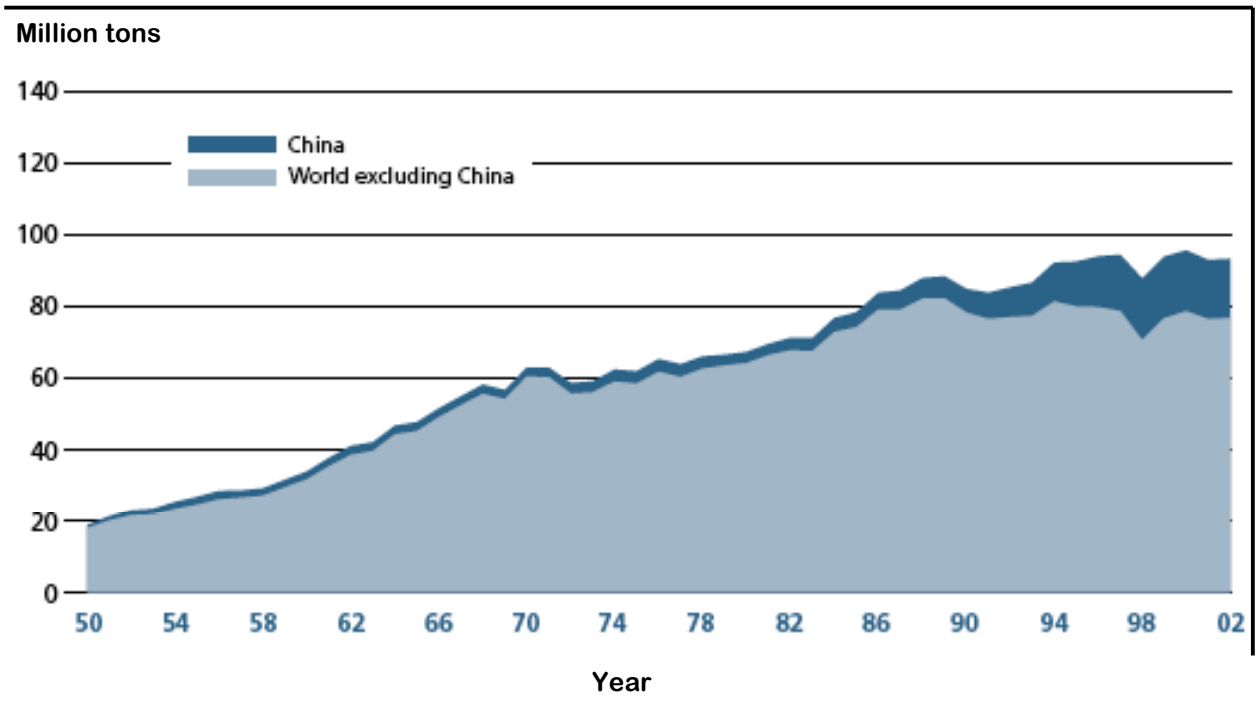
5. Managing Complexity Through Integrated Natural Resources Management

5.1 Excursus: Global Fisheries

5.1.1 Managing Fishery Resources

Global landings from marine capture fisheries in 2002 were 84.5 million tons (Figure 47) and remained relatively stable between the years 1999 until 2002[1] (FAO 2004,5). Global landings include nominal catches of fish, crustaceans, mollusks and other aquatic organisms. The annual statistics are based on reported national data from commercial, industrial and small-scale fisheries, carried out in coastal and high seas fishing areas. In the developing world nearshore fisheries contribute the largest share to total fishery production and are increasingly recognized as an intrinsic part of the livelihoods (cf. PAYNE 2000; POMEROY and WILLIAMS 1994; GREEN et al. 2003).

Figure 47. World capture fisheries production.



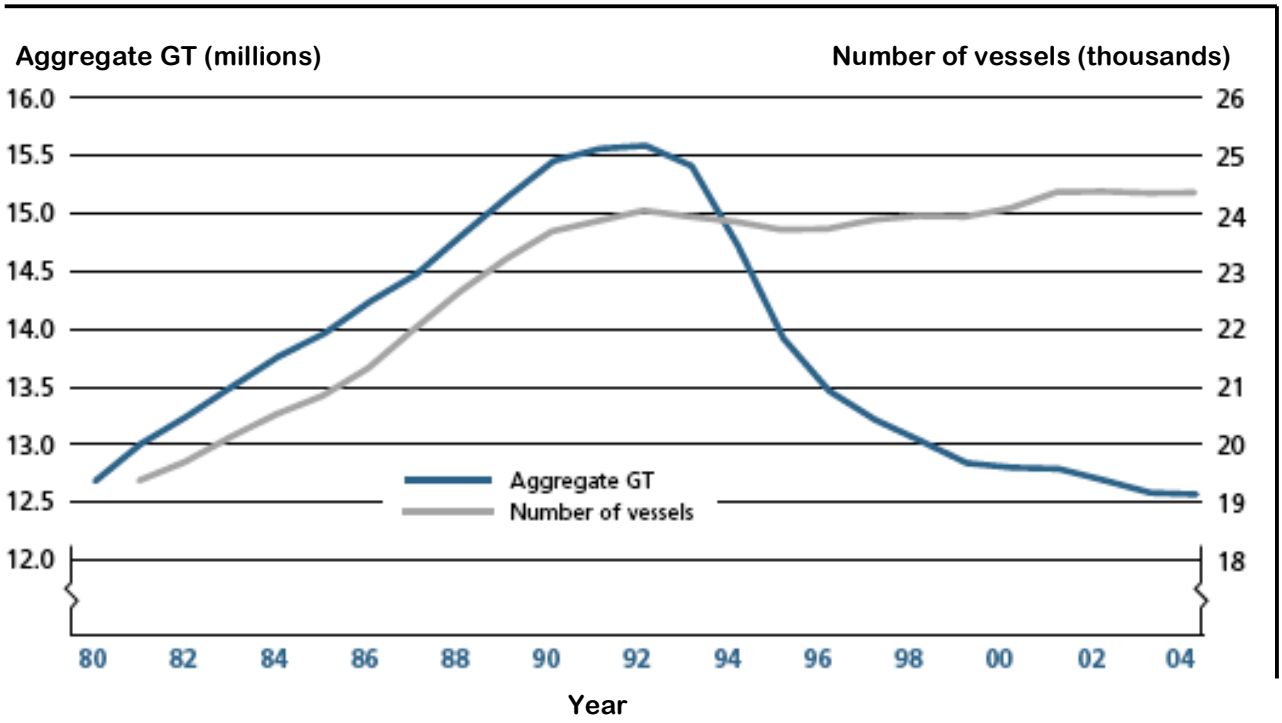
Source: FAO 2004,5

The rise of world marine fish catches coincided with the rapid growth of the commercial fishing fleets (Figure 48). . The vast majority of the world fishing fleet is concentrated in

[1] The discussion led by WATSON and PAULY (2001,534) about overestimates of China's marine capture fishery production between 1995-1999 and the resulting understating of the degradation of world fisheries and its consequences has been refuted by the FAO, which draws upon an analysis by GRAINGER and GARCIA from 1996. This analysis pictures a dramatic progression of overfishing since 1950 and thus confirms, *" (…) despite likely errors in the data sets, the main global trends have not been masked (…)"* (FAO 2002,3-4).

Asia with about 85 percent of total decked vessels, 50 percent of powered undecked vessels and 83 percent of unmotorized boats (FAO 2004,6). The aggregate gross tonnage (GT)[2] of fishing vessels above 100 gross tons increased to a peak of 15.6 million gross tonnage in 1992 and has subsequently declined (Figure 48). Yet, the number of these vessels increased gradually until 2001 and has remained relatively stable at around 24 000 vessels (Figure 48) in recent years (FAO 2004,24). However, in the meantime fishing technology advanced. New and modified fishing gears, electronic sonar and navigation equipment increased the efficiency of the fishing vessels (GREEN et al. 2003,4; FAO 2001,4).

Figure 48. Global fleet above 100 gross tonnage[3] recorded in Lloyd's Maritime Information Services database.



Source: FAO 2004,25

Between 1970 and 1995 the size of the world fishing fleet expanded by more than 400 percent, while fish catches increased by only 30 percent (GREEN et al. 2003,5). The overinvestment in the world's capture fisheries has led to more harvesting effort than is appropriate (WTO 2002,3). ARNASON (1998) compared several studies on the overcapitalization of world capture fisheries and its consequences. While the total value of world capture fishery harvests is fluctuating around 80 billion USD (GRAINGER 1999,21; FAO 2004,7; WTO 2002,3), an FAO study from 1993 estimated that global

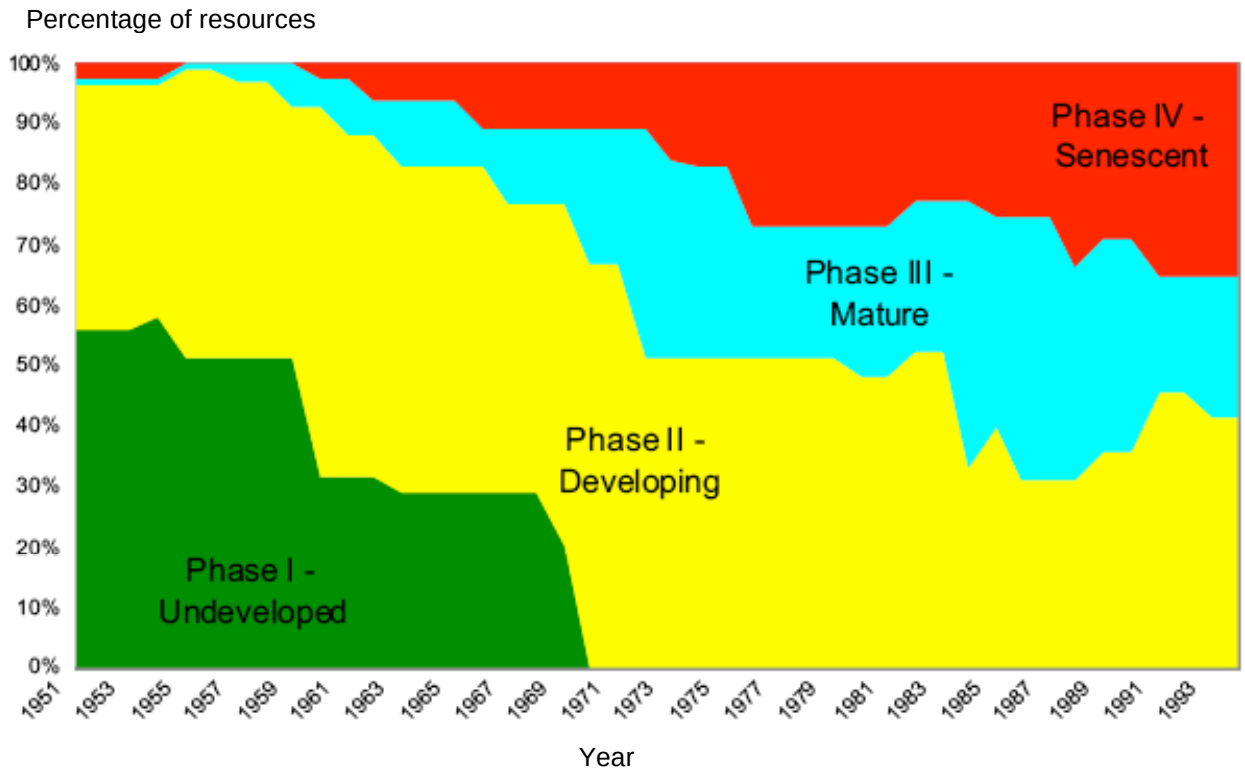
[2] The gross tonnage for ships of 24 meters in length and over refers to the volume of all ship's enclosed space (from keel to funnel) measured to the outside of the hull framing (FAO 1998).

[3] It should be noted that only a small proportion of the Chinese fleet vessels are included in the Lloyd's Maritime Information Services. Furthermore, changes in the measurement of tonnage, gross registered tonnage (GRT) to gross tonnage (GT), require caution in the interpretation of trends. (FAO 2004,24)

fisheries costs exceed revenues by 54.4 billion USD or 78 percent (FAO 1993, cited in ARNASON 1998,1). Direct or indirect subsidies that MILAZZO (1998, cited in ARNASON 1998,1) estimated at between 14 and 20 billion USD annually or 17 to 25 percent of industry's revenues has met the shortfall (cf. WTO 2002,3). Given the high level of subsidies in global capture fisheries it is not surprising that the fisheries are heavily overcapitalized (ARNASON 1998,2). As a result this excess capacity is exported to previously undesirable fishing grounds of many developing countries consequently causing overfishing and preventing a successful development of these countries' own fisheries (WTO 2002,3; FAO 1998). However, my incentive is not to engage in the ongoing debate about global marine capture fisheries subsidies but to draw attention to the resulting overfishing of fishery resources (cf. FAO 2004,128; GRAINGER 1999,23; FROESE and PAULY 2003,250).

A study undertaken by the FAO in 1996 based the world's 200 most important fishery resources in terms of landings and grouped them into a few families to identify the stages of fishery development (GRAINGER and GARCIA 1996). The results shown for 1994 indicated that about 35 percent of the 200 major fishery resources were senescent, about 25 percent mature, 40 percent were still developing, and zero percent remained at low exploitation level (Figure 49). In other words 60 percent of the major world fish resources were categorized as either mature or senescent and the authors proposed that urgent need of management action was required to halt the increase in fishing effort or rehabilitate overexploited resources (GRAINGER and GARCIA 1996; GRAINGER 1999,23).

Figure 49. Major marine fish stocks in various phases of fishery development.



Source: GRAINGER 1999,23

A more recent study from the FAO (2004,32) estimated that in 2003 three percent of the stocks monitored were underexploited and 21 percent moderately exploited (Figure 50). About half of the stocks, namely 52 percent, were fully exploited i.e. producing catches close to their maximum sustainable limits (Figure 50). Further, 10 percent of stocks were overexploited, seven percent depleted, and one percent of stocks were recovering from depletion and needed rebuilding (Figure 50).

Figure 50. Level of exploitation of world's main fish stocks.

Source: FAO 2004,32

Several forms of overfishing exist and have been described in the literature (PAULY, SAEGER and PREIN 1998; PAULY, SILVESTRE and SMITH 1989; GREEN et al. 2003). The authors commonly use the Philippines to exemplify the nature of overfishing and its causes, since the once outstanding and productive marine ecosystem of the Philippines shows severe signs of overfishing nowadays (GREEN et al. 2003,6).

- Growth overfishing is the case, if the fish caught in fisheries simply did not have the time to grow to bigger size (PAULY, SAEGER and PREIN 1998,17). This somewhat mildest form of overfishing began to occur in some northern European fishing grounds and today is common in most fisheries worldwide yet is of particular importance in the marine capture fisheries of the Southeast Asian region (PAULY, SAEGER and PREIN 1998,17; PAULY, SILVESTRE and SMITH 1989,310). Although growth overfishing can be remedied by fishery management, e.g. through the introduction of minimum mesh sizes for fishing gears, it is difficult to appoint an appropriate mesh size in multispecies fisheries that utilizes all species at their biologically optimum range (PAULY, SAEGER and PREIN 1998,17; PAULY, SILVESTRE and SMITH 1989,310). The Southeast Asian coastal trawl fishery is a typical example for a multispecies situation, whereby 30 to 50 species usually

dominate the landings (PAULY, SILVESTRE and SMITH 1989,310). These species vary in size from very small (shrimp) to very big (sharks, rays). The common use of mesh sizes of 2.0 centimeters and less in these regions just as in Nha Phu Lagoon thus leads to considerable growth overfishing (PAULY, SILVESTRE and SMITH 1989,310). PAULY, SAEGER and PREIN (1998,18) point out that the current statutory mesh size of 3.0 centimeters in the Philippines needs to be raised to at least 4.0 to 5.0 centimeters to maximize yields.

- Recruitment overfishing is the next step in overfishing and describes the phenomenon when the spawning stock is reduced to a point that it only produces limited numbers of eggs and thus recruits (PAULY, SILVESTRE and SMITH 1989,315). Since a majority of the fish caught in a fishery showing recruitment overfishing are juvenile, as most of the adult fish have already been caught, the remaining fish are smaller, earlier maturing and less productive leading to the eventual depletion of the stock (GREEN et al. 2003,22).
- Ecosystem overfishing characterizes a situation where intensive fishing leads to an ecological imbalance, so that some species increase but fail to replace the depleted ones (PAULY, SAEGER and PREIN 1998,18). Basically, an increased part of the ecological production goes into side branches of the marine food web, e.g. into benthic invertebrates (squid, shrimp) or into large, inedible zooplankton such as jellyfish (PAULY, SAEGER and PREIN 1998,18). General indices of ecosystem overfishing in tropical regions are:
  - Increased abundance of squid, shrimp and triggerfish
  - Above-average decline of grouper and related species
  - Disappearance of sharks and rays (PAULY, SAEGER and PREIN 1998,18)

  This process of changes in the faunal composition associated with increased fishing pressure has also been described in PAULY et al.'s (1998) *"Fishing Down Marine Food Webs"*.
- Malthusian overfishing occurs when poor fishermen facing declining catches and lacking alternative livelihood strategies use illegal and destructive fishing gear (small mesh size, dynamite, cyanide) to improve their catch (PAULY, SILVESTRE and SMITH 1989,315). This form of overfishing is often misunderstood by administrators and fishery scientists, since it only produces short term benefits, yet critics overlook that it is the logical result of declining catches and that it can only be tackled by providing alternative income strategies in the non-fishery sector (PAULY, SILVESTRE and SMITH 1989,323; PAULY, SAEGER and PREIN 1998,18).
- Economic overfishing is referred to when fishery expenses are higher than the anticipated maximum economic yield (MEY) (PAULY, SAEGER and PREIN 1998,18). Note that this optimum level of effort is lower than that which produces maximum sustainable yield (MSY) (PAULY, SILVESTRE and SMITH 1989,320). Based on the Philippine studies PAULY, SAEGER and PREIN (1998,18) estimate that effort levels in demersal and small pelagic fisheries are three times that, which would generate maximum sustainable yield. The implied dissipation in the form of excessive operating costs is estimated to be about 100 to 160 million USD annually

for demersal fish and about 300 million USD per annum for small pelagic fish (PAULY, SAEGER and PREIN 1998,18).

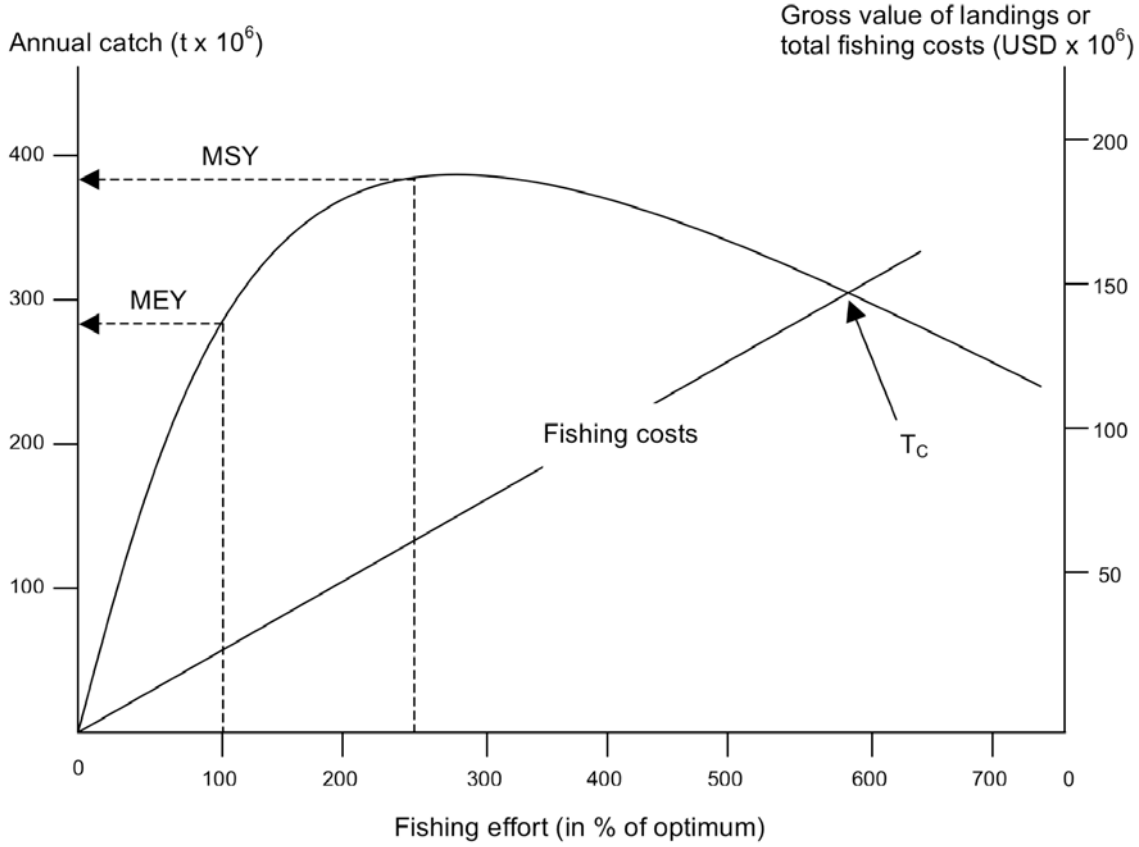
In order to meet overfishing fishery management offers several approaches. The most common terms and concepts used in fishery management are:

Maximum sustainable yield, MSY is the largest long-term average catch (yield) that can be continuously taken from a stock without affecting significantly the reproduction process, i.e. threatening the existence of the population (FAO). Maximum sustainable yield is the classical sustainability indicator in fisheries management with the longest history (DEGNBOL 2001,10). Maximum sustainable yield itself is no indicator of the state of the stocks or the sustainability of the fisheries and must be used in combination with a fishing effort indicator or fishing mortality to make sense (DEGNBOL 2001,10). The concept of maximum sustainable yield is subject to broad discussion and critique in fisheries biology partly because of the following shortcomings:

- In practice no data exist that estimate the maximum of the yield curve especially beyond maximum sustainable yield and with standardized effort measure (DEGNBOL 2001,11).
- Another problem of the concept, if used as a single indicator, is that exploitation and recruitment are decoupled and the term 'sustainability' implies that the stock remains at maximum sustainable yield and exploitation is sufficient to maintain reproduction, although the model does not acquire knowledge concerning the spawning stock (DEGNBOL 2001,11).

To a certain extent the shortcomings have been met by replacing the former surplus production model from SCHAEFER (1954) a logistic growth curve underlying the dynamics of the yield curve with an age structured population model following BEVERTON and HOLT (1957) fisheries biology (DEGNBOL 2001,10). However, data requirements for the latter are much higher, which is why this model found little application in tropical fisheries (PAULY, SILVESTRE and SMITH 1989,315). For better understanding I draw on the model of SCHAEFER (1954) as described by PAULY, SAEGER and PREIN (1998,17) that depicts in the form of a parable the effort and catch of a fishery (Figure 51). From the starting point of the coordinates (no effort = no catch) the curve rises rapidly and reaches a maximum that describes the maximum sustainable yield (Figure 51). Any further increases in effort decreases the catch, until the stock of fish eventually becomes extinct. From an economic point of view it would be best to maximize the resource rent, i.e. to approach the maximum sustainable yield until there is no increment in catch associated with an increment in effort. This point is called maximum economic yield (MEY) see Figure 51. For fishermen these concepts are of little relevance, since their incentive is their own catch which is supposed to be of more value than the associated fishing costs. To understand the behavior of fishermen it is necessary to look at total catches and total costs of effort. This factor can be depicted in a simple line (fishing effort = costs in monetary units) that crosses the yield curve in the point T_C (Figure 51).

Figure 51. The Schaefer model of the Philippine demersal fisheries.



Source: modified and adopted from PAULY, SAEGER and PREIN (1998,18)

It should be noted that yield levels around the point T_C also occur to the left of the yield curve, i.e. the quantity of fish caught in a situation involving overfishing can also be caught with considerably less fishing effort, less fishermen or boats, and at less expense (KONSTAPEL and NOORT 1995,16).

Catch per unit of effort, CPUE is the amount of catch that is taken per unit of fishing effort, e.g. weight of fish in tons taken per hour of trawling (FAO). Catch per unit of effort is often used as a measure of the economic efficiency of fishing gear as well as an index of fish abundance (FAO). Generally, a decline in catch per unit of effort against a background of stagnating catches implies overfishing and most likely overcapacity (FAO 2004,121). However, one needs to be careful using decline of catch rates as a direct indication of overfishing, since this would assume that fish stock and fishery are randomly and spatial distributed which is the exception rather than the rule (DEGNBOL 2001,12). In addition constant catchability of the fishery is also the exception due to the development in fishery technology (DEGNBOL 2001,12). Hence, this indicator of abundance itself is not sufficient to identify the reference points of fishery management (DEGNBOL 2001,12; FAO 2004,121).

Total allowable catch, TAC is the quantity of fish that can be taken from each stock annually (FAO). The total allowable catch is usually allocated among resource users in the form of quotas. The management of fisheries resources by

limiting catches through the imposition of catch quotas (TACs) has a long history (MORGAN 1997). Nevertheless, several of the fisheries managed by catch quotas experienced declines or collapses at some point (MORGAN 1997). One of the reasons is that discards (the unintended catch of non-target species which are returned to the sea) are not included in the total allowable catch, even though, depending on the type of fishery, discard rates can reach over 80 percent of the total landings (FAO 2004,34,121,123,127). In the North Atlantic the International Council for the Exploration of the Sea (ICES) advises the 19 member countries to set the total allowable catch of fish stocks. Despite the proposals from the International Council for the Exploration of the Sea fishing quotas are decided on the basis of political considerations and largely ignore scientific advice typically legalizing catches beyond sustainable levels (FROESE 2004,87).

5.1.2 Limitations of Fishery Management: Discussion and Further Implications

Overfishing affects fish populations in different ways. In general the so called 'fishing down marine food webs' describes the process of fishing down trophic levels, i.e. from high trophic level piscivorous fish to low trophic level planktivorous fish and invertebrates (PAULY et al. 1998,860). The initial ecosystem reaction may be a release from predation leading to increased catches (PAULY et al. 2002,691). Although this effect has rarely been observed in marine ecosystems scientists argue that smaller fish grow faster and increase the overall fish biomass (PAULY et al. 2002,691). The next step are stagnating or declining catches (PAULY et al. 1998,860). A comprehensive study by MYERS and WORM (2003,282) revealed that industrialized fisheries reduced community biomass of large predatory fish by 80 percent within 15 years of exploitation. However, the observed compensatory increase in fast-growing species often reversed within a decade ultimately leading to a collapse in all species groups (MYERS and WORM 2003,282). MYERS and WORM (2003,282) estimate that large predatory fish biomass today is only about 10 percent of pre-industrial levels. In other words the global fishery has lost more than 90 percent of large predatory fish. Overall, this has implications for fisheries management since the fishery-induced reduction of fish biomass supports only low economic yields and more important risks the extinction of populations (MYERS and WORM 2003,282; cf. PAULY et al. 2002,691).

In his chapter: *"Global Trends in Fisheries and Aquaculture"* GRAINGER (1999,23) from the FAO claims that national and international fisheries management has generally failed to protect resources from being overexploited. And FROESE and PAULY (2003,252) notice that the fish stocks in the Northeast Atlantic and the North Sea studied best are the ones most heavily overfished, although prevailing management and monitoring institutions are the strongest in the world. Both sources attribute this failure to the institutions in fisheries management and consider all other factors secondary in importance. GRAINGER (1999,24) continues that if the opportunity to improve fishery management is lost, there could be a shortfall of food fish between demand and supply for human consumption despite increased aquaculture production. However, this scenario is most unlikely since recent studies confirm that the sum of national forecasts to expand aquaculture production is

likely to be compatible with projected increases in the demand for food fish (FAO 2004,107-115). Other risks GRAINGER (1999,24) associates with not improving management are that abrupt resource decline might cause major socio-economic damage. This scenario is not unlikely to occur and has been impressively demonstrated in the rise and fall of the Canadian cod fishery at the Grand Banks (cf. HARRIS 1998). In addition GRAINGER (1999,24) sees threats in the loss of traditional fishing rights to other sectors such as conservation, tourism, oil industry, and other coastal activities (cf. LOZÁN et al. 2003,22-24).

FROESE and PAULY (2003,255) specify, that the reason for the failure of fishery management lies in the inability to control fishing capacity and to prevent fishermen to fish fragile habitats (spawning grounds). More precisely, this may be due to current methods of regulation such as mesh size and fishing quotas that are unintelligible and neither can be controlled by fishermen nor by the public (FROESE and PAULY 2003,255). In a more recent publication FROESE (2004,87) argues that over the past 100 years fisheries research *"(…) has developed increasingly complex stock assessment models that are incomprehensible to but a few experts"*. He continues, that the complexity of fishery models has made it impossible for outsiders to involve themselves in fisheries issues yet influence the responsible use of aquatic resources.

The ongoing debate about the failure of fisheries management in marine capture fisheries and the suggested measures to overcome some of the presented maladies is long: Ecosystem-based fisheries management, overcapacity reduction of global fishing fleets, the establishment of a 'no discards' policy or at least the use of discard estimates in stock assessments, and the reduction of international subsidies to the fishery sector are only a few of the major solutions in fishery literature (FAO 2004,118-137; FAO 2001,10; WTO 2002,4; LOZÁN et al. 2003,29-31). FROESE and PAULY (2003,255) suggest to harvest fish at optimum length L_{opt} which is typically beyond the length at first maturity to ensure that fish spawn at least once before capture. Although these suggestions seem obvious, an analysis of cod stock from the western Channel area between 1994 and 2001 showed that only 20 to 54 percent of the fish in the annual catch were mature, i.e. every year about two-thirds of the cod stock were excluded from reproduction (FROESE 2004,87). However, to avoid recruitment failure and ensure sustainable catches large specimen should account for 30 to 40 percent of the fish stock and represent a healthy age structure (FROESE 2004,88; FROESE and PAULY 2003,256). These so called *"mega-spawners"* play several roles in the long-term survival of a population: (1) large females are much more fecund compared to young specimen, because they produce more and larger eggs, distribute their eggs better spatial and temporal, and produce larvae with a greater chance of survival; (2) large specimens are reservoirs and distributors of desirable genes, since reaching old age is an indication of overall individual fitness; and (3) a natural age structure prolongs the reproductive phase and is a safeguard against occasional recruitment failure (FROESE 2004,88; FROESE and PAULY 2003,256). Although no upper size limits exist for any commercial species in the ICES area, FROESE (2004,89) refutes critics that state it is not possible to catch only fish of a certain size class but argues that most commercial fish show clear patterns of spatial and temporal distribution by size group. With regard to FROESE and PAULY (2003,256) who suggest the establishment of 'no take' zones or marine protected areas as a second management tool to protect fragile habitats (spawning grounds) and ensure the protection of juveniles, this measure

complements very well with FROESE'S (2004,87) objective: *"Let the mega-spawners live"*! Practically, FROESE and PAULY (2003,257) visualize that fishing boats are equipped with *"black boxes"* that constantly transmit their positions to a supervisory board that observes the 'no-take' zones. Froese (2004,86) also offers three simple indicators for the proposed management regime:

> *"(i) percentage of mature fish in catch, with 100% as target; (ii) percent of specimens with optimum length in catch, with 100% as target; and (iii) percentage of 'mega-spawners' in catch, with 0% as target, and 30-40% as representative of reasonable stock structure if no upper size limit exists"*.

He and Pauly argues, that such simple indicators have the potential to allow anybody to participate in fisheries management such as fishermen, wholesalers, retailers, supermarkets, restaurants, and consumers. Their idea is to use posters to depict commercial fish and their respective size at first maturity to allow consumers to judge if fish had a chance to spawn (FROESE and PAULY 2003,257). Just like a grocery shopper that buys organic vegetable or free-range chicken this would enable him to add sustainable seafood[4] to that list.

Although the submitted fishery management approaches offer strategies how to deal with overfishing, it is difficult to transfer these recommendations to the coastal fishery in Nha Phu Lagoon. In a further argument critics may question the cause of declining catches, i.e. making environmental pollution and ecosystem changes responsible and not the local fishery. Environmental pollution and the degradation of the coastal ecosystem certainly play a role in the degradation of coastal fishery resources in Nha Phu Lagoon. However, evidence from local fishing practices and the self-critical ascertainment of fishermen who perceived their own actions unsustainable highlight the overexploitation of marine resources. PAULY et al. (2002,690) demonstrate that global fisheries have an incentive to attribute the collapse of fishery stocks to environmental effects since it allows business to continue as usual. Above all the total allowable catch in the coastal waters of Vietnam is estimated between 580 000 and 600 000 tons of which 1 010 890 tons were exploited in 2003, roughly 1.7 times more than the total allowable catch (RUANGSIVAKUL and SIRIRAKSOPHON 2002,5; DANG NGOC THANH 1995,79; FAO/MOFI 2005b). Presumably the national trend of overfishing in coastal areas is also prevalent in Nha Phu Lagoon.

Up to now fishery management has largely neglected the extent and effect of fishing (trawling) on habitat structure in marine ecosystems (TURNER et al. 1999,402). A fisherman in Nha Phu Lagoon even believes that trawling has a beneficial impact on the sea bottom by 'ploughing' it like a farmer preparing his field (79:9). PAULY et al. (2002,691) show *"(…) that the ploughing analogy is inappropriate and that if an analogy is required, it should be that of clear cutting forests in the course of hunting deer"*. HALL (1998, cited in PAULY et al. 2002,691) demonstrates that bottom trawling seriously impacts the benthic organisms at the base of the food webs leading to food fish. TURNER et al. (1999,404) describe the impact of bottom trawling on habitat heterogeneity and its degradation and loss with the consequence of impeding larvae recruiting and increasing the recovery time for biological communities. The authors plead that fishery management needs to minimize the direct and indirect impacts of fishing on the marine ecosystem and

[4] The website www.seafoodchoices.com is such an example, that allows viewers to compare seafood recommendations of several different organizations.

also needs the understanding that protection and habitat restoration should be seen as components of an integrated program of coastal zone and fishery management (TURNER et al. 1999,401).

In the context of small-scale fisheries management such as in Nha Phu Lagoon there is no simple management solution, since every community has different conditions, processes, needs and demands (POMEROY and WILLIAMS 1994,iv). This principle may also be transferred to a global level, i.e. region or nation. Especially for the case of multispecies tropical fisheries POMEROY and WILLIAMS (1994,3) see little applicability of the temperate scientific models but rather *"the main focus of fisheries management should be people, not fish per se"*. Bearing in mind what has been said about the failure of global fisheries management the consequence is evident. But how can we ever hope to address the sustainable management of the many fishery resources? New approaches off the beaten track of stock assessment may help in sustaining these resources. One of the answers to this question is community-management (co-management) or sometimes termed community-based resource management (CBRM) (POMEROY and WILLIAMS 1994,iv; BERKES, FAST and BERKES 1996,2). Then again, successful conditions for co-management are:

- clearly defined boundaries;
- restricted number of fishers or households;
- a high degree of homogeneity among resource users;
- existing strong fishers' organizations;
- high participation by those affected to ensure that management rules are enforced;
- high degree of authority given to the organizations from the government;
- existing tradition of cooperation and leadership at community level; devolution of management responsibility and/or authority to local levels and;
- coordination between government and community (POMEROY and WILLIAMS 1994,12; BERKES, FAST and BERKES 1996,8).

Yet, the multi-stakeholder system of resource users in Nha Phu Lagoon with its different sectors constitutes a very different situation and features conditions that nearly resemble the opposite, such as:

- nearshore and offshore fishing boundaries extend outside the lagoon to distant fishing grounds;
- the number of fishermen that fish in the lagoon is not restricted to the residents but augmented by numerous outsiders;
- various fishing gear type and livelihood strategies result in a high degree of heterogeneity of the 'community';
- the only form of fishery cooperation, the Fishermen's Union has virtually disappeared and plays no role in lives of the fishermen;
- the concept of participation including fishermen in the management process is only just emerging in Vietnam and is evident in the high incidence of illegal fishing;

- authority lies at higher levels, although the example of Ha Lien Village marks a beginning;
- cooperative structures bear negative associations, since production cooperatives were set up in the past by the socialist plan economy;
- cooperation between government and community does not reflect representatives from fishermen but communist party cadres.

Thus, the ultimate answer to the question was to address the coastal fishery environment of Nha Phu Lagoon with a natural resource management concept that (1) integrates among different stakeholders, levels, sectors, and problems (2) ensures that fishermen become partners in decision-making, and (3) that assures mutually established management regulations will be followed by all.

5.2 Critical Assessment of Integrated Natural Resources Management

Before discussing practical issues in the application of integrated natural resources management the question arises, if the shortcomings of the 'conventional research approaches' are met by integrated natural resources management or not. To answer this question I compare my own experience with the theoretical contemplations in Chapter 2.

5.2.1 The Context in Goal-Oriented Research

The goal to eradicate poverty through the sustainable use of natural resources has been one of the driving forces behind the development of integrated natural resources management (CAMPBELL and HAGMANN 2003,1; CGIAR 2003,3). Yet, integrated natural resources management is still in its infancy and the call to eradicate poverty has somewhat been redeemed by the call for methodological development and to justify this new research approach (CAMPBELL and HAGMANN 2003,18; PROBST and HAGMANN 2003,12). Although this course of action taken in the integrated natural resources management literature is certainly necessary, it is vitally important not to repeat the mistake to focus solely on research development and neglect impact, i.e. poverty eradication. There is a great risk that integrated natural resources management research focuses too much on methodological and theoretical issues to become recognized in the scientific world instead of producing relevant results in the real world. This risk is reflected in CORNWALL and BROCK'S (2005,iii) stance who contend, that the use of 'buzzwords' *"(…) in development policy may offer little hope of the world free of poverty (…)"*. The justification of its relevancy to solve today's problems in sustainable resource management comes from successful examples that mirror poverty reduction, stable ecosystems and/or confident and creative resource users experimenting with alternative livelihood strategies only to name a few.

In a meta-evaluation of the CGIAR by GARRITY (2003,6) he admits that natural resources management research within the CGIAR has made significant contributions in training scientists from national agricultural research systems (NARS) and developing NARS institutional capacity. However, he notices that resource-oriented centers may be doing

more and better work in integrated natural resources management. He further accentuates that although natural resources management research has attracted increasing interests and resources over the past decade, the CGIAR has not focused on the topics and functions where it can make tangible contributions such as sustainable agricultural productivity increases, improving livelihoods and reducing the vulnerability of the poor. And while VOSS (2003,5) still focuses on the challenge how to bring reductionists and system thinkers together, he also admits that impacts of integrated natural resources management on income and poverty are rarely documented. In congruence with the meta-evaluation impact assessment of integrated natural resources management is becoming increasingly prioritized a reasonable demand of donors (GARRITY 2003,6; VOSS 2003,5).

However research on natural resource systems and its management is highly complex and places high demands on the quality of applied research methods. Furthermore the complexity does not reveal itself right from the start but becomes evident during the research process. To be scientific meaningful a high degree of conceptual preparation is necessary. The ongoing debates about interdisciplinarity versus monodisciplinarity and qualitative versus quantitative research approaches reflect these issues and are widely dispersed in the literature (cf. STRAUSS and CORBIN 1996; GLASER 1992; GREENE 1997; MAYRING 2001; BURZAN 2004; CRESWELL 1994; BITSCH 2000). The same discussions but on a less aggregated level exist in the integrated natural resources management literature (cf. PROBST and HAGMANN 2003). Thereby integrated natural resources management provides the concept for the wider research framework and participatory action research represents the method of inquiry. Participatory action research is a well-established and credible research approach. The relevant action research literature is rather old but has lost no relevance compared to modern times and offers concepts, examples and discussions that allow the reader to take action (cf. RAPOPORT 1970; SUSMAN and EVERED 1978; CALDER, PHILLIPS and TYBOUT 1981; BROWN and TANDON 1983). However as mentioned before the high degree of complexity places a high demand on participatory action research, which has also never been applied in a coastal fishery environment. Understanding complexity in action-oriented integrated natural resources management means to explore the system from the perspective of fishermen (cf. HAGMANN et al. 2002). Thereby the conceptual elements offered by integrated natural resources management such as the constructivist paradigm, adaptive management, the sustainable livelihoods framework, and integration as central concept provide useful guidelines for the pursued method of action research learning cycles.

5.2.2 Impacts of Applied Research Methods in Integrated Natural Resources Management

CHECKLAND (1981,288) characterizes natural resource systems, *"in which objectives are hard to define, decision-taking is uncertain, measures of performance are at best qualitative and human behaviour is irrational"*. Therefore selecting indicators for impact assessment is not simple. CAMPBELL et al. (2000) propose an approach based on the sustainable livelihood framework and its five types of capital assets: physical, financial, social, natural, and human. For each capital asset a number of principles is proposed, e.g. natural capital: (1) options for future use are maintained and (2) yield and quality of

natural resources is maintained or improved. For each of the principles indicators will need to be selected. Meaningful indicator sets will have to be quite large given the complexity of the natural resource system. However, many outcomes may not be covered by the monitoring system because they are not expected (PACHICO et al. 1999, cited in CAMPBELL et al. 2000). CAMPBELL et al. (2000) advocate an approach to impact assessment that is part of a learning process integrated into the integrated natural resources management learning cycle. This implies the need for constant iteration between research practice and research evaluation, the use of many qualitative indicators, simulation modeling to address uncertainty and numerous external influences on integrated natural resources management systems, and bounding the system through developing a conceptual framework (CAMPBELL et al. 2000). The authors point out that most of these activities have already been carried out in the course of doing the research. To answer the question which indicators can be combined to give an integrative assessment of the performance of an integrated natural resources management system, various tools are suggested: (1) a simple additive index, (2) the use of radar diagrams and (3) multivariate techniques (CAMPBELL et al. 2000).

In their 10 years of practical experience in integrated natural resources management in Zimbabwe HAGMANN et al. (2000,18) emphasize a shift from conventional understanding of 'impact' to performance, quality and strategy monitoring and assessment. As performance indicator they highlight empathy, confidence, self-esteem, creativity, values, and social energy that create adaptive capacity. And this *"(…) capacity to learn and reflect and re-adapt the strategy and action is the process impact to be achieved"* (HAGMANN et al. 2000,18). But how did Hagmann et al. reach this assertion? During a mid-term evaluation the reviewers came to the conclusion that fortunately Hagmann and his colleagues had not followed what they had set out to do (HAGMANN et al. 2000,17). Instead they had done a successful and innovative job by responding to unforeseen opportunities and thus had generated substantial impact (HAGMANN et al. 2000,17). In the same evaluation, the reviewers recognized, that the human and emotional capital of farmers was the strongest factor in finding solutions to their problems (HAGMANN et al. 2000,17). Thereby good process documentation not only helped external project evaluators by making decisions transparent but was central for Hagmann's team own learning as well as for demonstrating the quality of process impact (HAGMANN et al. 2000,17).

Similar to the experience of Hagmann et al. (2000,17) the most evident impact in this study was in the human asset base. Although not fully comparable since the study only marked the beginning of a possible development project, I ascribe the awareness building among participants to the integrated natural resources management learning cycle. The mediation and facilitation processes and especially the repetition of the 'learning cycle', i.e. the sharing of research findings with participants lead to deep self-reflection among participants. Consequently in the beginning of the field research resource-users had no or little opinion about the degradation of resources their livelihoods depend on. Later in the research process local people not only took a stand but also were developing ideas and debating with others how to manage the coastal resources in a more sustainable way. Reflecting on their daily lives encouraged people to stop and think and the set of ideas ranging from biological-technical to institutional-organizational demonstrated their willingness and ingenuity to change things.

5.2.3 Specific Lessons Learned

The following chapter is concerned with **implementation challenges** of integrated natural resource management research. In general I had the impression that integrated natural resources management is widely accepted. Yet, my intention to include other scientists in the research process was characterized by experiencing how mono-disciplinary scholarship is. This had strong implications, since I had to cover the entire bandwidth of the agro-ecosystem Nha Phu Lagoon and its socio-economic environment myself. Hence, a team approach to integrated natural resources management is essential. This work was only possible through collaboration with strong research partners, which expertise could be tapped regarding fisheries management through the WorldFish Center on Penang, Malaysia, aquaculture, through the Research Institute for Aquaculture No. 3 in Nha Trang, Vietnam, and through the University of Fisheries also in Nha Trang, Vietnam, which specialized in the socio-political aspects of the coastal fishery sector and participatory methodologies used in a coastal fishery environment.

After moving quickly into the field to explore the system from within and before developing preconceived ideas, hypotheses and develop bias, I was quickly confronted with the day-to-day problems of fishermen and other community members. Sticking to what I had read about integrated natural resources management, process facilitation and mediation I encountered several organizational problems associated with this research approach and procedure. Mobilizing rural communities in critical self-reflection and developing options to engage in natural resource management is not exactly along the lines of a Communist country like Vietnam. Some village leaders demanded special permissions and those villages had to be avoided until I had acquired all of the relevant documents for my work.

After a long explorative research phase learning more about the multiple stakeholders, system levels, institutional and organizational issues, the next step was to feed back this information to the communities, policy makers and government officials. This was no easy step. Not only because of the unexpected outcome and reactions I was going to encounter but also because of the locations this was going to take place. My preference was to organize workshops and to invite representatives from each of the interest groups mentioned before. However due to financial, personal and temporal limitations I arranged group meetings and visited government officials personally.

Yet, the biggest challenge in the implementation of integrated natural resources management on site was drawing the lines between research and client orientation, the demarcation between personal and public interests, i.e. delivering relevant research results versus impact and process results at local level.

DENZIN and LINCOLN (1998,3) describe the qualitative researcher and the multiple methodologies of qualitative research as bricoleur respectively as bricolage, i.e. a "*professional do-it-yourself person*" (LÉVI-STRAUSS 1966,17) that produces a construction by using whatever comes to hand or as WEINSTEIN and WEINSTEIN (1991,161) put it, *"a pieced-together, close-knit set of practices that provide solutions to a problem in a concrete situation, …and is an [emergent] construction"*. Applying what has been said, this means that the researcher involved needs to be adept at performing a large number of diverse tasks ranging from participant data inquiry to mediation and facilitation, to self-reflection and knowledge about the multiple paradigms (cf. DENZIN

and LINCOLN 1998,4). This approach adds complexity to the research design and demands a great deal from the researcher, as he or she usually is less familiar with either qualitative or quantitative paradigms (CRESWELL 1994,178).

The **attitude, motivation and ability** of the researcher to focus on the social environment of the resource system seem vital to achieve both relevant research results and local impact. Thereby it is not only core competencies like facilitation as HAGMANN et al. (2000,20) stress or the types of participation as described by PROBST and HAGMANN (2003,6) to steer the integrated natural resources management process. First and foremost I see the attitude of the researcher as the most compelling factor for successful learning and participation within the integrated natural resources management research process. Especially from a natural science perspective associated with fishery management RAPOPORT'S (1970,499) statement directed towards social scientists that see *"(…) clients with a problem to be solved"* has not lost much of its relevance today. During many lectures and discussions I recognized that the attitudes of most scientists and students would not allow them to abandon linear research and one-way thinking as suggested by BATIONO, LOMPO and KOALA (1998,33). Although this general shortcoming is met by integrated natural resources management, the scientists attitude and way of thinking is much more crucial to focus on the underlying reasons for adoption and non-adoption of technologies and innovations.

The motivation of the scientist is another factor in establishing a participatory learning cycle in the research project. An honest interest in the natural resource system is not enough but must encompass the resource users and their lives. Only open interest will convince participants to establish relationships with the researcher and engage in a learning cycle together. In this context HAGMANN et al. (2000,20) talk of researchers that engage themselves emotionally in the research process to fully understand the dimensions and be able to contribute effectively. Thereby the motivation of the researcher might need to be transferred to some of the participants to initiate the process.

Last but not least the ability of the researcher to engage in such a research process is not to be underestimated. First of all there is the ability to engage in a research process with no clear beginning and end; without any research hypotheses and objectives; and a constantly changing research setting. The latter means adapting to a constantly broadening natural resource system with unfolding facets that need to be addressed spontaneously and in an iterative manner. This demands a lot of improvisation talent from the researcher to bring uncertain processes to a successful ending. Second of all there is the ability to separate the ideals of research from the methodology of research and not to fall into the *"idealist trap"* as described by SWEPSON (1998,1-2). RAPOPORT (1970, 507-509) calls this a goal dilemma and tries to answer the question how an action researcher can deliver scientifically accepted research results and provide something to the client system without getting over-involved or evoke a defensive reaction. This question reflects very well a situation I experienced many times during my field study, i.e. not to get lost in the whole and assimilate with the studied fishermen and their situation but to focus on the research process, the applied methodologies and the desired outputs. This point cannot be emphasized enough, because integrated natural resources management research goes beyond participatory methods, and on one hand the scientist might find himself identifying with the day to day problems of the researched but on the other hand he might

lose track of his research and fail to achieve his research objectives. Needless to add that any other researcher might experience the opposite extreme namely the *"rejection phenomenon"* of research clients (cf. RAPOPORT 1970, 509). That means the researcher might live up to scientific standards but fails to grasp the client system he is studying since the clients themselves reject him.

Conflicts and negotiation define the processes of the integrated natural resources management learning cycle. Many times the topics raised during group discussions evoked issues that lead to heated debates among fishermen. Sometimes these were unexpected, other times I would provoke them through rendering reality or by asking critical questions. My experience was that these debates were always fruitful and often yielded information of previously unknown instances. On the other hand these situations sometimes required careful negotiation in order to restore calm and achieve good results, i.e. awareness building among participants and new insights. This process is also a direct answer to one of the shortcomings, namely conducting objective research without getting involved, influencing the system and thus being ineffective in explaining real life (cf. LAL et al. 2001,2). Quite to the contrary influencing the resource system from within and having a stake in the coastal community myself allowed me to see reality through the eyes of the fishermen, an approach that resembles what HAGMANN et al. (2000,11) describe in much detail by *"(…) exploring these systems from the perspective of farmers (…)"* in a *"pro-active process"* and who state, that *"it was the key success factor in the identification of the most effective intervention points"*. In addition the interdisciplinarity immanent in integrated natural resources management addresses various dimensions and scales of the complex multi-stakeholder resource system. The latter also addresses the shortcomings mentioned by CONWAY (2003,3) and VAN KEER et al. (1998,12), that is to say, neglecting the wide diversity of ecosystems and the socioeconomic environment.

The **research design** followed an explorative approach without prior formulated hypotheses or theories. Research goals and objectives were formulated to act as a research framework with the specification that they will be followed flexibly in response to research collaboration, local factors, and the ongoing research process. Although CAMPBELL and HAGMANN (2003,4) endeavor to use *"clear research hypotheses"*, I believe that such preconceived ideas introduce bias and hamper *"decisions must be made, owned and internalized by NR managers and other stakeholders"*, as CAMPBELL and HAGMANN stress earlier (2003,2). Therefore I had chosen a nearly ideal scientific inquiry, i.e. observation and recording of facts without hypothesis or postulates other than those necessary to envision the research process. This process highlighted that a qualitative study is consistent with a qualitative paradigm, that CRESWELL (1994,1) defines *"as an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting"*. By contrast the inquiry process of a quantitative study is theory-driven, i.e. based on testing a theory through statistical analysis of empirical findings (cf. CRESWELL 1994,2). CRESWELL (1994,7) continues that the research design of qualitative studies emerges from the research process with informants identifying the categories. The design of a qualitative study begins with the selection of a paradigm and the associated theories and methods, the focus of the study remains the central concept

being described (CRESWELL 1994,1). CRESWELL (1994,2) suggests the use of a clear and easily understood language compared to commonly used complex and academic language to frame a sentence that describes the research focus.

Choosing the right methods was therefore the next step to identify the natural resource system and its resource users. This study was carried out following an adaptive research framework. That means that qualitative and quantitative methods were applied according to the respective situation at hand. With little theoretical background on the combination of qualitative and quantitative methods I set out to answer the immediate questions of the subject matter. Engaging deeper in the possible forms of data analysis, did I discover that empirical findings and the use of qualitative analysis software would add to the transparency and replicability of findings and to the generalization and credibility of the study (cf. Mayring 2001). In this respect engaging in social science and philosophy of science literature proved the most fruitful occupation.

Initially one of the research objectives was to operationalize the applied methods applicable in a coastal fishery environment. Today I have abolished this objective. Recapitulating my belief mentioned earlier I feel confident that operationalizing selected methods is neither a core competency necessary for the success of integrated natural resources management nor a sensible utilization of time. Furthermore the selection of appropriate methods for any particular research setting should serve the respective situation at hand making the best of scarce resources such as finances, personnel, material, and time. In addition the selected methods will most likely be adapted to personal preferences and the prevailing circumstances. And last but not least several sourcebooks are readily available that offer a variety of choices of appropriate methods (cf. IIRR 1998). Most of these sourcebooks are even specialized in community-based coastal resource management like in the present sourcebook.

One of the most prolific methods to gain deeper understanding was participatory action research. Although more a research approach itself it proved vital to apply the selected methods and to encourage **participatory learning**. Applying integrated natural resources management is very process- and result-oriented, i.e. the integrated natural resources management scientist becomes an actor himself and experiences how different stakeholder groups perceive their living and how after each ‘learning cycle’ new problems reveal themselves. Letting stakeholders participate in the research design not only opens the doors to people but leads to result-oriented research and a wide acceptance of the researcher and his work. When visiting fishermen for the first time for example and explaining the research ‘vision’ participants were skeptical and discussions yielded scattered information. During follow-up visits participants experienced one’s determination, so that the collected information could be verified and ‘real’ problems detected. One possible explanation is that not only people are taken seriously and listened to, but that for the first time in their lives they engage in a research process, that firstly puts livelihoods in the center, secondly not only asks participants for their opinions but thirdly seeks to establish a dialogue between the stakeholders (the scientist being a stakeholder himself, acts as a mediator between the different and often conflicting stakeholder groups). Thus the role of the integrated natural resources management

researcher is identical to an action researcher in developing a learning environment and helping communities to adopt more sustainable resource management strategies (cf. ALLEN 2001). The concept of 'learning by doing' recognizes that people learn through the active discussion of their experiences with other people accounting for both the researcher and the researched (cf. ALLEN 2001). The advantage of action research is that it provides a framework for this process of learning and makes it visible. By being deliberate and intentional about this process learning can be maximized (ALLEN 2001).

5.3 Discussion of the Case Study

5.3.1 Analyzing the Fishery Sector

Comparing the numbers of the actual marine catch and the total allowable catch one can see that overexploitation takes place in the nearshore fisheries and that offshore species are underexploited. Several independent authors support this such as EDWARDS et al. (2004,18), RUANGSIVAKUL and SIRIRAKSOPHON (2002,5), TRI (2002,4), and HOI (2003,8) as well as Vietnam's Ministry of Fisheries (RIMP 2005) itself.

Latest figures show that during the period from 1986 until 2004 the total engine capacity increased by 8.78 times from 537 503 hp in 1986 to 4 721 701 hp in 2004. However, during the same time the total marine catch only increased by 3.02 times from 570 481 tons in 1986 to 1 724 200 tons in 2004. (RUANGSIVAKUL and SIRIRAKSOPHON 2002,4; RIMP 2005) This means that the catch per unit of effort (CPUE – tons/hp/year) has declined from 1.06 tons/hp in 1986 to 0.37 tons/hp in 2004 and thus signals overexploitation and possible overcapacity. A study by the Ministry of Fisheries from 1984 to 1994 confirms this downward trend of marine fish resources in stock, production and size of captured fish, particularly for demersal fish stocks, which decreased by over 30 percent (HOI 2003,8). This negative trend is also reflected in the fishery of Nha Phu Lagoon. Recapitulating findings from the questionnaire catches had declined by 55 percent in recent years. Looking at possible forms of overfishing it is likely that several forms exist and overlap each other. Growth overfishing is most likely the case in a multi-species fishery like that of Nha Phu Lagoon where mesh sizes of dragnets often only reach 10 mm and small fish (juveniles) account for 75 percent of the catch (cf. 58:17; 58:19). Considering the fish size in fish landings it could be apparent that recruitment overfishing has set in already and is one reason for declining catches. Certainly Malthusian overfishing occurs since many fishermen have no alternative jobs and accordingly cause high incidences of destructive and illegal fishing practices.

It is acknowledged that the enforcement of fishing regulations and restrictions in Vietnam is weak or not existing (NORAD 2002,14). The FAO (2005) notices that gear size and type restrictions are seldom enforced due to budgetary constraints and although fishing licenses are required, many fishermen appear to ignore them. In Nha Phu Lagoon the situation is similar. Quantitative and qualitative findings acknowledge a high prevalence of illegal fishing practices and problems in the enforcement of current fishery legislation.

Analog to the limitations of global fishery management i.e. fishery management has generally failed to protect resources from being overexploited in Nha Phu Lagoon (GRAINGER 1999,23). And according to authors who attribute this failure to the

institutions in fishery management the situation presents itself in Nha Phu Lagoon (GRAINGER 1999,23; FROESE and PAULY 2003,252). Although Vietnams Ministry of Fisheries has launched several initiatives to develop offshore fishing in order to reduce the pressure on nearshore coastal resources, i.e. target programs and the provision of soft loans with low interest rates for the purchase of bigger boats, unforeseen circumstances prevent fishermen in Nha Phu Lagoon to invest in offshore fishing (cf. EDWARDS et al. 2004,18). One reason is reflected in a coding category that deals with the difficulties of boat sales. Many fishermen reported that there used to be a government program that bought medium sized fishing vessels to accelerate the reorganization of the fishery sector. However, the program has stopped and now fishermen have difficulties to sell off their fishing vessels to invest in a bigger boat for offshore fishing or change their job (65:24; 65:25; 70:2). Since dragnet fishing is illegal in Vietnam's coastal waters of less than 25 meters of depth, there is no market and no potential buyers for medium sized motorized boats, because these size boats are mainly suitable for dragnet fishing but not in offshore conditions (65:23; 70:2; 65:17). However, this is only one possible solution to the general problem of overfishing in coastal waters and does not address the underlying causes. The complexity of the resource system Nha Phu Lagoon adds to the shortcomings of global fishery management.

5.3.2 Lessons from Nha Phu Lagoon

Identifying **government organizations** in the fishery sector proved somewhat difficult, since party organs of the Communist Party such as the People's Committees and the People's Councils are responsible for the implementation of national fishery law. Yet unlike officials from the Provincial Department of Fisheries officials from the People's Committees were aloof. Thus the attempt to detect the responsibilities of the actors was clouded and information obscure. In addition, responsibilities were not always clear, neither to the government officials nor to the village leaders themselves. Unfortunately the five levels of governance in Vietnam, of which only four are recognized by the state, do not add clarity (13:11; 76:6). For this reason there is some discontent among fishermen over the authorities (cf. 56:15; 76:6). The ineffectiveness of government institutions is also reflected in the failure to keep up with new developments, e.g. the spontaneous development of the deep-water trap net (19:10).

Another failure is the hitherto exclusive focus on the expansion of fishery production and at the same time neglecting the development of local, regional and national **fishery marketing** opportunities. Although new market opportunities have emerged, they exclusively target export markets. For example, product markets for green mussels, a locally consumed product, are only poorly developed, as green mussels are no export commodity (cf. 35:13; 35:14). Informal market structures and high transaction costs for fishery products lead to economic dependence on intermediaries and middlemen, since fishermen are prevented market access. Informal markets also inhibit effective controls of product hygiene as witnessed under Kai Bridge in Nha Trang (Figure x). Product hygiene is not only a concern of public health but also of effective utilization of fishery resources, since up to 50-60 percent of high value fish on some offshore trawlers becomes waste because of poor storage (EDWARDS, TUAN and ALLAN 2004,23).

Analogue to the market sector the **financial sector** is subdivided into a formal and an informal sector. And like the market sector the same middlemen and intermediaries who provide credit to the poorer households dominate the informal financial sector. Although this is not necessarily bad, it does pose some restrictions for the economic development of poorer households. The term 'poorer households' is not exactly correct, as these households are not directly poor but instead usually lack legal land rights and capital resources both prerequisites to obtain formal bank credits (cf. 67:6; 68:1). In addition banks are not interested in financing small-scale fishing operations but rather agriculture, aquaculture or other forms of self-employment. As a last resort fishermen depend on middlemen with no perspective to improve their livelihoods. A discussion in Ngoc Diem also yielded little outlook. The subject of the discussion was the successful practice of community saving groups in Dac Lac Province (personal communication, Mr. Phuong, RIA 3). These saving groups had been established in fishing communities around reservoirs and handed out small credits to members. However, fishermen in Ngoc Diem doubted that this practice could be successful in their village and failed to choose even one person in the village whom they would trust as cashier.

The various forms of **decision-making processes** are visualized in the Venn diagrams in the previous chapter. Most noticeable are the strong differences between the three villages and the organization of circles. These circles represent the relationship structures of stakeholders and thus the channels of decision-making. The Venn diagrams also reveal that those organizations responsible for fishery management, e.g. the Fisheries Resources Protection Department (i) received a rather low ranking by Tan Dao and Ha Lien because it has only limited influence on the local coastal fishery sector, (ii) has no direct connection to the fishermen households, and (iii) is situated at great distance. This arrangement is a sign for the exclusion of fishermen from the decision-making processes concerning fishery management and vital information for future attempts to integrate stakeholders and internalize decisions from resource users. The differences between the three villages emphasize that in order to introduce sustainable management of natural resources, the forums to address the resource users need to be adaptive to the respective village situation.

Several **trends** have been identified in Nha Phu Lagoon of which the decline of coastal fishery resources is the most noteworthy and perhaps interlinked with some of the other trends identified. Rising populations and lack of alternative jobs is forcing more people to enter the fishery sector. Simultaneously these inexperienced fishermen choose fishing methods that require no specific knowledge, e.g. illegal fishing techniques such as trawling or electric fishing. Hence the pressure on coastal fishery resources increases. Several examples of resource depletion in Nha Phu Lagoon highlight the 'human' effect on coastal fishery resources. Environmental degradation further accelerates the pressure on the coastal ecosystem of Nha Phu Lagoon. The destruction of mangroves to develop shrimp ponds is self-evident. Less noticeable is the increasing environmental pollution caused by sewage, industrial wastewater, surface run-off from agricultural land, shrimp pond effluent, and nutrients and chemicals from lobster culture. Unfortunately results from a study by the Institute of Oceanography in Nha Trang on water quality in Nha Phu Lagoon could not be incorporated, as it was not completed at the time.

Several lessons can be drawn from the example of Ha Lien Village and the formation of a community **self-help organization**. Although there have been reports on local TV about

the success story of Ha Lien Village, no horizontal scaling was detected, i.e. villages in close proximity with similar large numbers of electric fishermen, social conflicts, and disagreement react differently. In most villages this means that no action is taken, even though similar to Ha Lien Village, individual actors are very aware of the negative effects of their unsustainable action. But only the shared understanding of the situation and thus further increasing awareness encouraged 'community action' generally known as collective action. In addition this increased awareness combined with knowledge about the cause and effect of the degradation of resources or like in the case study, of social tension leads to a willingness to change and to innovative ideas. In integrated coastal fisheries management SILVESTRE (1996,11) recalls *"problems must first be perceived and diagnosed as one before solutions to them may be prescribed"*. In an analysis on forest management of 18 sites in Nepal, VARUGHESE (1998) points out the ability of resource users to organize themselves and use their what BÉNÉ (2003,968) calls *"institutional richness"*, to establish arrangements governing resource use and to enforce these arrangements (cf. OSTROM 1998,17). Those communities that had formed self-help organizations experienced similar or improving forest conditions and can be compared to the constant or presumably slightly increasing coastal fishery resources surrounding Ha Lien Village (VARUGHESE 1998). Interestingly no correlation between the variation in population growth rates and the variation of forest condition in the studied locations was detected (VARUGHESE 1998; OSTROM 1998,17). The recognition of mediating effects of local institutional arrangements on the dynamics of resources and resource-users has important implications for those who seek to engage in participatory approaches to natural resources management (VARUGHESE 1998).

5.3.3 Livelihood Strategies and their Externalities

Illegal fishing and its perception by users and government officials play a key role in the degradation of coastal fishery resources in Nha Phu Lagoon. Thereby it is important to note that the common explanations of fishery depletion mentioned by fishermen are outspoken. That means fishermen are very aware of their actions and social effects. For instance, in problem ranking electric fishermen and dragnet fishermen regularly gave high rankings to electric fishing and dragnet fishing identifying them as reasons for declining catches. Similarly respondents associated the increasing population as one of the reasons for declining catches and gave it a high ranking. Qualitative methods yielded the same results. These findings are very different from JOHNSON'S (2001,967) experience in a fishing community in Southern Thailand. In a household survey the studied community did not associate fisheries depletion with the number of boats in the village. Instead a much more common explanation for the depleted fishery was the push nets and trawlers which were outside the village community. Quite contrary to the fishery community studied by JOHNSON (2001,967) the local fishery in Nha Phu Lagoon does challenge existing practices in the sense of conserving the local fishery.

On the other hand government officials from the Marine Border Police, the Fisheries Resources Protection Department, the Fisheries Department, and People's Committees share the perception that only poor fishing households practice illegal fishing. Although

this perception might be true for a few of the electric fishermen, none of the interviewed electric fishermen confirmed this assertion. However, government officials refer to dragnet fishermen which is an even greater oxymoron since dragnet fishermen use medium sized motorized boats worth 50 million VND versus gill net and electric fishermen who use small, unmotorized boats worth 500 000 VND to 800 000 VND, i.e. roughly one hundredth (70:8; 75:12). These findings are similar to SILVA'S (2006,37) analysis of the linkage between poverty and the use of destructive fishing gear in Tanzania. Her study revealed no direct link between income poverty and the use of destructive fishing gear. And just like dragnet fishermen who fish illegally in Nha Phu Lagoon have access to credit, SILVA (2006,27) validates that access to credit increases the probability of using destructive gear.

Thus the discrepancy in the perception of illegal fishing by fishermen and government officials is one reason for the failure to enforce existing regulations.

Electric fishing is said to cause great damage to eggs and larvae of marine fish and invertebrates floating in the water body. For better understanding of electric fishing the impressed voltage that stuns the fish and invertebrates is dependent on the size of the organism. In other words the bigger the fish the bigger the voltage drop and hence the impact (KNÖSCHE 1995,16). Latest studies on the effects of electric fishing reveal that small invertebrates showed no higher mortality (RÜMMLER, SCHRECKENBACH and PFEIFER 1998,90). The negative effect on fish eggs is also questionable since electric fishing is commonly used to capture broodstock for restocking efforts (OCHL et al. 1998,308). The alleged negative effect of electric fishing on the coastal fishing grounds in Nha Phu Lagoon is most likely a result of the efficiency, its widespread use and the fact that electric fishing areas and breeding grounds are congruent. In any case electric fishing is an illegal activity and banned nationwide.

During the field study I had the possibility to experience the development of the newly introduced deep-water trap in Nha Phu Lagoon. Although the traps are quite obvious and the use of small mesh netting violates the current regulation on minimum net size, authorities did not intervene despite the growing numbers of traps. When I finally left the study site, a government notification had been passed that informed about the dismantling of deep-water traps though until then no action had been taken. Instead an interesting phenomenon occurred in Tan Thuy that affected the numbers of deep-water traps in the area. First of all quite a few people had misjudged the high maintenance costs which led to a decline of deep-water traps (53:7; 52:13). Yet, a more striking reason for the decline of deep-water traps was that crab fishermen were experiencing increasing crab catches and thus making more money than in the past, since those fishermen operating deep-water traps had abandoned crab fishing (53:9). For exemplification, about 100 fishermen catch 400 to 500 kilograms of mud crabs a day in Tan Thuy, whereas four to 10 kilograms are caught per person (52:7). A possible explanation could be that crab stock exploitation is at equilibrium and that the amount of crabs caught is equally distributed among the number of fishermen fishing the area.

Another effect of the deep-water trap was that although many people perceived this new fishing technique as a threat to fishery resources, others noticed that the deep-water trap was not responsible for declining catches but only in the way of fishing boats (54:23). As a result its construction was said to prevent trawling through blocking the boat passageways (32:21). Yet further investigation proved this assertion wrong, since the

water in the deep-water trap area was not deep enough for trawling in the first place (3:11; 78:2). On the other hand fishermen using cast nets were said to catch a lot of fish that take cover and live close to the wooden-pole construction of the trap (53:10). Personal observation showed that nearby structures for green mussel culture were actually attracting a lot of fish and provided cover in the monotone tidal zone of the lagoon. In this sense the deep-water trap structure was perhaps fulfilling the same function.

Apart from fishing **aquaculture** certainly has a major impact on livelihoods Nha Phu Lagoon and its ecosystem. The propagation of shrimp aquaculture in Nha Phu Lagoon is the most evident aquacultural activity and shrimp ponds cover vast areas. The promotion of shrimp farming is seen as a panacea to rural development of coastal communities in Vietnam and substantial effort of the Research Institute for Aquaculture No. 3, the Institute for Oceanography, the University of Fisheries, and the Fisheries Promotion Centre in Nha Trang is directed towards shrimp aquaculture (cf. EJF 2003,5,16). In 2003 Vietnam's Ministry of Fisheries reported that 574 953 ha were used for shrimp culture (FAO/MOFI 2005a). The profits within reach are without doubt appealing to many households to engage in shrimp aquaculture however responsible officials often downplay the associated high risks. For example, in Tuan Le Village, Khanh Hoa, 70 to 80 percent of shrimp harvests failed in 2001 (EJF 2003,17). The resulting widespread indebtness of rural households in Tam Ich, Tan Te, Ha Lien, and Le Cam highlights the socioeconomic disparity of shrimp farming. The ENVIRONMENTAL JUSTICE FOUNDATION (EJF 2003,16) has reported on the social and economic impacts of shrimp aquaculture in Vietnam and confirms what has been said above with the following citation:

> *"In many coastal areas the spread of shrimp farming, resulting from clear government support, has resulted in a major upheaval in social structure. The subsequent failure of the shrimp harvest to reach initial profit levels has caused high levels of indebtedness, shifts in livelihood structure and an increased reliance on open access resources.''*

An often-neglected effect of shrimp farming is the irrecoverable conversion of rice fields into shrimp ponds. Alone in Ca Mau Province in the Mekong Delta 120 000 ha of paddy was converted to shrimp ponds in 2001 (EJF 2003,19). In addition saltwater seeps through shrimp pond dikes and causes salinization in neighboring rice fields. The Department of Fisheries in Ca Mau reported that most of the dikes of the 200 000 ha of acid-free rice fields have been damaged and that intruding seawater is threatening rice and sugarcane crops and fruit trees (EJF 2003,20).

The degradation of mangroves through the conversion of mangrove areas into shrimp ponds has several effects on the ecosystem of Nha Phu Lagoon. Up until now Vietnam has lost more than 80 percent (220 000 ha) of its original mangrove forests (EJF 2003,11). The most striking effect is the loss of breeding and feeding grounds for coastal fishery resources. A second and often mentioned problem is the increasing siltation of the lagoon as mangroves are absent that could hold back some of the sediments. The loss of mangroves has globally been recognized to reduce biodiversity, fish catches, cause coastal erosion, acidification, loss of nutrients, and loss of forestry products (EJF 2003,11). In Malaysia fishermen reported declining incomes to 1/6 of its former level within two to three years of large-scale mangrove deforestation (EJF 2003,11). Some of the fishermen

in Nha Phu Lagoon know about the benefits of mangroves and several replanting efforts on the banks of shrimp ponds could be observed. However, these replanting efforts are most likely not just the cause of deliberate fishermen but to a larger extent caused by government replanting efforts and economic support. Mangrove rehabilitation is said to improve biodiversity which is particular important for the rural poor (EJF 2003,33). The return of juvenile shrimp and crabs families can improve their livelihoods through the collection and sale of juvenile crabs (EJF 2003,33).

Other environmental impacts of shrimp aquaculture are the dispersion of chemicals, diseases and nutrients into the coastal waters of the lagoon. The ENVIRONMENTAL JUSTICE FOUNDATION report (2003,15) describes in great detail the release of effluent by shrimp farms into the natural environment and its effects on coastal ecosystems and human health including chemical inputs (disinfectants, antibiotics, fertilizers, pesticides, hormones) and waste (uneaten food, faeces, ammonia, phosphorous and carbon dioxide). Analogue to statements from fishermen that shrimp pond effluent was killing fish and in one case cultured grouper, the International Marine Life Alliance documented the death of 6 000 lobsters cultured off the coast in Xuan Tu, Khanh Hoa, in 2001 and reported that lobster culturists hold the shrimp farmers responsible through their untreated wastewater (HUE, WADE and VINH 2002,3). The effects of frequent over-use or misuse of chemicals, bad pond design and inadequate feeding regimes are twofold. One is its negative impact on coastal resources and human health and the other is its negative impact on the shrimp production process itself.

Many shrimp culturists in Nha Phu Lagoon reported that post-larvae quality was low and that shrimp hatcheries were responsible for this forcing broodstock to spawn early. By this shrimp farmers most likely refer to the practice of raising seven or eight broods per broodstock (EJF 2003,24). According to recent estimates only 10 percent of broodstock in the central region meet quality standards thus post-larvae tends to be of very poor quality with high mortality rates and increased susceptibility to disease (EJF 2003,24). Another reason that might add to the poor quality of broodstock is, that according to own observation and information from fishermen broodstock were caught as by-catch during trawling. Depending on the time of capture during the trawl and on the position in the cod-end broodstock were still alive or dead after the dragnet was hauled in.

Shrimp aquaculture as currently practiced in Vietnam is largely unsustainable (EJF 2003,1). In Nha Phu Lagoon declining productivity has already led to an unintended shift from intensive to extensive production systems or conversion of shrimp ponds for other uses such as polyculture of shrimp and crabs.

The ENVIRONMENTAL JUSTICE FOUNDATION (2003,38) recommends lobster aquaculture as an alternative livelihood strategy and as an alternative to export dominated shrimp production. However, lobster culture is no panacea and is associated with risks and negative impacts on its socioeconomic and natural environment itself. Lobster culture is very well export-oriented and high investment costs and long cultivating periods combined with disease susceptibility make it a risk prone undertaking. Similar to post-larvae quality problems in shrimp culture juvenile lobsters are often of poor quality with high mortality rates. The cause is said to be the use of too strong light associated with lift net fishing at night, although regulations exist that stipulate the wattage of technical equipment. Catching juvenile lobsters with drilled coral is therefore a solution to poor quality but one needs to consider the negative environmental impact of extracting coral

from Nha Phu Lagoon. In 2000 the International Marinelife Alliance (IMA) conducted an extended field survey in Van Hung Municipality, Khanh Hoa Province, including a study of lobster culture in Van Phong Bay. HUE, WADE and VINH (2002,2) reported that lobster culturists pour sand into their cages to clean them amounting to 6 000 m^3 of sand each month and that feeding is irregular and often excessive. Estimates show that between 60 to 70 tons of chemicals are used in lobster culture in Khanh Hoa Province per year (HUE, WADE and VINH 2002,2). Contrary to HUE, WADE and VINH'S (2002,3) observation of a decline of lobster larvae in the wild, lobster larvae in Nha Phu Lagoon is abundant and reported to be on the increase.

The negative impacts of **agriculture** through agricultural runoff on coastal ecosystem seems to be low on the agenda in Vietnam, since the issue was only voiced once during the entire field study by an elderly dragnet fisherman in Luong Son (66:2; 66:3). BEMAN, ARRIGO and MATSON (2005,211,213) demonstrate that nitrogen-deficient areas of tropical and subtropical oceans are acutely vulnerable to nitrogen pollution caused by agricultural runoff, which strongly influences marine ecosystem processes causing large phytoplankton blooms within days of fertilization and irrigation of agricultural fields. In conjunction with projected increasing levels of nitrogen fertilizer applied in developing regions, BEMAN, ARRIGO and MATSON (2005,211) highlight the present and future vulnerability of these ecosystems to agricultural runoff.

5.4 'People Planning their Future'

Throughout the field study awareness building encouraged participants to develop their own strategies for the sustainable management of coastal fisheries. Other ideas resulted from the interaction with stakeholders in the fishery sector of Nha Phu Lagoon and are thoughts about possible enhancements. The following chapter presents a selection of the most promising approaches to integrated natural resources management of coastal fisheries.

5.4.1 Developing New Management Forms and Ideas

During the preparation of Venn diagrams, group discussions and interviews participants expressed their "visions" how to improve their livelihoods, prevent poverty increase and develop the fishery in Nha Phu Lagoon. The subsequent list gives a review of new management forms and ideas:

- Develop aquaculture suited to the local environment (93:2)
- Allocation of land suitable for lobster culture (18:21)
- Compulsory shrimp pond effluent treatment (18:18)
- Mangrove replanting (18:19; 54:16)
- Construct artificial reefs (95:2)
- Develop agriculture, in particular animal husbandry (93:1)
- Develop offshore fishing (18:20; 41:10; 47:11; 65:11)
- Government scheme to buy up small to medium sized dragnet boats (65:19; 70:9; 66:5)

- Construction of a harbor in Vinh Luong Municipality (23:11)
- Provision of knowledge, credit and assistance to help people to exit the fishery sector and change to another job (75:18; 75:19)
- Provide alternative jobs (65:20; 57:5)

The development of aquaculture is generally seen as an option to diversify livelihoods and provide alternative incomes. Lobster culture is among the most favored production systems next to Babylon snail culture (65:12; 65:25; 47:12). As mentioned in the previous chapter the associated risk in lobster culture and the high initial investment capital do not predestine lobster culture to be an adequate and well-suited production system. Moreover, lobster culture in Nha Phu Lagoon has developed somewhat unregulated and suitable areas for lobster culture are already occupied preventing boat passage (cf. 24:13). Furthermore, the only area left for the possible development of lobster culture is congruent with one of the "best" coral reefs in the lagoon and the only other available area was taken away to develop a tourist resort (65:25; 18:21). Since most lobster are only cultured during a short season the diversification of production through the introduction of new species suited for cage culture could be an option to better utilize existing structures.

Polyculture of shrimp and crabs seems to be a practical livelihood strategy that utilizes shrimp ponds and requires relatively low-inputs. Remarkably, few officials were aware to what extent polyculture was already practiced in Ninh Hoa District. Although some research on polyculture of shrimp and crabs is practiced at the Research Institute for Aquaculture No. 3, extension offered by the Fishery Promotion Centre in Nha Trang focuses mainly on shrimp and lobster culture (94:4). This disparity between the actual pursued livelihood strategies and public guidelines needs to be addressed if development efforts are to be effective. Obviously blood cockle is not suitable to Tan Te since villagers turned down a training course offer (94:6). On the other hand the Fishery Promotion Centre had great success with a training course in Tan Dao highlighting the suitability of green mussels to that particular area (94:2). The bottom line is the development and promulgation of highly diversified low input aquaculture adapted to the respective agro-ecosystem and its socioeconomic environment. As demonstrated above this environment widely varies from village to village and every village has adapted their own strategy to the prevailing circumstances. This implies that suitable aquaculture that serves rural communities needs to be developed locally, if costly and time-consuming adjustment is to be avoided. This also implies that in order to learn about the respective agro-ecosystem and its socioeconomic environment, local communities need to be incorporated into the research and development process of new aquacultural systems.

Intensive shrimp culture is still carried out on a large scale despite growing problems associated with disease and loss of entire harvests. One of the main reasons is certainly poor pond design, i.e. the discharge of effluent and recruitment of water into and from the same canal (cf. EJF 2003,26). The long-term solution to this problem is the conversion of some of the shrimp ponds and the creation of second supply channels. The idea to establish a Shrimp Farmer Group to solve this problem is discussed in the next chapter. However a few participants demand treatment ponds as stipulated in regulations that make sure that effluent is treated prior to discharge. As most farmers have little land available it is understandable that they do not favor converting valuable shrimp pond area

to treatment ponds. The ENVIRONMENTAL JUSTICE FOUNDATION (2003,27,38) encourages harvesting shrimp only once a year, since the second shrimp harvest is often very risky. Accordingly water treatment could be carried out in the shrimp pond itself without the construction of new settlement and treatment ponds.

Several fishermen were promoting replanting of mangroves in order to restore coastal fishery resources. From the replanting efforts observed about half gave the impression to be successful and the other half had failed. Fishermen and pond owners could neither detect any direct causes nor any success factors for the failure or success of replanting efforts. Experience from Oxfam mangrove replanting projects in Vietnam offers some explanations. Monoculture plantation encourages pest attacks and causes the loss of 40 percent of planted mangroves (EJF 2003,33). Mangrove diversity will increase survival and there are more than 30 mangrove species available (EJF 2003,35). High planting densities (0.3-0.7 m intervals) are also problematic reducing sunlight, causing reduced leaf decomposition rates, and also inhibiting root development and thus making the mangroves susceptible to wind and waves (EJF 2003,33).

The construction of artificial reefs is a similar attempt to restore the coastal ecosystem and fishery resources. In addition to habitat enhancement for marine life artificial reefs provide obstacles to boats and nets and may be used to augment enforcement of trawling in Nha Phu Lagoon (cf. 15:8; 32:11).

In contrast to aquaculture agriculture receives only little official support. Especially animal husbandry is barely represented in the villages although quite a few respondents expressed their interest to engage in animal husbandry of cows and goats (93:1). Thus small-scale animal husbandry could possibly contribute a large share to household incomes in villages with access to land that is not yet utilized as rice paddy, shrimp pond or orchard like in Le Cam.

Next to aquaculture offshore fishing development is also high on the agenda of fishermen, although only in those villages that pursue illegal dragnet fishing already and who represent the higher income households in Nha Phu Lagoon. Although promoting offshore fishing is sought to reduce pressure on inshore fisheries, it must be noticed that the total catch in 2002 exceeded the total allowable catch (RIMP 2005). Nevertheless the Research Institute for Marine Fisheries in Hai Phong recommends management measures to reduce the number of inshore fishing boats and to adjust the number of offshore boats (RIMP 2005). The underlying assumption is that offshore fishery resources are considered underexploited (NGUYEN CHU HOI 2003,8). However, the offshore fishery resources do not meet the demand of the Vietnamese fishing fleet. The total allowable catch of nearshore coastal resources is estimated at 580 000 tons hence the total allowable catch of offshore fishery resources amounts to 820 000 tons (RUANGSIVAKUL and SIRIRAKSOPHON 2002,5). Latest figures show that in 2003 the total catch in offshore capture fisheries was 845 215 tons (FAO/MOFI 2005b). The implication is that the total allowable catch of offshore fishery resources has already been exceeded in 2003. This interior conflict of the Vietnamese fishery sector is becoming more and more evident and in the meanwhile is recognized by government agencies and policy makers (NGUYEN CHU HOI 2003,8; RIMP 2005).

The suggestion from fishermen to establish a government scheme to buy up small to medium-sized dragnet boats to enable fishermen to invest in bigger boats suitable for

offshore fishing is based on a former existing scheme that had been discontinued. However the overcapitalization of the fishing sector through direct and indirect subsidies and its negative effects on the sustainable management of fishery resources has been discussed in chapter 5.1.1. The resulting overcapacity of fishing fleets and the subsequent effort to reduce capacity has been demonstrated on global scale. Therefore the proposed government scheme is problematic in the sense of creating a fishing fleet that is unfitted to the local fishery resource capacity.

The recommendation from villagers to construct a fishing harbor to protect boats during stormy weather and support loading and unloading of boats is appropriate to improve the livelihood of the local coastal communities and to develop the fishery sector (23:11). The infrastructure facilities to handle fishery products are generally poor and bigger boats are loaded and unloaded by hand using small boats (cf. NGUYEN CHU HOI 2003,8). This practice is time-consuming and costly (23:11). Therefore the construction of a harbor eases logistics, allows better hygiene and thus improves product quality. Consequently household incomes are improved and the fishery sector strengthened.

Several respondents mentioned creating alternative jobs outside the fishery sector through the provision of knowledge, credit and assistance as a possible solution to create new household incomes. The side effect to socioeconomic development is the reduction of fishing pressure. SILVA (2006,9) analyzed the effects of alternative income generating activities as an integral component of MPA management strategies to reduce fishing pressure and address poverty concerns in Tanzania. She concludes that alternative income generating activities reduce the probability that households use destructive fishing gear but have no significant effect on household consumption levels (SILVA 2006,38,1). However, IRELAND (2004, cited in SILVA 2006,9) points out that several factors influence the decisions of coastal communities in the Western Indian Ocean to engage in alternative livelihood strategies and that profitability is not the only factor. Other important factors include the attitude towards risk, access to assets, vulnerability, and institutional influences (IRELAND 2004, cited in SILVA 2006,10). Bearing in mind that fishing households in Nha Phu Lagoon are exposed to high risks in shrimp and lobster aquaculture, vulnerable to the changing ecosystem and declining catches as well as violating existing institutions by pursuing illegal fishing activities, alternative income generating activities are important to reduce pressure on coastal resources.

A group discussion with women in Le Cam yielded ‘birth control’ as means to improve livelihoods and reduce the pressure on coastal resources (27:5; 27:6; 27:7). Although young women in Le Cam were said to use contraceptive coils today after they had one or two kids, the only training course on birth control by the Municipal People’s Committee lies 10 years back (27:5). Astonishingly women of different age were openly discussing birth control measures like contraceptive coils and sterilization. Yet it seemed that this topic was neither on the agenda of government officials nor of respective husbands and that women were left alone with these decisions. Hence birth control is an essential element in the long-term sustainable management of coastal fisheries.

5.4.2 Guidelines and Recommendations for the Reorganization of Institutions and Organizations

Next to management forms and ideas to manage coastal resources more effectively in the future, stakeholders of the fishery sector in Nha Phu Lagoon envisioned organizational and institutional considerations for implementation. Suggestions for successful enforcement of fishery regulations include:

- Stop dragnet fishing (95:3)
- Strict enforcement of electric fishing and confiscation of gear (75:20)
- Station a patrol boat in Nha Phu Lagoon (20:28)
- Empower the Marine Border Patrol to administer sanctions (76:5; 77:4).
- Establish a public Shrimp Farmer Group (78:15)

The strict enforcement of illegal fishing activities such as trawling and electric fishing was one of the most frequently mentioned issues during the entire field study. Its importance is highlighted by the concrete recommendations listed above. In general lax enforcement and the prospect to increase utility is seen as encouragement to engage in illegal fishing activities (56:2; 56:12; 62:6; 65:13; 71:4; 71:7; 71:9; 79:2; 81:8; 95:9). The failure to enforce the trawling ban is directly linked to the disparity of perceptions between fishermen and government officials and has been described in chapter 5.3.3. In the case of electric fishing recommendations suggest outlawing the possession of electric fishing equipment. SILVA (2006,37) demonstrates that a policy that confiscates illegal fishing gear is just as important as the enforcement of existing regulations banning the use of the illegal fishing gear. Households that own destructive fishing gear, which also happens to be illegal, are virtually certain to use such gear (SILVA 2006,37). Therefore confiscation of illegal fishing gear such as electric fishing equipment and dragnets is very much applicable to Nha Phu Lagoon. These gear types are not only conspicuous but also easy to distinguish from others. In particular electric fishermen from inland communities can be dissuaded from purchasing destructive fishing gear before using it. The same applies for dragnets used in nearshore fishing and thus illegal that are openly manufactured and sold in Vinh Luong Municipality, although they are assigned to a specific use. Manufacturers and users know very well that these dragnets are illegitimate and rigorous confiscation is likely to influence household choice of fishing gear. SILVA (2006,37) suggests a gear exchange program to facilitate the exchange of destructive fishing gear for more environmentally sustainable fishing gear. In combination with strict enforcement of existing regulations this could be an incentive for fishing households pursuing trawling to change to more sustainable fishing practices.

To realize strict enforcement fishermen suggest to permanently station a patrol boat in Nha Phu Lagoon. Besides deterrence this would overcome the practice of fishermen to avoid controls from the Fisheries Resource Protection Department through communicating the location of the patrol boat thus giving the fishermen enough time to cease illegal fishing activities.

The different administrative structures, i.e. the Department of Fisheries, Fisheries Resources Protection Department, and the Marine Border Patrol 368 prevent effective action (76:6). As a result fishermen plead for a reorganization of the organizations responsible for fisheries management. The Marine Border Patrol 368 is stationed in Nha

Phu Lagoon already and uses their own patrol boat. Their main field of responsibility is the control of boat traffic and merchandise trade. However the Marine Border Patrol 368 regularly accompanies the Fisheries Resources Protection Department on their patrols. Furthermore the Marine Border Patrol 368 is familiar with the resource system Nha Phu Lagoon, its structures, fishermen and boat owners. Thus the recommendation from fishermen to empower the Marine Border Patrol 368 to administer sanctions, i.e. invoke warnings, issue fines, and confiscate fishing gear without being dependent on the Department of Fisheries or the Fisheries Resources Protection Department is likely to encourage enforcement of existing regulations. In addition village and municipality leaders have no incentive to enforce strictly, because enforcement would affect the lives of community members and make some people's lives even poorer whereby these would not vote for the representatives a second time (76:6). The second village leader from Ha Lien highlights this issue stating*: "If you want to stop illegal fishing, you need to involve xa leader, thon leader and all agree at the same time"* (78:18).

According to the experience gathered with the self-formed Fisheries Resources Protection Group in Ha Lien Village residents suggest forming a Shrimp Farmer Group similar to the Farmer's Union with the obligation that everybody who joins has to follow good rules of practice (78:15). An example for such good practice could be the idea from a group of fishermen in Tan Thanh to establish compulsory shrimp pond effluent treatment (18:17). A shrimp farmer near Tan Thuy adds that small treatment ponds could be a solution, if everybody were forced to use them (22:6). Similar attempts are successfully practiced in Vietnam and are initiated and attended by the University of Fisheries, Nha Trang. Crucial to its success is the highly participative approach including methods such as history time line, Venn diagram, gender analysis, and group discussion to improve local understanding and build awareness (personal communication, Ms. Hoa, University of Fisheries). Therefore the link to improve organization thus improving livelihoods and the environment is a feasible approach.

Apparently the taxation of shrimp ponds is inadequate, as nobody could be identified paying taxes. However adequate taxation of shrimp ponds and the diligent collection of taxes may prevent uncontrolled shrimp farm development and encourage only those to engage in shrimp farming who hold the necessary skills, knowledge and financial resources to successfully culture shrimp.

5.5 Organizational Implications

Centralized, state-led fishery management is ineffective addressing the complexity of the coastal fishery in Nha Phu Lagoon. Factors like various types of fishing gear, their spatial and temporal distribution, the combination of livelihood strategies and their externalities, and the multiple interests of stakeholders, only to name a few, are not only hard to detect and comprehend but least likely to be addressed in a satisfactory way. Furthermore, these findings are not transferable to the next lagoon or bay where other types of fishing gear dominate and livelihood strategies widely differ (cf. BRZESKI and NEWKIRK 2000). In this respect a study from the WorldFish Center carried out on co-management in Africa analyzing nine case studies is representative and recognizes that centralized approaches to fishery management seem incapable of dealing with resource degradation (KHAN,

MIKKOLA and BRUMMETT 2004,60). In his work on marine resource management practice and institutions in Indonesia THORBURN (2000,1461) concludes that centralized, state-led "one-size-fits-all" natural resources management combined with uneven enforcement and the danger of collusion threatens resources and local institutions. Only local resource users are able to reflect local circumstances. VARUGHESE (1998) states that government policy on participatory resource management will be more successful if it is facilitative of institutional innovation and adaptation at the village level. In a recent study on the willingness to participate in community-based management of a Venezuelan freshwater fishery ZANETELL and KNUTH (2004,803) conclude that willingness to participate could be enhanced by extension efforts that raise villager awareness. Apparently integrated natural resources management is appropriate to address each of the factors mentioned above. This study demonstrates that integrated natural resources management is capable identifying the multitude of stakeholders, levels, decision-making processes, and livelihood strategies, as well as the associated problems with the sustainable management of coastal resources in the resource system Nha Phu Lagoon. Furthermore the process of identification mobilized local fishermen to engage in the formulation of fishery management and simultaneously sensitized government officials to possibly organize fishery management new. Underlying this assertion JOHNSON (2001,957) describes common property regimes enforcing fishery management from within the village community that are striking by their absence of free riders[5], salaries for enforcement and compensation for the provision of boats, fuel and labor. Furthermore the role that local government officials play in the development and implementation of the common property regime is minimal. And last but not least, the local fishery management was remarkable for its nearly total lack of formal or written rules (JOHNSON 2001,957).

However coastal communities are unlikely to deal successfully with impacting factors on the coastal ecosystem, as for example, environmental pollution or increased sedimentation through inland logging. The concept of subsidiarity is ideal to organize competency across different levels and scales. The principle is to handle matters at the lowest possible level and hand only those tasks up towards a central authority that cannot be performed effectively at local levels. In other words problems are best solved where they arise. In this respect problem boundaries have considerable implication for the organization of the subsidiarity concept. Due to the complexity of the resource system and the problem of fit between institutions and ecosystem boundaries it is difficult to find a resource management system that does not have some cross-scale linkages (BERKES 2004,8). Since cross-scale linkages are so pervasive attention to the community level alone is never likely to be sufficient to provide for effective management (BERKES 2004,8). Transboundary problems like environmental pollution, for example, can only be captured at the organizational level of watershed management. However watersheds may cover numerous local governments across municipal, district or provincial boundaries. Effective watershed management need to engage relevant municipalities, districts or provinces in cooperation with a central authority that specifies directives in the pursuit of water quality. On the other hand the problem boundary of electric fishing may encompass only a

[5] In economics and political science free riders are actors who consume more of their fare share of a resource or shoulder less than their fare share of the costs of its production (WIKIPEDIA 2006). For example some may participate less than others in the enforcement of illegal fishing, although these free riders reap the benefits of this action by going fishing.

few municipalities. The example of Ha Lien Village demonstrates that local governance is effective in managing the fisheries in their own municipality. Matching the geographical scale of problems with the level of governance (municipal, district, provincial, national) and involving stakeholders of multiple levels in decision-making is essential to manage natural resources effectively.

The next step is to identify effective forums for resource users and policy makers to participate in and implement integrated natural resources management. JOHNSON'S (2001,968) experience in Thailand was that meetings or gatherings were highly inclusive affairs between village officials and villagers. JOHNSON (2001,968) refers to meetings as important forums through which individuals could assert their place in the village community. He continues that individuals whose livelihoods were highly dependent upon coastal fishing had strong incentives to protect and improve the local fishery. The absence of a dominant authority created a situation in which collective action was the only viable means of protecting the fishery. By engaging in local fishery management movements villagers were asserting a right to claim benefits that only the community could provide. Similar to Johnson's experience is the situation in Nha Phu Lagoon. However in addition to incentives that motivate people organizing themselves own observations showed first signs of possible development how participants discuss different interests and agree on shared decision-making. After repeated visits to the same village and the preparation of a Venn diagram, for example, participants negotiated the position of each circle to reflect the relationships of various stakeholders in the fishery sector in relation to their own fishery household. This process involved considerable amount of time for discussions, yet participants always managed to find consensus. Thus meetings during group discussions or Venn diagrams could prove to be viable and effective forums for resource user groups to encourage a bottom-up approach to develop and implement options for sustainable resource management. Participating in activities of this nature further improves a participant's ability to deal with high-ranking officials as well as strengthening the position between village and state and reaping the benefits of state interventions (JOHNSON 2001,969). The organization of communities to manage resources sustainable could be the first step in empowerment. Village representatives could engage with policy makers from the Department of Fisheries or the Fisheries Resources Protection Department in policy assessment and implementation.

6 Summary of Conclusions

The extensive discussion of this study supports the following conclusions. Integrated natural resources management is a possibility to manage resources more effectively and with greater participation of the associated communities. What makes integrated natural resources management unique to other resource management strategies, for example community based resources management, is the integrated 'learning cycle'. This tool alters the perspective of every single participant. Scientists become aware of the complex problems inside the natural resource system and the people become aware of their action and of the complex issues that need to be dealt with. This awareness building on both sides, as described in Chapter 2, is what forms the basis for an active engagement in the natural resource system. Dealing with different interests of various stakeholder groups in a coastal fishery sector requires compromises and a willingness to change; both can be achieved through applying integrated natural resources management.

The selected methods for the implementation of integrated natural resources management in this study are adequate to assess the coastal fishery sector, involve stakeholders and encourage awareness building. Helpful for the selection of methods is the consideration of trade-offs between the anticipated utility and the expected time and effort. However selected methods need to be adjusted to prevailing circumstances such as cultural and social characteristics.

As shown in Chapter 4 the resource system of Nha Phu Lagoon consists of a multitude of different resources, actors, levels, livelihood strategies, trends, and associated problems in the sustainable management of the natural resources. Overexploitation and destructive (illegal) fishing practices are major factors in coastal fishery resource degradation. However, other impacting factors on the coastal ecosystem include environmental pollution through untreated shrimp pond effluent, peri-urban and rural sewage, nutrient and pesticide runoff from agricultural fields, deforestation of mangroves for shrimp pond construction, as well as dispersion of chemicals from shrimp and lobster aquaculture.

Government on provincial, district and municipal level fails to enforce existing fishery regulations. Furthermore the attitude and perception of government officials concerning fishery management is apparently encouraging actors at the local level to exploit resources uncontrollably and by means of illegal (destructive) fishing practices. The exclusion of stakeholders in decision-making and the unequal distribution of authority discourage actors to participate in protection and management of coastal fishery resources.

The extended use of coastal fishery resources is linked to enforcement to reduce utility through illegal action, improved natural resources management, and alternative income generating activities outside the fishery sector. As national and local government fail to enforce current fishery laws and regulations the community of Ha Lien Village succeeds in enforcing state law themselves. The emergence of local governance occurs unintentionally. Self-help organizations or collective action proves effective in enforcing fishery regulations and in developing improved natural resources management. The devolution of natural resources management to local resource-users could play a vital role in the successful management of Vietnam's coastal resources but one needs to consider government agencies to strengthen local governance and provide guidance on how to manage the coastal fishery in an appropriate manner.

Applied integrated natural resources management succeeds in building awareness among participants and identifying core problems in the sustainable management of coastal fishery resources. Exemplary for the success of integrated natural resources management are new management forms and ideas as well as guidelines and recommendations for the reorganization of institutions and organizations within the fishery sector. Meetings and gatherings in the course of applied integrated natural resources management prove to be effective forums for resource user groups and encourage a bottom-up approach to policy assessment and implementation. The principle of subsidiarity provides a concept how to address problems of different scales and offers implications for the organization of competency across multiple system levels.

Eventually however, the challenge is to develop the acceptance of integrated natural resources management and encourage new scholarly thinking from discipline-based towards interdisciplinary research.

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7 Annex

7.1 Institutions and Organizations

A-5.3.2 Institutional Structure: Existing Laws and Regulations

The decree **No. 191/2004/ND-CP** issued on the 18th of November 2004 regulates the fishery activities of foreign fishing vessels in Vietnam's Seas (MOFI 2004). And decree **No. 27/2005/ND-CP** issued on the 8th of May 2005 regulates and guides the implementation of certain articles in the fisheries law concerning:

- Criteria for the classification of marine protected areas, management and organization
- Financial sources for the rehabilitation of fisheries resources
- Duties of specialized agencies, e.g. broadcasting weather developments, establishing forecasts on fishery resources, providing guidance on fishing techniques
- Allocation and lease of marine areas and land for aquaculture, area quotas, duration of allocation and lease
- Developing wholesale fish market infrastructure, i.e. transaction place, roads, electricity, water supply and drainage system (MOFI 2005b)

A-5.3.3 Organizations and Structures

The following **associations** play an important role in representing workers and organizing to improve working conditions in the fishery sector, encouraging fishery development and participating in the fishery sector administration:

- Vietnam's Fisheries Trade Union, with 67 900 members (FAO 2005)
- Vietnam's Fisheries Association (VINAFIS) is a socio-professional organization established in 1992 on a voluntary basis of people from various economic backgrounds operating in various fisheries organizations such as individual organizations, cooperatives and State-owned enterprises. VINAFIS plays a role in the representation of interests of the government and the fishermen, i.e. the government's objectives and orientations to promote fisheries development and practical benefits to all its members as well as fishermen communities. (VINAFA)
- Vietnam's Association of Seafood Exporters and Producers (VASEP) is a non-governmental organization founded in 1998 including members from Vietnam's seafood producers and exporters. Its main role is to promote the development of Vietnam's seafood industry and to facilitate the export of Vietnam's seafood products internationally. (VASEP)
- The National Fisheries Inspection and Quality Assurance Centre (NAFIQACEN) established in 1994 focuses on the assurance of quality and hygiene in the whole production chain of seafood products, from capture/aquaculture to handling, processing, transportation, export, import, and distribution in domestic markets.

Further, Vietnam's fishery sector comprises of several **research organizations**:

- The Research Institute of Marine Products (RIMP) in Hai Phong is the main fisheries research centre in Vietnam. The institute focuses on biological aspects and is engaged in resource monitoring and stock assessment but also conducts research in fishing and processing technology. (FICEN c)
- The Research Institute for Aquaculture No. 1 (RIA 1) in Bac Ninh employs 103 people. The main tasks are to carry out scientific and technological research in the field of fish seed techniques, culture techniques, fish feed, protection of aquatic resources, fishing, preservation and processing of aquatic products as well as to undertake some basic research on physiology, biochemistry, ecology and genetics of aquatic species. Further tasks are to collect data on environment and aquatic resources for formulating a master plan in aquaculture and related fields and to cooperate with other national and international institutes in the field of fisheries. (RIA 1)
- The Research Institute for Aquaculture No. 2 (RIA 2) in Ho Chi Minh City is responsible for research activities on aquaculture development, post harvest technologies and management of environment and inland fisheries resources (RIA 2).
- The Research Institute for Aquaculture No. 3 (RIA 3) in Nha Trang City employs 74 people. The main tasks and responsibilities are: Investigating environmental and aquatic resources; Research on aquatic seeds production, aquaculture, fishing, processing, and aquatic resources protection; Applying advanced aquaculture techniques for farmers in the coastal provinces (from Da Nang to Binh Thuan Province) and in the Central Highlands; as well as education, training, technical transfer, and effectuating international co-operation. (RIA 3)
- The Institute of Fisheries Economics and Planning (IFEP) in Hanoi compiles statistics as well as sector analyses and employs about 35 people. The Institute is also involved in fisheries management problems and serves as a training centre. (FAO 2005)
- The Mekong River Commission (MRC) takes a special position representing an international cooperation of the member countries Cambodia, Lao PDR, Thailand and Vietnam. The MRC member countries agree to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin, such as navigation, flood control, fisheries, agriculture, hydropower and environmental protection. The MRC maintains regular dialogue with the two upper states of the Mekong River Basin, China and Myanmar. (MRC 2005)

In addition to the research organizations there are two **information and management agencies**. These are:

- The Fisheries Information Centre (FICen) in Hanoi manages and implements activities of information services at the ministry level and supplies concrete guidance on professional skills to information departments of all institutions and agencies under the Ministry of Fisheries (FICEN d).

- The Fisheries Review represents the voice of the Ministry of Fisheries in Vietnam and is published bi-monthly in Vietnamese (FICEN c).

Education and training institutions in the fishery sector can be divided into higher education and vocational schools. All institutions for higher education belong to the Ministry of Education and Training (MOET). However, only the University of Fisheries in Nha Trang is independent, whereby four universities have established faculties or institutes. The most important institutions in higher education are:

- University of Fisheries, Nha Trang City
- HCMC Agricultural and Forestry University, Institute for Aquaculture
- Can Tho University, Institute for Marine Aquaculture
- Hue University, Institute for Forestry and Agricultural Science
- Hanoi Agricultural University, Faculty for Aquaculture

There are three vocational schools that belong to the Ministry of Fisheries. They train technicians and skill workers in: navigation and fishing; processing and preserving of aquatic products; operating and repairing ship diesel engines; operating and repairing refrigerators; building and repairing ships; mechanics, electricity and refrigeration; ship electricity; information of wireless telegraphy on ships; welding of ship hulls; fitting and repairing ships; and fishing crew duties (cf. FISTENET b). The three vocational colleges are:

- Technical Colleges of Fisheries No. 1, Hai Phong
- Technical Colleges of Fisheries No. 2, HCMC
- Technical Colleges of Fisheries No. 4, Tu Son Bach Ninh Province

7.2 Pictures

Figure 52. Lower middle-class house in Le Cam.

Figure 53: Poultry production.

Figure 54: Preparing crab traps with chopped eel.

Figure 55. Boats prepared for lift net fishing with light.

Figure 56: Wooden structures to catch lobster fry with drilled coral blocks.

Figure 57: Big trawling boat for offshore fishing.

Figure 58. Small-scale animal husbandry with cows.

Figure 59. Informal market at Bon Bridge, Nha Trang.

Figure 60. Informal market under poor hygienic conditions at Kai Bridge, Nha Trang.

7.3 Data sources

7.3.1 Questionnaire

Thôn: Ngọc Diêm
Village:

Ngày: 10/2/2004
Date:

Anh/Chị bao nhiêu tuổi? 36 Tuổi
How old are you? Years

Anh/Chị có gia đình chưa? ☑ Có ☐ Không
Are you married? Yes No

Anh/Chị có bao nhiêu con? 1 Con
How many children do you have? Children

Có bao nhiêu người đánh bắt thủy sản hoặc nuôi trồng thủy sản ? ☑ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ nhiêù hơn
How many family members work in fishing/aquaculture?

Anh/Chị sống bằng nghề gì ? ☑ đánh cá ☑ nuôi tròng thủy sản ☐ nông nghiệp ☐ thành phần khác
How do make a living? fishing aquaculture agriculture other

Anh/ Chị đã đánh bắt / nuôi trồng trong bao nhiêu năm? 14 Năm
How long have you been work ing in you job? Years

Đánh bắt thủy sản:
Fishing:

Anh/Chị có bao nhiêu tàu /thuyền đánh bắt? ☐ 0 ☑ 1 ☐ 2 ☐ 3 ☐ 4
How many fishing boats do you own?

Bao nhiêu thuyền có động cơ? ☑ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4
How many boats have an engine?

Mã lực bao nhiêu? cv cv cv cv
How big are the engines

Anh/Chị có đăng ký không? ☐ có ☑ không
Is your boat registered?

Anh/Chị đánh bắt bao nhiêu tháng trong môt năm? 12 Tháng
How many months a year do you go fishing? Months

Anh/Chị đánh bắt bao nhiêu ngày trong một tháng? 20 Ngày
How many days a month do you go fishing? Days

Mỗi lần đi đánh bắt mất bao lâu? 7 Giờ
How many hours a day do you go fishing? Hours

Anh/Chị dùng kỹ thuật gì để đánh bắt? Và đánh bắt loại thuỷ sản gì?
Which fishing technique do you use and what do you catch?

Kỹ thuật đánh bắt Fishing technique	Sanr phẩm Product	Số lượng Amount/day
☐ Lươí cản (> 1,8 cm) Gill net Lưới 3 Màng 3 layers	☐ cua, ghẹ	
	☑ tôm	0,5 kg
	☑ cá	0,5 kg 1,5 kg

1

Kỹ thuật đánh bắt Fishing technique	Sanr phẩm Product	Số lượng Amount/day
☐ Lưới cản (< 1,8 cm) Lưới ghe Slayers	☑ cua, ghẹ	3 kg
	☐ tôm	kg
	☐ cá	kg
☐ Giã cào Drag net	☐ cua, ghẹ	kg
	☐ tôm	kg
	☐ cá	kg
	☐ mực	kg
	☐ cá cho heo	kg
☐ Nò Fish trap	☐ cua, ghẹ	kg
	☐ tôm	kg
	☐ cá	kg
☐ Xiết điện Electric fishing	☐ cua, ghẹ	kg
	☐ tôm	kg
	☐ cá	kg
☐ Mành chong Light fishing	☐ cua, ghẹ	kg
	☐ tôm	kg
	☐ cá	kg
	☐ tôm hùm con	con/ngày
☑ Bắt tôm hùm (Đá vôi) lobster fry fishing (coral blocks)	☑ tôm hùm con	2→3 con/ngày

☐ Kỹ thuật đánh bắt khác
others

Trước đây Anh/Chị có đánh bắt được nhiều hơn không? ☑ có ☐ không
Did you catch more in the past? Yes No

Nếu có, thì nhiều hơn bao nhiêu? 4 ? kg/ngày
If yes, how much more? kg/day

Tai sao Anh/Chị đánh bắt ít hơn? Mức độ từ 1 đến 10
Why do you catch less? Rank from 1 to 10

7 ☐ Gĩa cào
Drag net

8 ☐ Xiết điện
Electric fishing

6 ☐ Nò
Fish trap

9 ☐ Ô nhiễm từ nông nghiệp/ thành phố
Pollution from agriculture/city

5 ☐ Ô nhiễm từ đìa nuôi tôm
Pollution from shrimp ponds

3 ☐ Tàn phá rừng đước
Destruction of mangroves

10 ☐ Dân số gia tăng
Population increase

6 ☐ Không có nghề thay thế
No alternative jobs

☐ Thành phần khác _____
others

Anh/Chị bán cho ai?
To who do you sell your products?

☐ Ở chợ địa phương
local markets
☐ Nhà hàng
Restaurants
☐ Những công ty xuất khẩu thuỷ sản
Sea food exporting companies
☑ Những người trung gian
Middleman

Nuôi trồng thuỷ sản:
Aquaculture:

Anh/Chị nuôi trồng gì?
What do you culture?

☐ Tôm
☐ Cua, ghẹ
☐ Vem xanh
☐ Tôm hùm
☐ Ốc hương
☐ Cá mú
☐ Thành phần khác _____
others

Tôm:

Anh/Chị có bao nhiêu đìa? Đìa
How many ponds do you have?

Đìa rộng bao nhiêu m^2
How big are they together?

Anh/Chị nuôi bao nhiêu vụ mỗi năm
How many shrimp seasons per year do you have?

Anh/Chị thu hoạch bao nhiêu tôm mỗi vụ? kg
How many kg shrimps per season do you harvest?

Cua/ghẹ:

Anh/Chị nuôi bao nhiêu?
How many crabs do you culture?

Anh/Chị thu hoạch được bao nhiêu mỗi năm? kg
How many crabs do you harvest per year?

☑ Vem xanh:

Diện tích nuôi vẹm của Anh/Chị rộng bao nhiêu? 100 m^2 (50 pillars)
How big is your culture area?

Anh/Chị thu thu hoạch được bao nhiêu kg mỗi ngày? 800-900 kg / year
How many kg of mussel do you harvest per day?

Tôm hùm:

Khu vực nuôi tôm của Anh/Chị rộng bao nhiêu? m^2
How big is your culture area?

Anh/Chị có bao nhiêu lồng? Lồng
How many cages do you own?

Anh/Chị nuôi bao nhiêu con? Con
How many lobsters do you raise?

Một năm Anh/Chị nuôi bao nhiêu tháng? Tháng
How many months a year do you culture lobster?

Anh/Chị cho tôm ăn bao nhiêu kg mỗi ngày? kg
How much feed do you feed daily?

Ốc hương:

Diện tích nuôi ốc hương của Anh/Chị rộng bao nhiêu ? m^2
How big is your culture area?

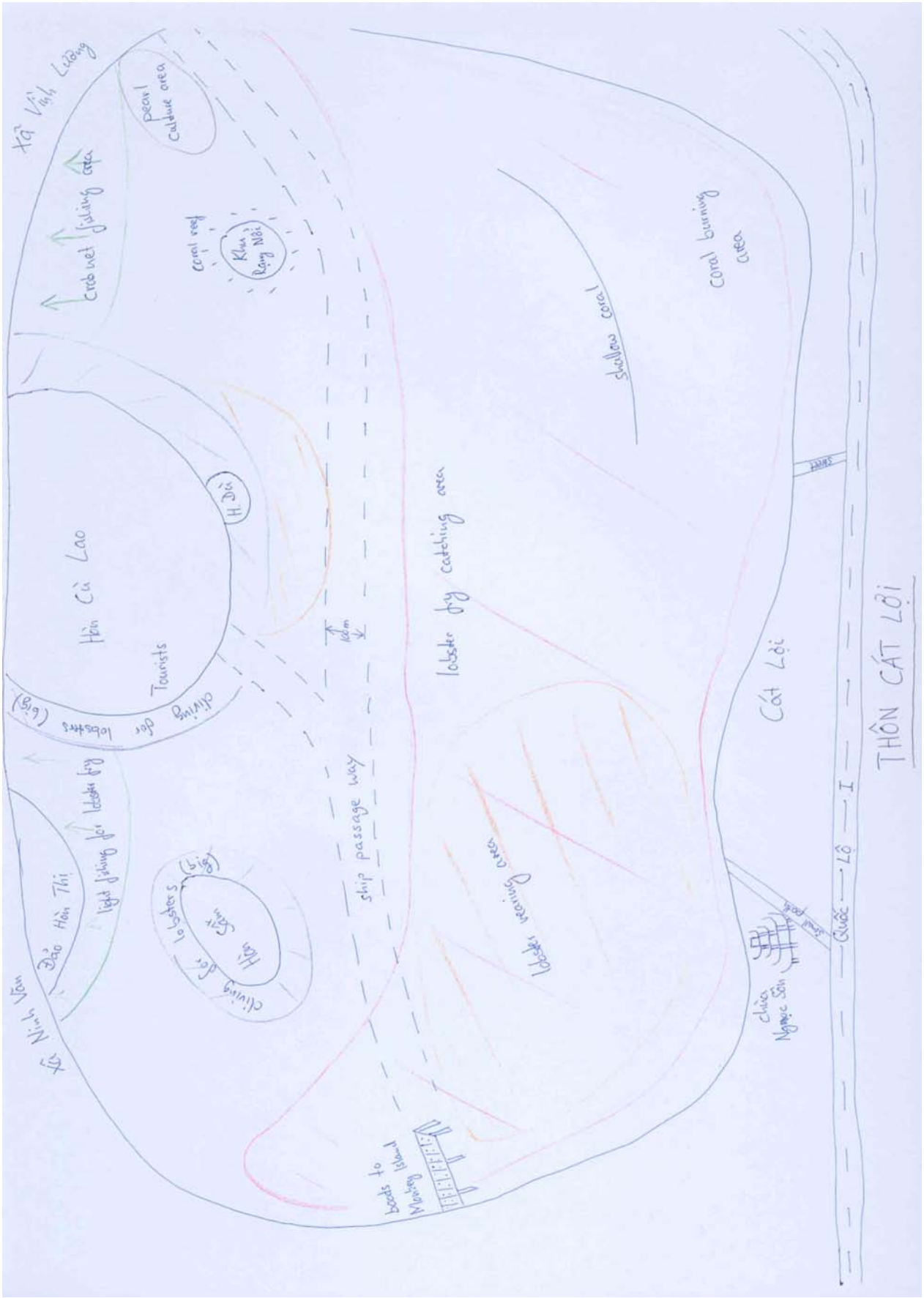
Anh/Chị thu hoạch được bao nhiêu kg mỗi năm? kg
How many babylon snail do you harvest per year?

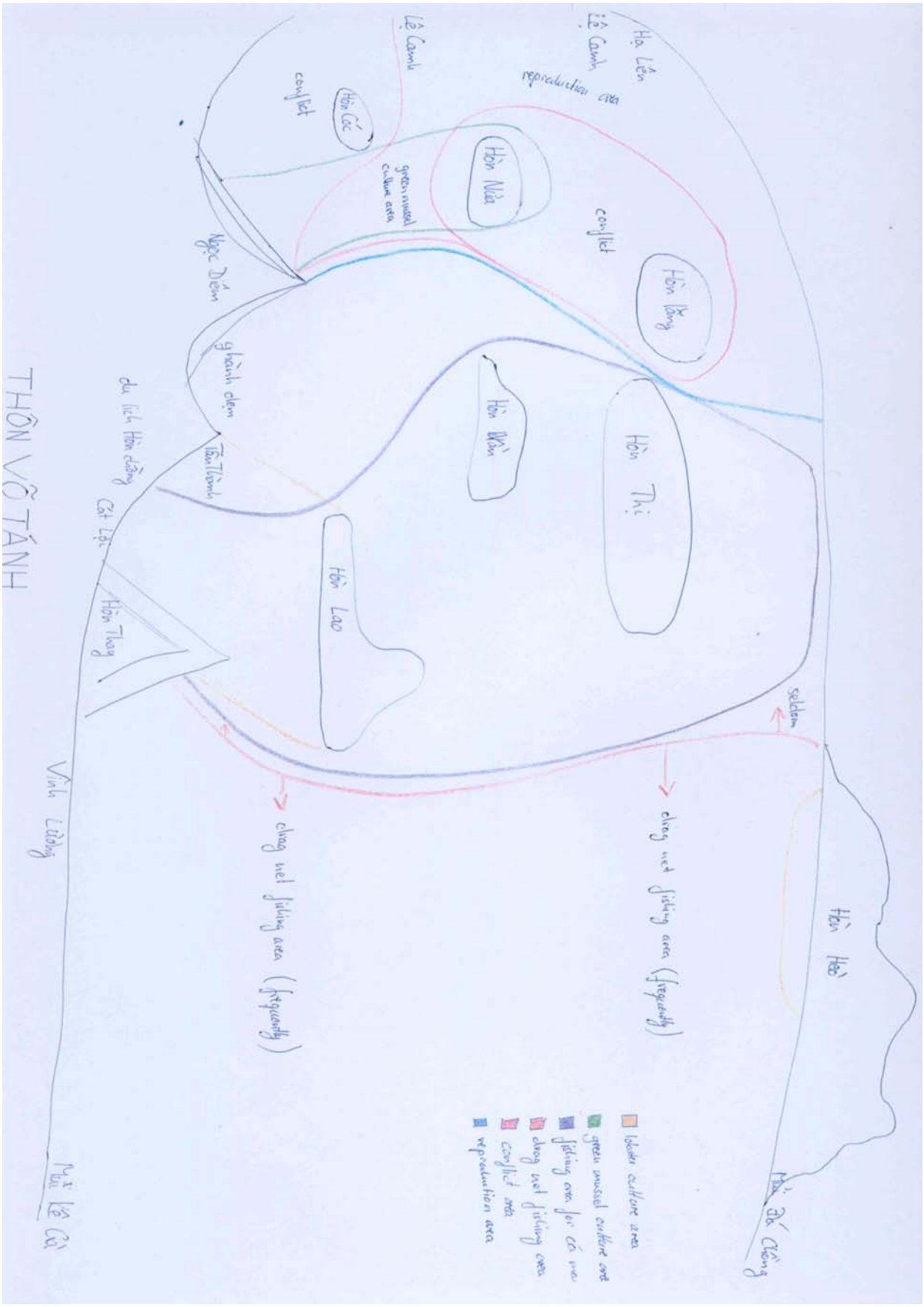
Cá mú: _____

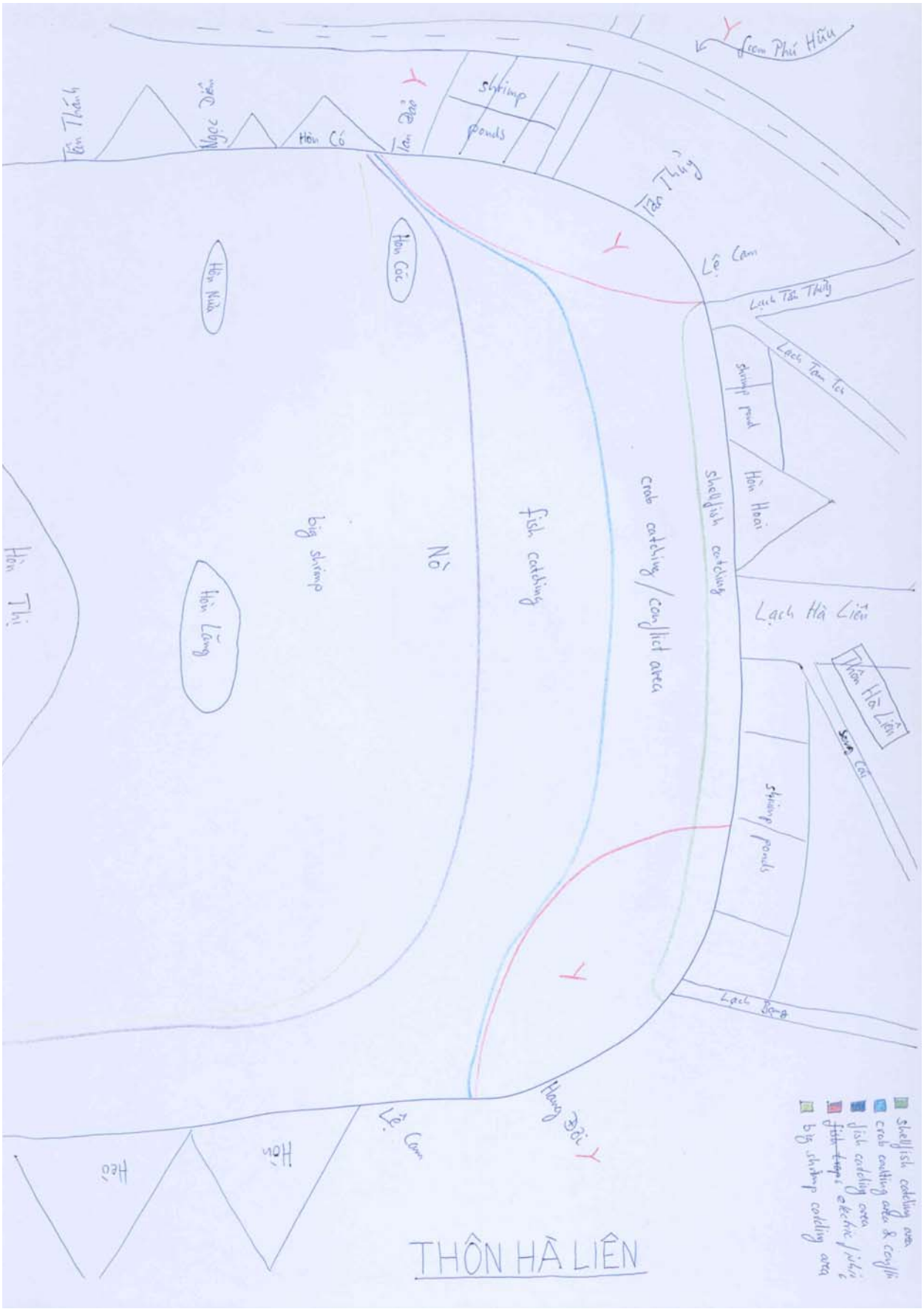
Anh/Chị bán cho ai?
To who do you sell your products?

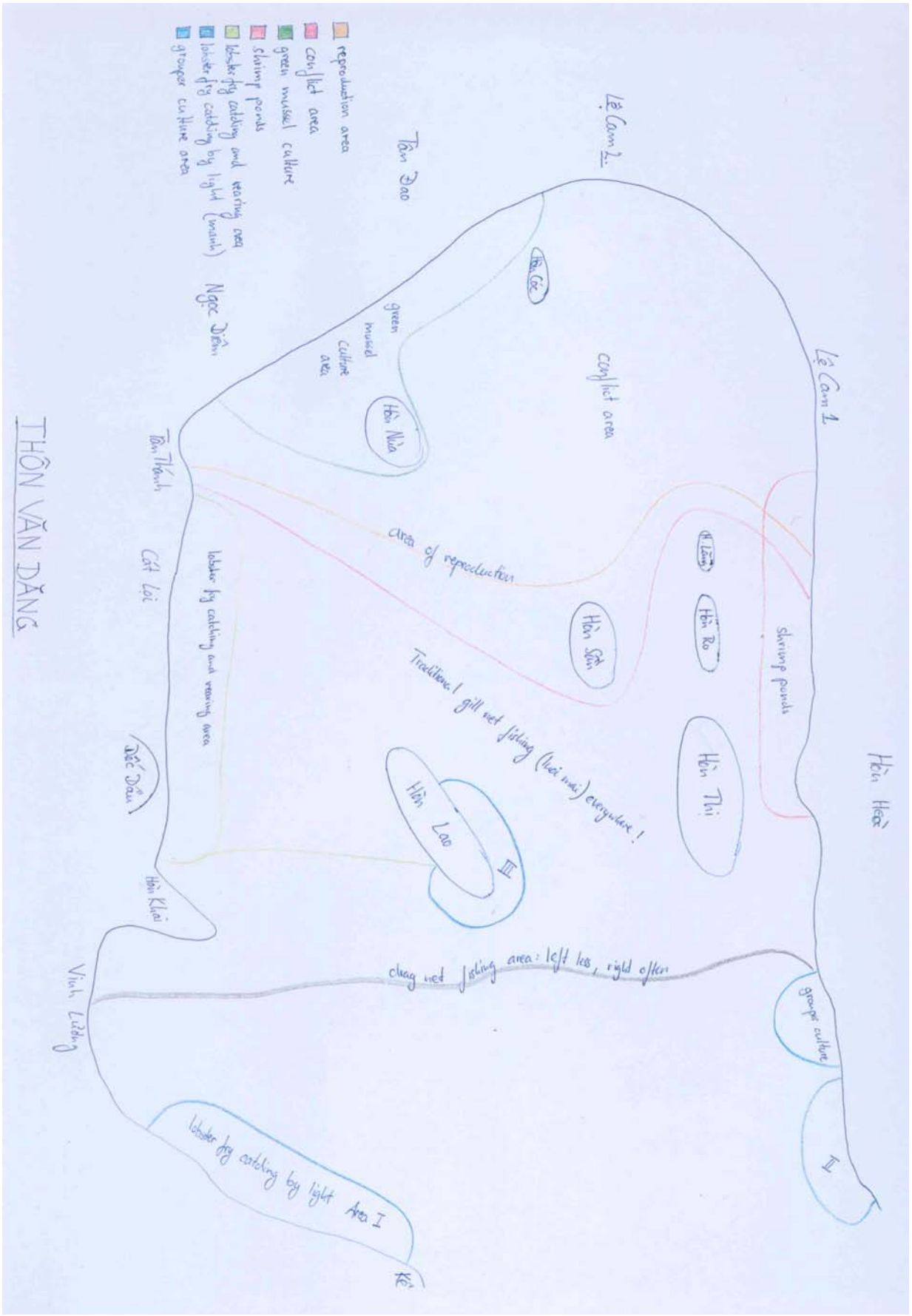
☑ Ở chợ địa phương
local markets
☐ Nhà hàng
Restaurants
☐ Những công ty xuất khẩu thuỷ sản
Sea food exporting companies
☑ Những người trung gian
Middleman

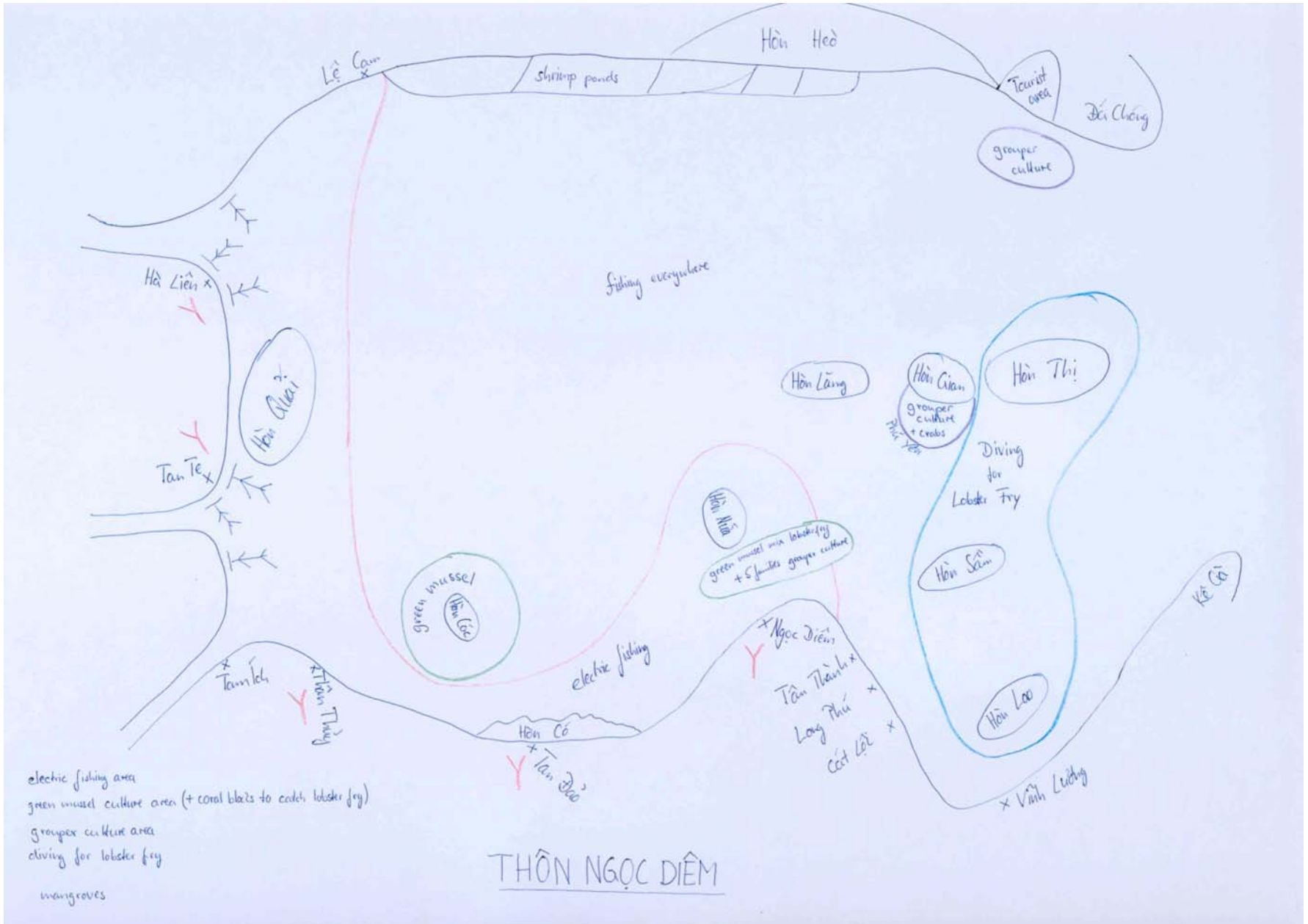
7.3.2 Resource Maps

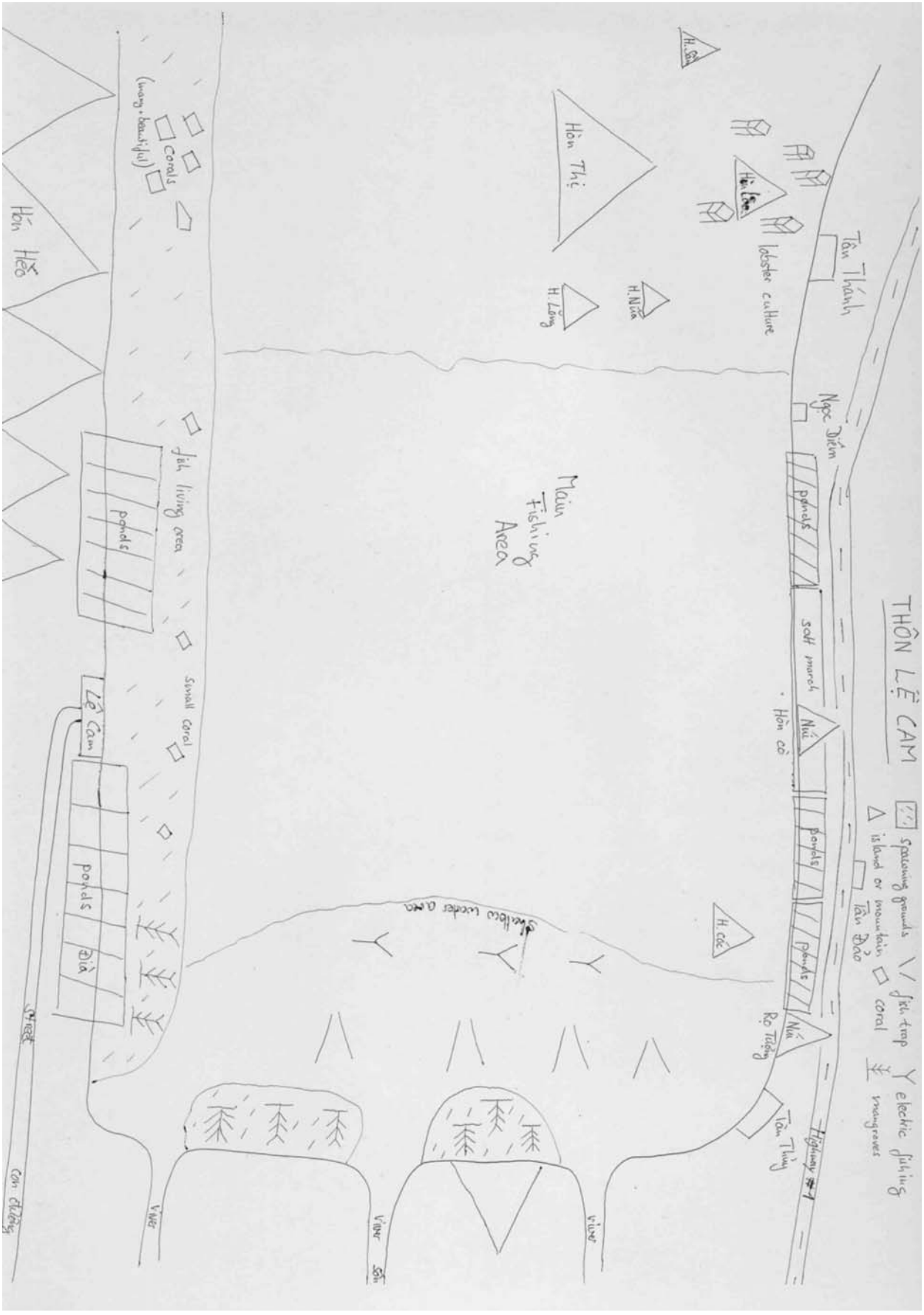


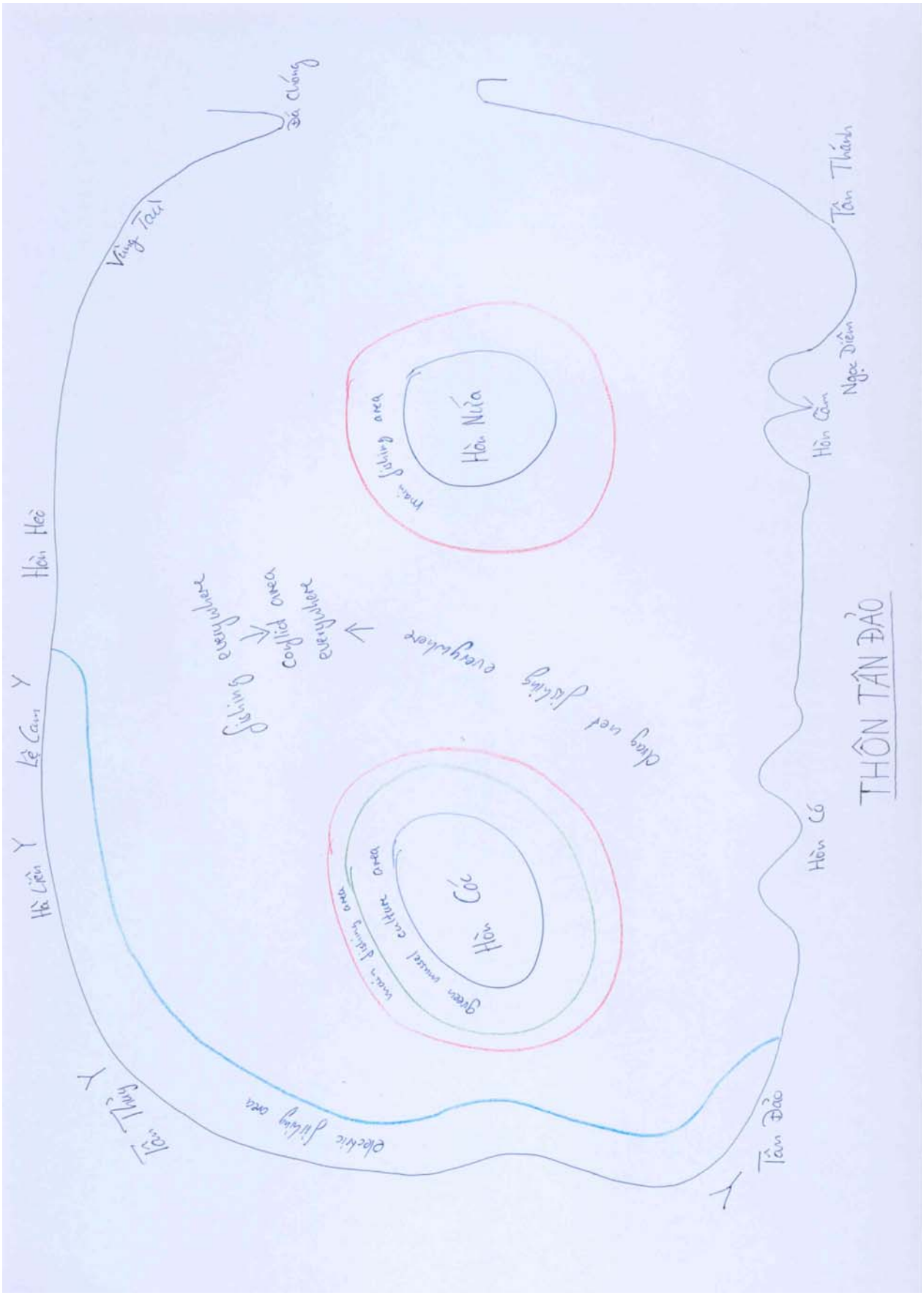

THÔN VÕ TÁNH
Hòn Thị
Hòn Lao
Hòn Khô
Hòn Nưa
Hòn Hèo
Hòn Bà Cửng
Hòn Thay
Hòn Các
Hòn Hàng
Hạ Lôn
Lệ Cảnh
Ngọc Diễn
Vĩnh Lương
Phú Lễ Cải
Cát Lộc
Tân Thành
selection
conflict
reproduction area
green mussel culture area
fishing area for cá nước
chang net fishing area
conflict area
reproduction area

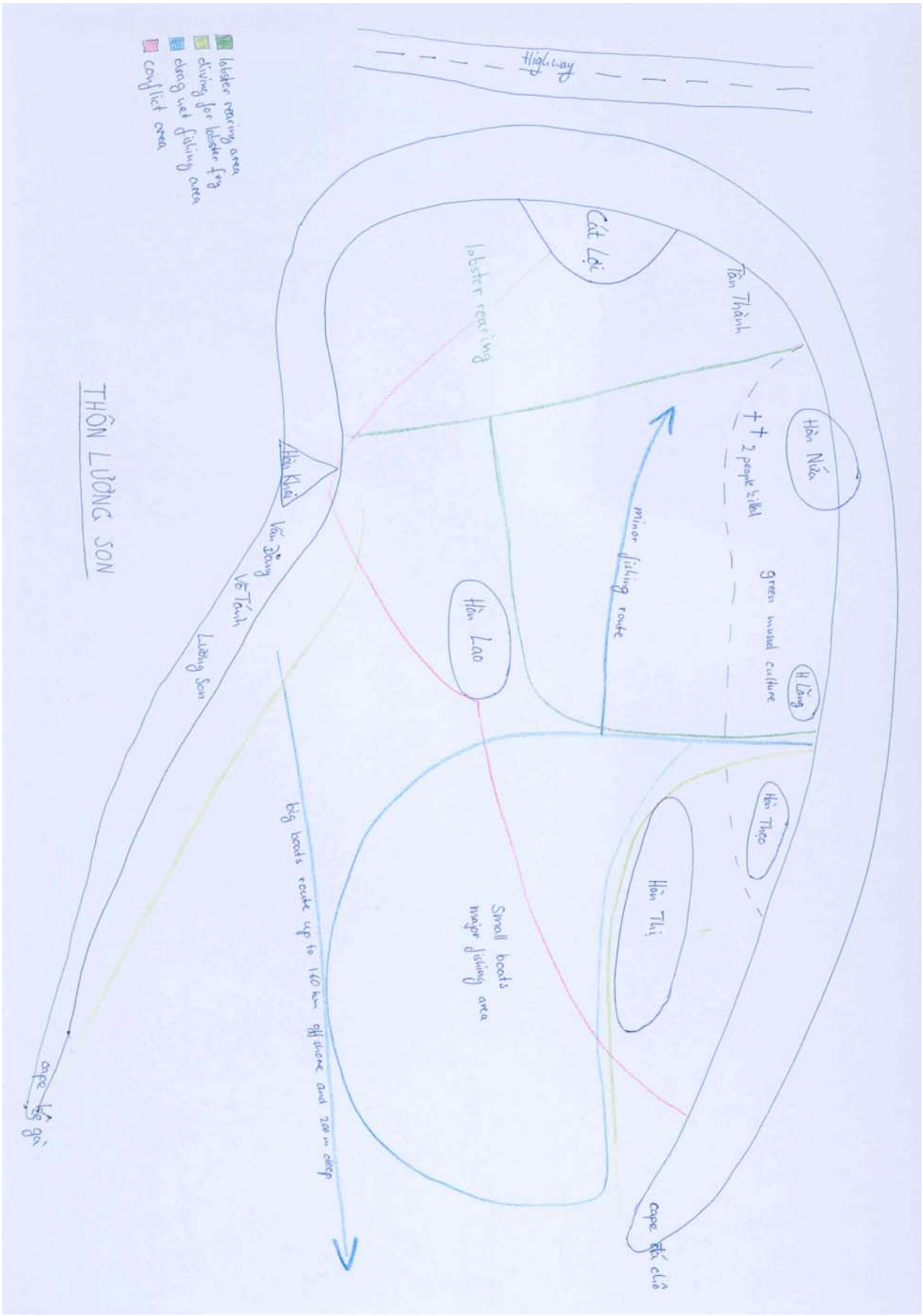

Cửa Phú Hữu
Tân Thắng
Ngọc Dêu
Hòn Cỏ
Tân Đảo
shrimp ponds
Tân Thủy
Lê Cam
Hòn Nưa
Hòn Cóc
Lạch Tân Thủy
Lạch Tam Tòi
shrimp pond
Hòn Hoai
shellfish catching
crab catching / conflict area
fish catching
big shrimp
Nò
Hòn Thị
Hòn Lăng
Lạch Hà Liên
Thôn Hà Liên
Sông Cái
shrimp ponds
Lạch Bàng
Hang Dài
Lê Cam
Heo
Hòn
shellfish catching area
crab catching area & conflict
fish catching area
fish trap, electric / jihi
big shrimp catching area
THÔN HÀ LIÊN

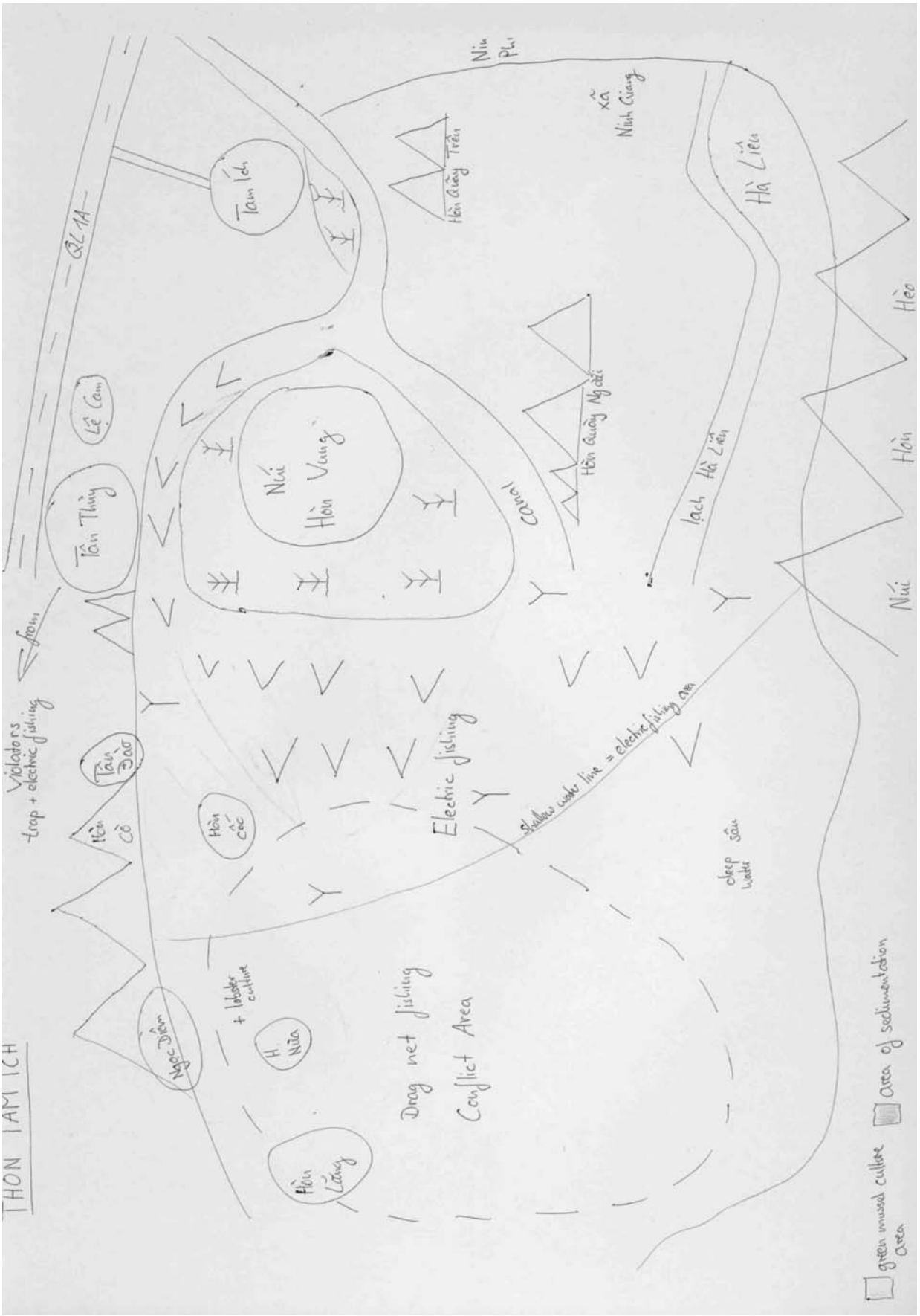

THÔN VĂN ĐĂNG
reproduction area
conflict area
green mussel culture
shrimp ponds
lobster-fly catching and rearing area
lobster-fly catching by light (main)
grouper culture area
Ngọc Diêm
Tân Đạo
Lệ Cam 2
Lệ Cam 1
Hòn Hèo
Hòn Cóc
Hòn Nhà
green mussel culture area
conflict area
Tân Thành
Cát Lợi
Hòn Sắt
Hòn Ro
Hòn Thị
shrimp ponds
area of reproduction
Traditional gill net fishing (hai mai) everywhere!
lobster fly catching and rearing area
Đất Đỏ
Hòn Lao
III
Hòn Khai
Vĩnh Lương
clean net fishing area: left less, right often
grouper culture
Tỷ
lobster fly catching by light Area I
Kê

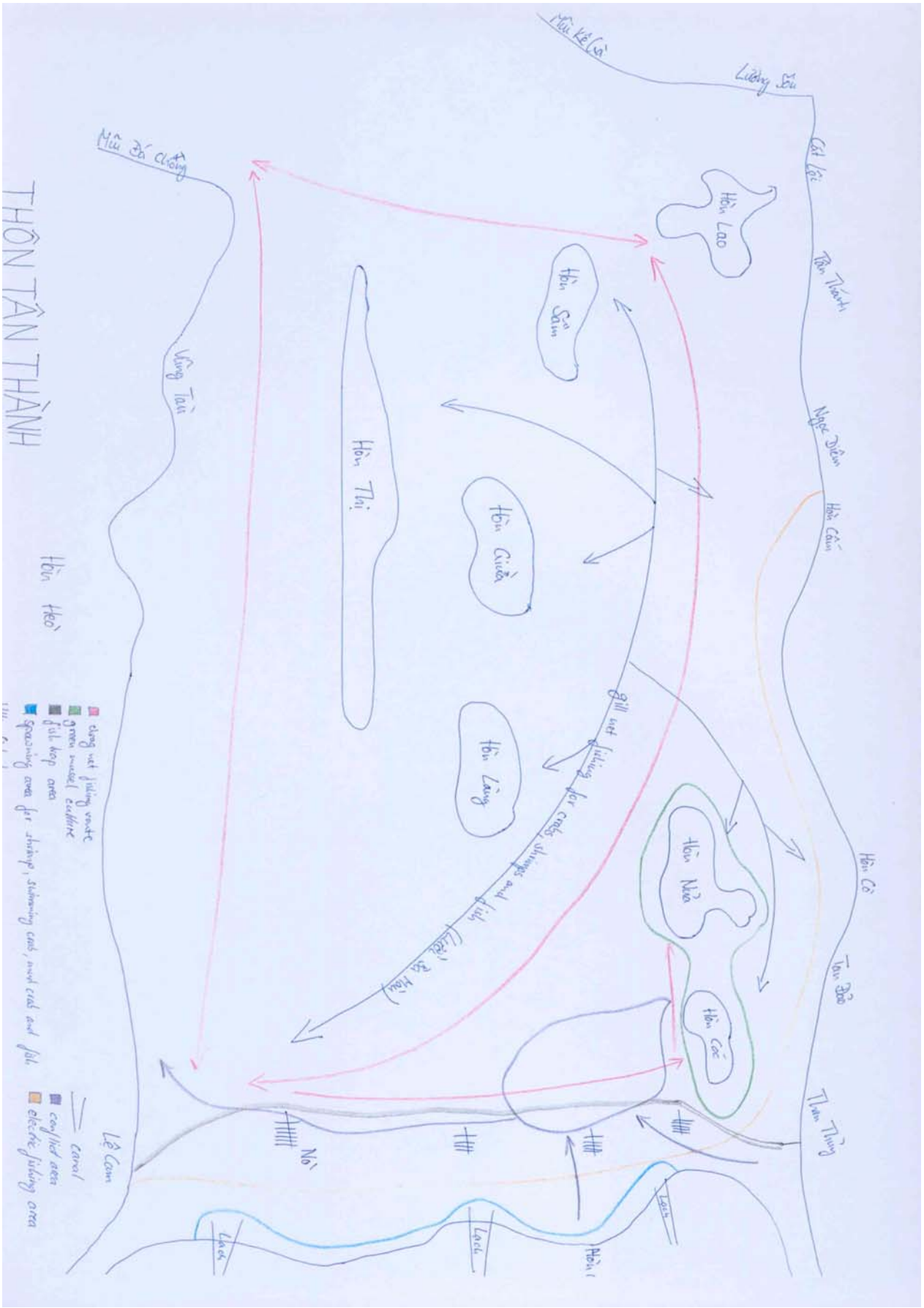

Hòn Heò
Lệ Cam
shrimp ponds
Tourist area
Đá Chồng
grouper culture
Hà Liên
Hòn Chuối
Tan Te
fishing everywhere
Hòn Lăng
Hòn Giam
grouper culture + crabs
Hòn Thị
Diving for Lobster Fry
Hòn Nưa
green mussel mix lobster fry + 5 floating grouper culture
Hòn Sâm
green mussel
Hòn Cóc
electric fishing
Ngọc Diêm
Tân Thành
Long Thủ
cát Lội
Kê Gà
Tam Tích
Thân Thủy
Hòn Cỏ
Tân Đảo
Hòn Lao
Vĩnh Lường
electric fishing area
green mussel culture area (+ coral blocks to catch lobster fry)
grouper culture area
diving for lobster fry
mangroves
THÔN NGỌC DIÊM

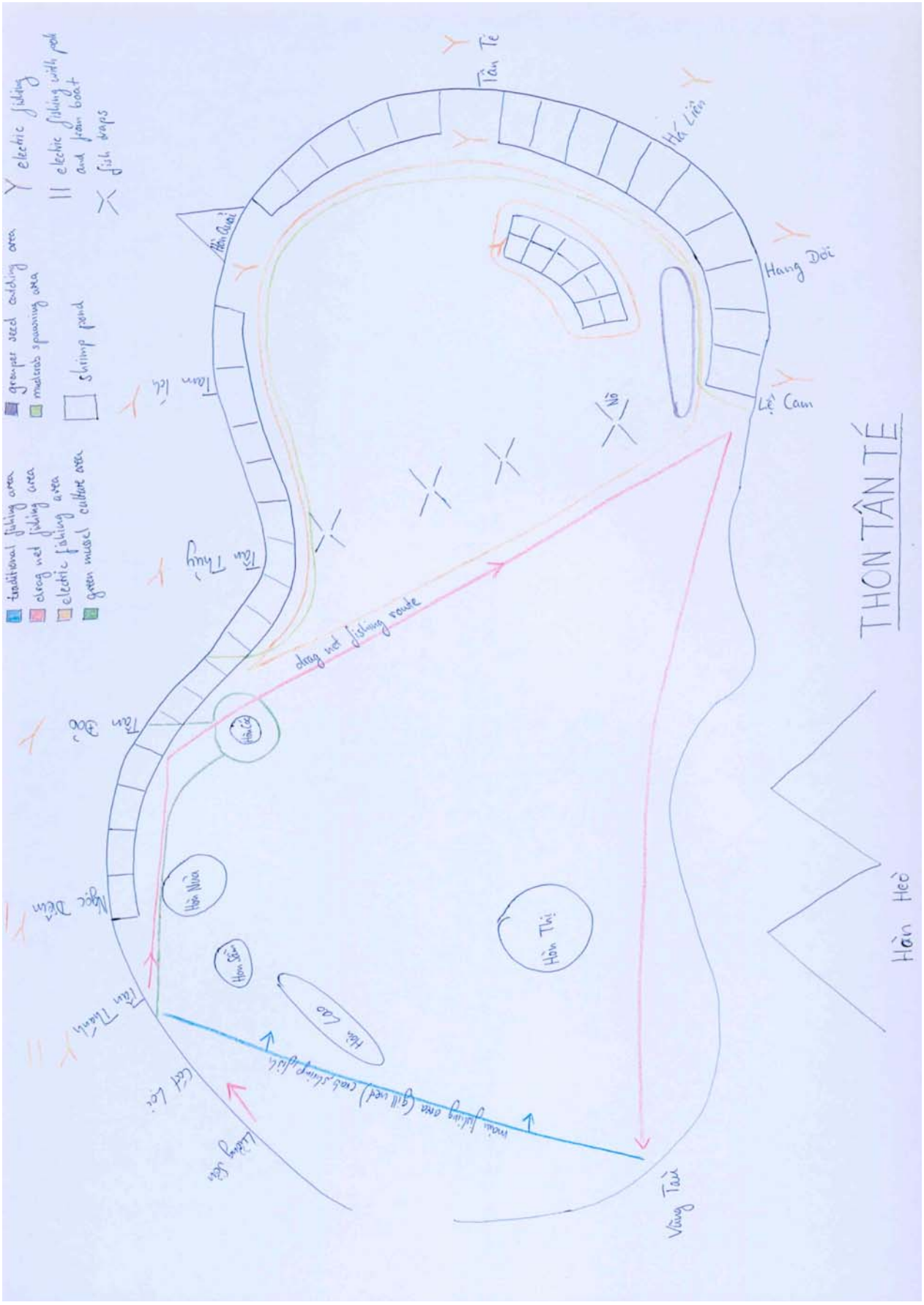

THÔN LỆ CAM
Hòn Hẻo
Hòn Thị
H. Sứa
H. Lồng
H. Nứa
H. Cáo
Tân Thành
Ngọc Diêm
Tân Đảo
Tân Thủy
Lobster culture
Coral
(many beautiful)
Fish living area
Small coral
Main Fishing Area
Lê Cam
Địa
Hòn cò
Rọ Tường
Highway #1
Con Chuồng
Street
Vinh
Vinh
Vinh

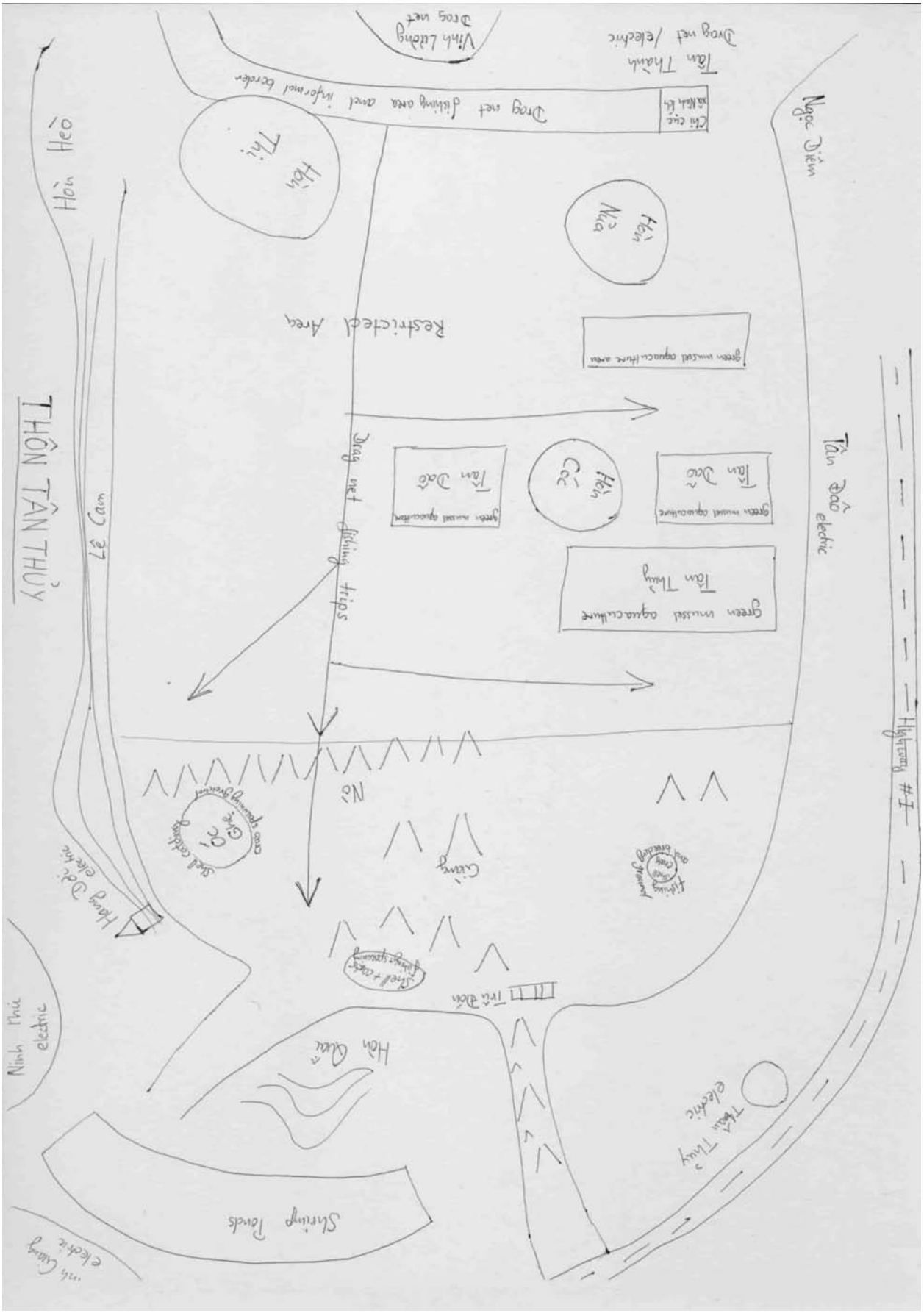

THÔN TÂN ĐẢO
Hòn Cỏ
Tân Đảo
Hòn Cau
Ngọc Diêm
Tân Thành
Hòn Nưa
Hòn Cát
Hòn Lớn
Hòn Bà
Vũng Tàu
Hải Hòa
Hà Liên
Lệ Cam
Electric display area
Main display area
Green mussel culture area
Floating area
Coral area
Floating area
Floating area


lobster rearing area
diving for lobster fry
diving net fishing area
conflict area
Highway
THÔN LƯỜNG SƠN
Cát Lợi
Tân Thành
lobster rearing
Hòn Khói
Hòn Nứa
2 people killed
green mussel culture
H. Lòng
minor fishing route
Hòn Lao
Hòn Thẹo
Hòn Thị
Small boats
major fishing area
big boats route up to 160 km offshore and 200 m deep
cape
Văn Hải
Văn Hải
Việt Trì
Lương Sơn


THON TAM ICH
Violators
trap + electric fishing
QL 1A
Tân Thủy
Lệ Cam
Tân Đào
Tân Ích
Hòn Cỏ
Hòn Các
Ngọc Diêm
Hòn Nia
Hòn Lăng
+ lobster culture
Drag net fishing
Conflict Area
Electric fishing
shallow water line = electric fishing area
deep sea water
Núi Hòn Vung
Canal
Hòn Quảy Ngoài
Hòn Quảy Trên
Nin Phu
xã Ninh Giang
Hà Liên
Hèo
Hòn
Núi
green mussel culture area
area of sedimentation


THÔN TÂN THÀNH
Mũi Kê Gà
Lường Sáu
Cát Lái
Tân Thành
Hòn Lao
Hòn Sâu
Mũi Đá Chồng
Vũng Tàu
Hòn Thị
Hòn Chùa
Hòn Làng
Ngọc Diêm
Hòn Cấm
Hòn Heo
Hòn Nưa
Hòn Cỏ
Tân Dò
Hòn Cát
Tân Thủy
Nò
Lệ Cam
Lạch
Lạch
Lạch
Hòn I
Bãi cát tuồng đẹp cảnh sinh hoạt (Tiệc, Đại Hội)
Spawning area for shrimp, swimming crab, mud crab and fish
Fish trap area
Green mussel culture
Flying net fishing route
Electric fishing area
Concrete area
Canal


THON TÂN TÉ
Tân Tế
Hà Liên
Hang Dơi
Lệ Cam
Hòn Nưa
Hòn Sẻo
Hòn Cao
Hòn Thí
Hòn Heò
Vàng Tàu
drag net fishing route
main fishing area (all year) (only shrimp fishing)
electric fishing
electric fishing with push and foam boat
fish traps
grouper seed catching area
mollusks spawning area
shrimp pond
traditional fishing area
drag net fishing area
electric fishing area
green mussel culture area


THÔN TÂN THUỶ
Hòn Hèo
Cảng cá
Ngọc Diêm
Tân Đảo
Highway #1
Vịnh Lương
Trong net
Tân Thành
Trong net /electric
Chùa cực lạc
Trong net floating area and infrared border
Hải Thị
Hải Nia
Restricted Area
Green mussel aquaculture area
Drag net fishing this side
Tân Thuỷ
Green mussel aquaculture
Tân Đảo
Green mussel aquaculture
Tân Đảo
Hải Cỏ
Nà
Cảng
Trạm điện
Hàn Quốc
Thuỷ Tiên electric
Shrimp lands
Ninh Thuỷ electric
Hòng Đức electric

7.3.3 Quotation ID's

1:1 Codes: [Local knowledge/biological characteristics]
After this the fish traps are drawn near the river mouths. Some areas with mangroves are drawn and the electric fishing area is pointed out. The mangrove area is also the spawning ground. Next is the coral area, first the entire coastline that has coral and then the area which has many and beautiful coral. They coral area serves as the fishing growing up area.
3:1 Codes: [Traditional fish trap]
The traditional traps (Gian) are very different and with the boat you can easily drive through them. The new traps are totally enclosed by a fine mesh, so it is impossible to drive through them.
3:2 Codes: [Collect shells]
Later on the way back the tide was down further and we saw many people using rakes to collect mussels (So long).
3:3 Codes: [Illegal fishing/Electric fishing]
On the way we also met a fishermen using electric fishing equipment.
3:4 Codes: [Crab fishing]
There are plenty of fishermen setting and controlling crab nets and traps.
3:5 Codes: [Positive externalities of green mussel culture]
Around Hon Coc is a lot of green mussel culture and the positive side effects cannot be overseen. Big ships cannot pass the area easily because of the many underwater constructions growing the green mussel. A fisherman using a cast net between the wooden polls caught a large number of fish with on cast and many were of rather big size. When purchasing green mussels from one of the farmers there, one could see many small fish schools moving in between the wooden stilts used to support the green mussels.
3:6 Codes: [Community (self-help) organization to initiate natural resource management]
There are also quite a few sites where one can see replanting efforts of mangroves. However, in some places they look very well and seem to develop well in other places they look weak and are stagnating in growth.
3:7 Codes: [Community (self-help) organization to initiate natural resource management]
There is a considerable amount of mangroves around the sides of the shrimp ponds and on the seaside of Hon Vung.
3:8 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
Nevertheless one can imagine which large numbers of them have been cut to create the large are covered with shrimp ponds.
3:9 Codes: [Sedimentation due to the destruction of mangroves]
The shallow area has been deeper in the past, maybe 2,5 meters, now only about 1,5 meters.
3:10 Codes: [Traditional gill net fishing]
Overall the bay seems bustling with people and everybody is pursuing some sort of fishing method using small un-motorized boats. Indeed, we are the only motorized boat on the bay for 3 hours.
3:11 Codes: [Positive externalities of fish trap structures]
The area covered with the new fishing traps is not suited for drag net fishing.
3:12 Codes: [Village conflicts over fishery resources]
Interestingly the old men tell me that drag net fishing is not done anymore in the back of the bay, because the villagers got angry with the violators and forced them out of the area again. Nowadays, they fish only until Hon Thi and not further.
3:13
Big fish like the ca nuoc (dolphin) were plentiful in the past, also in the back of the bay but now can only be found around Hon Thi.
3:14 Codes: [High potential of coastal fishery resources]
Overall the bay seems bustling with people and everybody is pursuing some sort of fishing method using small un-motorized boats.
4:1 Codes: [Village conflicts over fishery resources]
The drag net fishing area is drawn and their intrusion into their fishing area. They violate every

day.
4:2 Codes: [Village conflicts over fishery resources]
Only 6 days ago they had some conflict with the drag net fishermen, who came into the area to destroy some No with their boat. Because they usually come at night and also have a big boat the villagers are helpless.
4:3 Codes: [Illegal fishing/Electric fishing]
There are about 100 electric fishermen and they go fishing in the same area as the No. They come from various villages.
4:4 Codes: [Illegal fishing/Drag net]
Drag net fishing comes mainly from xa Vinh Luong and Tan Than, about 10 to 50 boats.
4:5 Codes: [Government fails to enforce fishing regulations]
When drag net goes on and the Chi cuc wants to stop them they use radio to inform each other and disappear.
4:6 Codes: [Corruption]
Also if they would catch one and impose the high fee, how can they make some money in the future? There seems to be a high number of corruptions.
4:7 Codes: [Community (self-help) organization to initiate natural resource management]
They cannot follow the Ha Lien example, because the xa leader doesn't agree.
4:8 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Drag net and electric fishing is the biggest problem.
5:1 Codes: [Village conflicts over fishery resources]
The area is marked where 2 people got killed, one in 1987 and one in 1992.
6:1 Codes: [Illegal fishing/Drag net]
Distinguishing the drag net fishing area takes some time, basically because many point out that they fish all of Dam Nha Phu. Later a border is drawn to separate an intensive drag net fishing area and the back of the bay, where they go fishing irregular due to much higher risk of getting punished.
6:2 Codes: [Village conflicts over fishery resources]
Next are some areas of conflict mainly with people from Ngoc Diem, Le Cam and Ha Lien. One area around two islands looks like having particular interest by both groups, especially for traditional fishing methods.
6:3 Codes: [Local knowledge/biological characteristics]
The back of the Bay they all confirm is the breeding and spawning ground for fish and crab, in DNP.
6:4 Codes: [Illegal drag net fishing destroys the sea floor through dredging]
5 years ago they used to have pearl oyster culture but they stopped culturing, because the conditions were getting unsuitable. The reason was too much turbid water from the drag net fishing boats stirring up the sea floor.
6:5 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)] [Trash fish]
After the drawing of the map we have a long discussion over undersized fish and drag net fishing and net sizes. They mistake illegal fishing practices, i.e. drag net fishing with the possibility to modify the net size in order to reduce the by-catch. They mention that when two boats go fishing, pulling a drag net they catch around 100 of these plastic bags.
6:6 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)] [Responsibility for fishery resources is at district level]
They agree if they could stop together using different net sizes they could change something but argue their wives will complain because they do and others don't.
They also believe it is the job of the chi cuc to do this.
6:7 Codes: [Poverty as reason for breaking laws and regulations]
Basically the say that hunger and their basic needs, drive them to go out and fish and that there is no way for them to change this behavior in the future.
6:8 Codes: [Market structures/Fish sales]
An area follows in which people fish for ca mai, a small fish for export (12000 VND/kg).
8:1 Codes: [Village conflicts over fishery resources]
Crab and shrimp fishing goes on everywhere inside the bay and the conflict area therefore is also

everywhere.
10:1 Codes: [Local knowledge/biological characteristics]
In the shallow water they find many small mud crabs so they assume that this is the spawning area.
10:2 Codes: [Illegal fishing/Electric fishing]
In the shallow water they find many small mud crabs so they assume that this is the spawning area. It is also the electric fishing area.
10:3 Codes: [Illegal fishing/drag net equiped with electric gear]
Violators come from almost every village but Gia nui (drag net with electric fishing equipment) comes from Tan Thanh and Ngoc Diem.
11:1 Codes: [Shrimp fishing]
Shrimp can be caught everywhere but the big ones mainly in the deeper water of the Lagoon.
11:2 Codes: [Illegal fishing/Electric fishing]
Electric fishermen come mainly from Hang Doi and Tan Dao but also from the village of Phu Nuu, which lays inlands.
11:3 Codes: [Village conflicts over fishery resources]
There was a battle in front of Ha lien village between traditional vs. electric fishing.
11:4 Codes: [Community (self-help) organization to initiate natural resource management]
They went to the court of Khanh Hoa to solve this and after that most electric fishermen in ha lien stopped.
11:5 Codes: [Illegal fishing/Electric fishing]
Today there are about 2 families left.
12:1 Codes: [Illegal fishing/drag net equipped with electric gear]
When drawing the electric fishing area, he mentions that there is no electric drag net fishing nowadays any more.
12:2 Codes: [New fish trap]
He thinks the No destroys a lot of the fishery resources, because they are close to the river mouths and this is the spawning ground for most marine resources.
13:1 Codes: [Village conflicts over fishery resources]
Lung Son fishermen used to come into their fish waters.
13:2 Codes: [Illegal fishing/Drag net]
Lung Son fishermen used to come into their fish waters and used large dragnets (highly destructive).
13:3 Codes: [Fishing regulations/illegal fishing methods]
Today only small boats are allowed into Nha Phu Bay.
13:4 Codes: [Illegal fishing/Drag net]
Today only small boats are allowed into Nha Phu Bay some using small drag nets (not allowed).
13:5 Codes: [Village conflicts over fishery resources]
People from Ninh Ich went to Luong Son and one small boy was killed (fish war) "but since then everybody lives in peace".
13:7 Codes: [Lobster fry catching/Lift net & light]
100 fishermen catch lobster fry (tom hum) - 100 boats.
13:8 Codes: [Green mussel cultivation]
few cultivate green mussel (vem xanh) for their shells
6000 VND/kg fresh
10000 VND/kg shells
13:11 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
There are five levels of governance (peoples committee) but the government from Vietnam recognizes only four.
13:12 Codes: [Responsibility for fishery resources is at district level]
The political leader from Ninh Ich (xa-level) is responsible for the “protection of land and sea”.
13:13 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
The peoples committee elects the village leader from the village peoples committee at the xa level (xa=municipality). There is also a peoples committee at the village level (thonh=village) but it doesn’t elect the village leader.

13:14 Codes: [Government structure/municipality level]
Persons from the xa-level peoples committee can also be in the thonh-level peoples committee and vice versa.
13:15 Codes: [Government structure/village level]
Besides the village leader there is also one police officer in each village.
13:16 Codes: [Government structure/district level]
In the district of Ninh Hoa there are 27 village departments. [Huyen > Xa > Thon]
The political leader is elected by the people committee and approved by the districts peoples committee (Huyen=District).
13:17 Codes: [Government structures and organization]
Tan Thanh lies in the village department of Ninh Ich. The political leader is also in charge of residence affairs (passports, registration,…) On the other hand there is also a peoples committee president on the xa-level and he is responsible for taxation, land sales,…
13:18 Codes: [Population and households]
1000 inhabitants and 220 households
13:19
"but since then everybody lives in peace"
14:1
"100% of fishermen used to fish with nets, nowadays only 10% do, the rest is into green mussel culture (vem xanh), crab fishing and various aquaculture activities."
14:2 Codes: [Decline of traditional fishing methods/gear net]
"100% of fishermen used to fish with nets, nowadays only 10% do
14:3 Codes: [Increase of aquaculture activities]
the rest is into green mussel culture (vem xanh), crab fishing and various aquaculture activities."
14:4 Codes: [Green mussel cultivation] [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)]
green mussel culture (vem xanh)
14:5 Codes: [Crab fishing]
crab fishing
14:9 Codes: [Blood cockle fishing] [Decline of coastal fishery resources] [New market opportunities (shrimp, lobster,blood cockle, green mussel, grouper)]
Blood cockle (So huyet) played a role for two years. In 2001, 500 fishermen where fishing for it. It was easy harvested and only two years later stocks had disappeared completely.
14:10 Codes: [High potential of coastal fishery resources]
The village leader emphasizes the high potential of natural resources in Nha Phu Bay.
14:12 Codes: [Community (self-help) organization to initiate natural resource management] [Public awareness building by individuals]
He has been on Khanh Hoa TV many times and visited Hanoi several times to spread the message that electric fishing and aquaculture activities are destroying the natural resources.
14:13 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [Increase of aquaculture activities]
Electric fishing and aquaculture activities are destroying the natural resources.
14:14 Codes: [Fishing regulations/illegal fishing methods]
In Vietnam three common fishing techniques are banned:

1. Explosive fishing
2. Cyanide fishing
3. Electric fishing

14:15 Codes: [Fishing regulations/fines] [Illegal fishing/Electric fishing]
Today electric fishing is still very common amongst fishermen in Nha Phu Lagoon, although the fine is 2 million VND and all equipment is confiscated.
14:17 Codes: [Fishing regulations/net size]
Also the mesh size of the fishing net is not allowed to be smaller than 1,8 cm (< 1,8 cm).
14:19 Codes: [Illegal fishing/Net size]
The mesh that is used is very fine, so every size is caught.
14:20 Codes: [Decline of coastal fishery resources]
Electric fishing kills the fish and also the mesh that is used is very fine, so every size is caught.
14:21 Codes: [Village conflicts over fishery resources]
From 1994 to 1999 there has been a war between Luong Son, Tan Thanh and Tan Thuy, although Luong Son and Tan Thanh have acted together. Two people were killed a small boy and his

father, with a stone around his neck. He, the village leader, was going to be arrested, because of pressure on the province government from Luong Son and Tan Thanh. The fishermen supported him and he was left in peace.

14:24 Codes: [Market structures/Fish sales]

Crab: (red crab) 18000VND/kg
(green crab) - male 40000 VND/kg, - female 80000 VND/kg

15:1 Codes: [Population and households]

800 inhabitants and 154 households

15:2 Codes: [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)] [Shrimp culture]

50 households aquaculture (tom su)

15:3 Codes: [Traditional gill net fishing]

250 small boats fishing with gill net

15:4 Codes: [Laborer and trading]

the rest laborers and trading

15:5

Before 2000 shrimp culture was good

15:6 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]

Before 2000 shrimp culture was good, since then many problems.

15:7 Codes: [Village conflicts over fishery resources]

There have been many complains about excessive drag net use by fishermen from Luong Son.
1998 some concrete pillars were sunk in the bay to destroy dragnets with no effect.

15:8 Codes: [Government fails to enforce fishing regulations]

1998 some concrete pillars were sunk in the bay to destroy dragnets with no effect.

15:9 Codes: [Corruption] [Government fails to enforce fishing regulations]

Enforcement is not working due to corruption.

15:10 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)] [Responsibility for fishery resources is at district level]

The initiative was with the help from the HDND in Nha Trang.

15:11 Codes: [Illegal fishing/Drag net]

There have been many complains about excessive drag net use by fishermen from Luong Son.

16:1 Codes: [Decline of coastal fishery resources]

“10 years ago there were 100% resources today there are 2% left.”

16:2 Codes: [Population and households]

220 households

16:3 Codes: [Green mussel cultivation] [High entry costs into aquaculture prevent alternative income development]

- Green mussel (vem xanh) culture is very common but many poor cannot afford the culturing facilities
- fry 10000 VND/kg (about 20)

16:4 Codes: [Shrimp fishing]

- land shrimp (tom dat) can be caught all year around, with about 3 to 5 kg in an average night per person
- 40000 VND/kg

16:5 Codes: [Community (self-help) organization to initiate natural resource management] [Government fails to enforce fishing regulations] [Public awareness building by individuals]

2002 a group was formed in Ha Lien to fight electric fishing. In one meeting the local fishermen were persuaded about the necessity to ban electric fishing and their awareness was raised.

16:6 Codes: [Responsibility for fishery resources is at district level]

A meeting at the peoples committee in Ninh Ha (xa) gave them the authority.

16:7 Codes: [Community (self-help) organization to initiate natural resource management] [Fishing regulations formulated by fishermen/village level]

There are about 20 people in the group, called “To bao ve” and they control all of Dam Nha Phu and take away the equipment.

16:8 Codes: [Low entry costs into illegal fishing activities/electric fishing]

The equipment used costs about 500 to 600000 VND and the voltage used is up to 300 volts.

16:9 Codes: [Community (self-help) organization to initiate natural resource management] [Fishing regulations formulated by fishermen/village level] [Public awareness building by individuals]

Today new emphasis lies on replanting of mangroves (cay duoc) and trying to keep people from

catching small crabs.
16:10 Codes: [Increasing fishing pressure] [Mud crab culturing] [Mud crab fry catching] [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)]
Every size crab is caught today and small ones are ongrown in ponds.
17:1 Codes: [Devolution of land management/ownership] [Increase of aquaculture activities]
In the future there will be 87 ha land to give to the two villages Tan Te and ha Lien for aquaculture.
18:1 Codes: [Government fails to enforce fishing regulations] [Illegal fishing/Drag net]
Drag net fishing: mainly in Nha Phu Bay all year around (fish, crab, lobster)
18:2 Codes: [Off shore fishing/Hook and line]
Hook & line: mainly Nha Phu Bay but further out (shark and other big fish)
18:3 Codes: [Diving] [Seasonal fishing techniques]
Diving: 6 months a year, then 20 days a month, he goes all the way to Hon Tre Island for diving, especially in the winter too rough sea conditions so he swaps to gill net fishing.
18:4 Codes: [Off shore fishing/Gill net (Mackerel)]
Gill net: all year around, fishes mainly in the open sea, labor intensive, so he does it, because he has a big family (ca thu=mackerel)
18:5 Codes: [Lobster fry catching/Lift net & light] [Seasonal fishing techniques]
Lift net: especially with light is used to catch lobster fry
From November to January it is the season to catch Lobster fry and everybody does it.
18:7 Codes: [Income]
Average income about 1 million VND a month!
18:8 Codes: [Fishing regulations/fishing area]
Everybody can fish everywhere in Khanh Hoa Province.
18:9 Codes: [Fishing regulations/license]
For about 50000 VND a license for neighboring fish waters in the other Provinces can be bought from the government in Nha Trang. It is valid for 3 months.
18:10 Codes: [Government failure to enforce laws and regulations] [Government regulations/Taxation on boats]
There is a tax that has to be paid per boat but so far it has never been collected.
18:11 Codes: [Illegal fishing/Drag net]
Although using drag nets
18:12 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources] [Increase of aquaculture activities]
Fishermen in Tan Thanh see the major destruction of the fishery resources in Nha Phu bay caused by the destruction of mangroves for shrimp pond development
18:13 Codes: [Local knowledge/biological characteristics] [Local perception of coastal habitats/Mangroves]
They argue that the mangrove where the breeding grounds for the fish and crabs.
18:14 Codes: [Local perception of livelihoods/pessimistic]
Their outlook into the future is very pessimistic.
18:15 Codes: [Government failure to enforce laws and regulations] [Government regulations/Shrimp pond water quality and saftey] [Shrimp pond effluence as reason for the decline of coastal fishery resources]
They see major threats from untreated shrimp pond effluence entering the bay (some chemicals toxic to fish are used in the shrimp ponds and then drained into the bay).
18:16 Codes: [Lack of alternative income] [Local perception of livelihoods/Poverty has increased]
They feel that poverty will increase, if no alternative income can be developed.
18:17 Codes: [Fishing regulations formulated by fishermen/village level]
Compulsory shrimp pond effluence treatment

- Mangrove replanting
- Big ship for off shore fishing (needs to be in conjunction with financial support)
- Land allocation (currently they own no land and the only area they had used for lobster culturing, was taken away to develop a tourist resort) suitable for lobster culture

18:18 Codes: [Local INRM approaches/Compulsory shrimp pond effluence]
Compulsory shrimp pond effluence treatment
18:19 Codes: [Local INRM approaches/Mangrove replanting]
Mangrove replanting

18:20 Codes: [Local INRM approaches/Off shore fishing development]
Big ship for off shore fishing (needs to be in conjunction with financial support)
18:21 Codes: [Local INRM approaches/Land allocation for aquaculture]
Land allocation (currently they own no land and the only area they had used for lobster culturing, was taken away to develop a tourist resort) suitable for lobster culture
18:22 Codes: [Government failure to enforce laws and regulations] [Poverty as reason for breaking laws and regulations]
Legislation is not effective, because people are too poor and also the repayment of loans brings them to break the law.
18:23 Codes: [Fishing regulations/fishing area]
Drag net is only allowed in water deeper then 25 meter.
18:24 Codes: [Fishing regulations/net size]
Drag net is only allowed in water deeper then 25 meter and the net size must be bigger then 4 cm.
18:25 Codes: [Government fails to enforce fishing regulations]
There has never been anybody to control the fishing nets.
19:1 Codes: [Population and households]
1433 inhabitants in 243 households
19:2 Codes: [Fishermen]
90% Fishermen
19:3 Codes: [Laborer and trading]
5% Traders
19:5 Codes: [New fish trap]
About one month ago a new type of great fish trap was introduced to the area (no dang dey) which covers a large area.
19:6 Codes: [Traditional gill net fishing]
They mostly use gillnets (luoi can) to catch swimming crab and fish.
19:7 Codes: [Crab fishing]
They also use traps for crabs.
19:8 Codes: [Illegal fishing/Net size]
The net used to build the trap is very fine 0,5 mm
19:9 Codes: [Decline of traditional fishing methods/gear net] [Increasing fishing pressure]
Within one month 100 traps were set up despite its negative effects and also it´s huge dimensions blocking passages for boats.
19:10 Codes: [Government fails to enforce fishing regulations] [Government fails to keep up with new developments]
Within one month 100 traps were set up despite its negative effects and also it´s huge dimensions blocking passages for boats. The xa Ninh Loc and Ninh Ha are watching this new technology carefully and will take some action in the near future with help of the sea police.
19:11
About one month ago a new type of great fish trap was introduced to the area (no dang dey) which covers a large area. The net used to build the trap is very fine 0,5 mm and they catch everything with it. Within one month 100 traps were set up despite its negative effects and also it´s huge dimensions blocking passages for boats. The xa Ninh Loc and Ninh Ha are watching this new technology carefully and will take some action in the near future with help of the sea police. Traps set up in the river mouth will be completely removed and the others will be controlled what mesh size they are using. About 10 boats from newly settled outsiders from Ba Ngoi, (Cam Ranh Bay), Dong Bo and Binh Tri Thien (Hue/Tam Giang Lagoon) have introduced this new technology.
19:12 Codes: [Fishing regulations/fishing area]
Traps set up in the river mouth will be completely removed
19:13 Codes: [Fishing regulations/net size]
and the others will be controlled what mesh size they are using.
19:14 Codes: [New developments brought in by outsiders]
About 10 boats from newly settled outsiders from Ba Ngoi, (Cam Ranh Bay), Dong Bo and Binh Tri Thien (Hue/Tam Giang Lagoon) have introduced this new technology.
19:15 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
The government has started a mangrove replanting program but 1000 newly planted plants died

shortly after planting.
19:16 Codes: [High entry costs into aquaculture prevent alternative income development] [Social exclusion/marginalisation through village elites]
The powerful persons in Vietnam own land in the whole country, so most of the shrimp ponds across from Tan Thuy belong to outsiders.
19:17 Codes: [Devolution of land management/ownership] [No participation in decision-making and policy formulation on village level (political disempowerment)]
The government has passed a new law to allocate land rights in coastal areas but people are not registering.
19:18 Codes: [Devolution of land management/ownership] [Fishing regulations/aquaculture area claims]
Everybody is promised 1000 sqm and there will have to be some tax paid for the land but very low.
19:20 Codes: [No incentives as reasons for the failure of the devolution of land management/ownership]
Reasons people are not responding are: rights may not be guaranteed; people can continue in the common practice; some areas are not very suited and if everybody registers land will be given away without the right to choose, so you might end up with a bad part of land; people don´t want to pay taxes.
19:23 Codes: [High potential of coastal fishery resources] [Increase of aquaculture activities]
In 1000 sqm about 1000 pillars can be set up with green mussel (vem xanh).
19:24 Codes: [High entry costs into aquaculture prevent alternative income development]
Initial investment for one pillar is 20000 VND. Another 20000 VND for fry
19:25 Codes: [Income]
Initial investment for one pillar is 20000 VND. Another 20000 VND for fry and after 6 months the harvest can be sold for 80000 VND. The net benefit is 60000 VND per pillar.
19:26 Codes: [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)]
Although some marketing problems were named.
19:27 Codes: [Family remittance] [Income]
5% Rich (35% have relatives in America)
20:1 Codes: [Fishermen]
70% fishermen
20:2 Codes: [Laborer and trading]
30% traders, aquaculture
20:3 Codes: [Laborer and trading] [Women]
Women do housework, sell fish on the market and prepare nets.
20:4 Codes: [Traditional gill net fishing]
Most people use gill nets everyday (Luoi can) to catch small fish.
20:5 Codes: [Market structures/Fish sales]
They are soled on the market of Ninh Ha.
20:6 Codes: [Income]
Maybe 100 boats per night average 5 million VND together.
20:7 Codes: [Illegal fishing/Drag net]
Dragnets are used by people from Tan Thanh and Luong Son.
20:8 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources] [Increase of aquaculture activities]
95% of all mangroves have been cleared for the construction of shrimp ponds. Shrimp ponds are private land, so there is no incentive to regrow mangrove.
20:9 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
Since 3 years there are many disease problems, so the shrimp production is very low. Many people have failed a third time and are bankrupt now.
20:11 Codes: [Devolution of land management/ownership] [Increase of aquaculture activities] [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)] [Social exclusion/marginalisation through village elites]
Before the ponds the land was common property but the government encouraged aquaculture and pond building and participants received legal ownership documents.
20:12 Codes: [Local perception of livelihoods/Poverty has increased]
Since 5 years poverty is increasing.
20:13 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]

- because of effluence from aquaculture

20:14 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]

- diseases in shrimp

20:15 Codes: [Decline of coastal fishery resources]

- decrease in fishery resources

20:16

Since 5 years poverty is increasing:

- because of effluence from aquaculture
- diseases in shrimp
- decrease in fishery resources

20:17 Codes: [Illegal fishing/Electric fishing] [New developments brought in by outsiders]

12 people in the village use electric fishing. It was introduced 4 years ago.

20:18 Codes: [Illegal fishing/drag net equipped with electric gear]

They fish with poles between two boats affecting a huge area causing a lot of damage and fishing in deep water mainly on the bottom (gie nhui).

20:19 Codes: [Government fails to enforce fishing regulations]

Quite a few people got caught.

20:21 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]

1. Destroy mangrove

20:22 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]

2. Drag net

20:23 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]

3. Electric fishing

20:24 Codes: [Population increase as reason for the decline of coastal fishery resources]

4. Population increase

20:25 Codes: [Environmental pollution as reason for the decline of coastal fishery resources] [Shrimp pond efluence as reason for the decline of coastal fishery resources]

5. Environmental pollution

20:26 Codes: [Land ownership vague]

Fish traps are not used, because the sea bottom belongs traditional to other owners from different Xas.

20:27 Codes: [Community (self-help) organization to initiate natural resource management]

An attempt from Ninh Loc to stop illegal fishing, was turned down by Ninh Hoa.

20:28 Codes: [Fishing regulations formulated by fishermen/village level]

The request was to provide a fast vessel and in change to stop illegal fishing in one year.

20:29 Codes: [Effects of drag net fishing/Destruction of aquaculture structures]

Dragnets destroy also underwater cages.

20:30 Codes: [Replanting of mangroves difficult due to land scarcity]

Shrimp ponds are private land, so there is no incentive to regrow mangrove.

20:31 Codes: [Illegal fishing/Electric fishing]

The less harmful technique is (xung duo) which is used in shallow water an which is quite common.

21:3 Codes: [Land tenure]

Most of the land around him is least from the government for 20 years.

21:4 Codes: [Increase of aquaculture activities]

In the past some of the land was used for agriculture but salinisation destroyed the soil and shrimp ponds were built.

21:5 Codes: [High entry costs into aquaculture prevent alternative income development] [Social exclusion/marginalisation through village elites]

Former poor farmers who hadn´t have the money for shrimp pond construction re-least their land to people from Ninh Hoa or Nha Trang which invested in shrimp farming.

21:6 Codes: [Polyculture/Crabs and shrimp]

The crabs polycultured with shrimp like low salinity (5-10°) but if it rains too much they will die.

21:7 Codes: [New market opportunities (shrimp, lobster,blood cockle, green mussel, grouper)]

Big crabs are soled to traders and exported to China.

21:8 Codes: [Natural disasters/flooding]

Yearly flooding effects the area and is unpredictable. Shrimps usually are lost do neighbouring ponds and crabs die and are given away for charity.

21:9 Codes: [Laborer and trading]
Major employee in the area is the Hyunday ship building company and a sugar cane processing company.
21:10 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources] [Fishing history]
During the war there was lot´s of forests in the area and many cruelties happened.
21:11 Codes: [Polyculture/Crabs and shrimp]
Crab and shrimp farmer Mr Ngoc
22:1 Codes: [Shrimp culture]
Shrimp farmer
22:2 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
15 years ago the first ponds were constructed and the mangroves cleared.
22:3 Codes: [Land tenure]
The people became legal owners of the land.
22:4 Codes: [Social exclusion/marginalisation through village elites]
On average one person owns about 1 ha but some people have 20 ha.
22:5 Codes: [Environmental pollution as reason for the decline of coastal fishery resources] [Increasing diseases and financial losses in shrimp culture (since 2000)]
He claims pollution is a major problem in shrimp farming and comes from the Hyunday ship building company and Nha Trang. But he also admits that some pollution comes from the ponds itself.
22:6 Codes: [Fishing regulations formulated by fishermen/village level]
Maybe small treatment ponds were a solution, if everybody was forced to use them.
23:1 Codes: [Off shore fishing/Drag net]
Some 500 fishing boats belong to the village (xa Vinh Luong) with many big trawling boats, worth 350 million VND each (24000 $).
23:2 Codes: [Loans and banking]
It takes them about 5 to 7 years to repay government loans.
23:3 Codes: [Income]
The average income per year is about 50 million VND.
23:4 Codes: [Illegal fishing/Drag net]
They use mainly dragnets in and outside Nha Phu Bay.
23:5 Codes: [Fishing regulations/fishing area]
There is a law that prohibits to enter Nha Phu Bay but some people break the law and go fishing anyhow.
23:6 Codes: [Off shore fishing/Drag net]
Usually the do offshore fishing trips to fishing grounds about 160 km of the coast. The fishing trip last for about 10 days and they catch everything.
23:7 Codes: [Decline of coastal fishery resources]
Fish catch is down from 100% 10 years ago to 30%.
23:8 Codes: [Lobster fry catching/Lift net & light] [Seasonal fishing techniques]
In November people go fishing for lobster fry and can make up to 50 million VND a night.
23:9 Codes: [Traditional gill net fishing]
Some people own small boats and go fishing with gill nets.
23:10
“Every job in town is related to fishing.”
23:11 Codes: [Local INRM approaches/Off shore fishing development]
Their vision is that the government builds a harbor to protect their boats against the rainy season storms and the big waves. Besides that it would ease to load and unload the boats, which takes long time and costs substantial amounts of money. Then they would even invest in bigger boats.
24:1 Codes: [Population and households]
1040 inhabitants and 223 households

- 130 households in fishery
- 93 households in agriculture, trading

24:2 Codes: [Fishermen]

- 130 households in fishery

24:3 Codes: [Agriculture] [Laborer and trading]

- 93 households in agriculture, trading

24:4 Codes: [Agriculture]
Agriculture: Fruit trees (mango, banana, jack fruit, cashews)
24:5 Codes: [Traditional gill net fishing]
Fishing: gillnets mostly with small unmotorized boats
24:6 Codes: [Lobster culture]
Aquaculture: lobster
24:7 Codes: [Decline of coastal fishery resources] [New market opportunities (shrimp, lobster,blood cockle, green mussel, grouper)]
20 years ago the fishing was good but there were now markets to sell the fish; today there are less fish but good markets (Factory 17)
24:8 Codes: [Access to credit is constrained]
There is not enough money to invest in big boats for drag net fishing.
24:9 Codes: [Land ownership vague] [Shrimp hatcheries]
There are 47 shrimp hatcheries in the area and there is some fight on land rights.
24:10 Codes: [No incentives as reasons for the failure of the devolution of land management/ownership]
Next month, the water surface of the surrounding waters will be divide into sectors and titles or rights handed out to single persons doing aquaculture.
24:11
Next month, the water surface of the surrounding waters will be dividen into sectors and titles or rights handed out to single persons doing aquaculture. The area around Cat Loi is almost the only area besides the Hon Mun region, suitable for lobster culture. Besides that the Hon Mun area is protected and lobster culture restricted. For this reason and to assure ship passing channels in the future the UBND of Khanh Hoa Province have taken these steps.
24:12 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
They have the only right to make decisions over water.
24:13 Codes: [Government structures and organization]
For this reason and to assure ship passing channels in the future the UBND of Khanh Hoa Province have taken these steps.
25:1 Codes: [Fishermen]
2 fishermen
25:2 Codes: [Population and households]
There are about 500 households of which 150 are rich.
25:3 Codes: [Decline of coastal fishery resources]
There was more fish 20 years ago but no industry. Today they can sell at factory 17.
25:5 Codes: [Income] [Population and households]
They have about 1 million VND per month and one and three children.
25:7 Codes: [Laborer and trading] [Women]
There wives repair nets and one buys and sells fishsauce purchased in Nha Trang.
25:9 Codes: [Decline of coastal fishery resources]
They go all the way to Nha Trang harbor to catch crabs, because there are less nowadays in their own waters.
25:11 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
They blame mainly the excessive dragnet use by fishermen from Tan Thanh and Luong Son.
25:12 Codes: [Government fails to enforce fishing regulations]
The boats use radio to contact each other when police boats appear. Then they also go mainly during the night.
25:13 Codes: [Fishing regulations/license] [Government fails to enforce fishing regulations]
Boats in Luong Son are registered but not any further up the coast, namely Tan Than. That is why they take greater risks, because their boats are hard to identify without number.
25:14 Codes: [Village conflicts over fishery resources]
Also villagers from Ngoc Diem who have accused people of dragnet fishing where intimidated.
25:15 Codes: [Conflicts between fishermen and authorities] [Government fails to enforce fishing regulations]
There have been occasions were the dragnet fishermen got help from other big fishing boats and tried to sink the police vessel.
25:16 Codes: [Illegal fishing/Drag net]
Every night drag net fishing continuous in Nha Phu Bay.

25:17 Codes: [Illegal fishing/drag net equipped with electric gear]
Electric pole fishing has stopped but some other method is used called gia tiep, which is a dragnet equipped with electric fishing.
25:18 Codes: [Land tenure]
They have no access to land.
25:19 Codes: [Agriculture]
Although half of the village works in agriculture culturing fields across the road.
25:20 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [Illegal fishing/Net size]
The new traps that were introduced one month ago destroy also fish and crab larvae and eggs that are washed against the netting and construction by waves.
25:21 Codes: [Green mussel cultivation]
There is no market for green mussels so the price is very low.
25:22 Codes: [Environmental pollution as reason for the decline of coastal fishery resources] [Shrimp pond efluence as reason for the decline of coastal fishery resources]
Shrimp ponds and Processing Plant “Viet Thang” cause pollution.
25:23 Codes: [Corruption] [Government failure to enforce laws and regulations]
“Corruption stops official police”
25:24 Codes: [Fishing regulations formulated by fishermen/village level]
Their visions: have police station in Tan Thanh and stop drag net fishing and traps.
25:25 Codes: [Local perception of livelihoods/Lives have improved]
There are about 500 households of which 150 are rich. Definition: nice house and balanced life.
25:26 Codes: [Population and households]
Most have 5 to 7 children.
25:27 Codes: [Traditional gill net fishing]
The fishermen fish usually with gill nets (3-layers) for fish, crabs and shrimp. The length can be up to 2 km.
25:28 Codes: [Material and production costs (economics of aquaculture and fishing)]
Nets need to be replaced every three months.
25:29 Codes: [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)]
There was more fish 20 years ago but no industry. Today they can sell at factory 17.
26:1 Codes: [No incentives as reasons for the failure of the devolution of land management/ownership]
One admits it’s a good way to go others get very angry, because they fear their water space will be taking away, so obviously they must have bigger spaces today and apparently pay takes for the space they occupy.
26:2 Codes: [Increase of aquaculture activities]
The other man also reminds that the space is already limited and that boat access ways are being blocked through lobster cages.
26:3 Codes: [High entry costs into aquaculture prevent alternative income development]
The angry man mentions that some poor people that not have any money to invest will get just more lazy through the money they make from loaning out their spaces.
26:4 Codes: [Access to credit is constrained] [Social exclusion/marginalisation through village elites]
Asking if they are really lazy he admits they have little access to credit and land or water space.
26:5 Codes: [No incentives as reasons for the failure of the devolution of land management/ownership] [Rural development is inequitable]
Lo also thinks it is a bad idea to take away the water area from the people that had enough money to invest and grow.
26:12 Codes: [Bureaucratic hurdle to obtain legal land rights]
The “red paper” that registers your house and gives you legal ownership over the land and would also make credit more available is hard to get.
26:13 Codes: [Access to credit is constrained]
would also make credit more available is hard to get.
26:15 Codes: [Corruption] [Government regulations/Land ownership]
It is given out for some money and after you have been living on the land for some time. Every decade the government registers houses from the previous one.
26:16 Codes: [Lobster fry catching/coral block]
he lobster fry they catch from the wild, using coral with holes, does not reach their requirements.

They have to purchase also.
26:17 Codes: [Low quality of lobster fry caught by light]
Interesting was that they mentioned that lobster fry caught through light fishing has often destroyed eyes and are not hardy and survival rates low.
26:18 Codes: [Women]
2 Ladies
26:19 Codes: [Loans and banking]
Loans available are mainly for a maximum of 3 million VND which is not enough to do any investment.
26:20 Codes: [Access to credit is constrained]
A minimum of about 12 million VND would be required. Access to credits seems to be the biggest constraint.
26:21 Codes: [Agriculture] [Fishermen] [Lobster culture] [Lobster fry catching/coral block]
The fishermen besides going fishing, culturing lobsters and catching lobster fry in the wild also culture fruit trees.
26:22 Codes: [Government regulations/Land ownership]
I started a big discussion talking about the new coming law to divide the water area for lobster farming.
27:1 Codes: [Women group]
Woman group (56, 88, …)
27:3 Codes: [Shrimp culture]
Additionally she does shrimp farming.
27:4 Codes: [Population and households]
She has 5 kids and she and her husband share the work and their monthly income.
27:5 Codes: [Birth control]
Birth Control:

- Young woman nowadays use a spiral after they had 1 or 2 kids.
- There has been training on this some 10 years ago from a woman from the xa UBND.

27:6 Codes: [Decline of coastal fishery resources] [Increasing fishing pressure]
Resources are reduced, because many people go fishing today. This situation has only occurred in the past 7 to 8 years.
27:7 Codes: [Population increase as reason for the decline of coastal fishery resources]
Population increase
27:8 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Also outsiders come in and do electric fishing from Ninh Hoa.
27:9 Codes: [Access to credit is constrained]
No money to invest in big ships
27:10 Codes: [Lack of alternative income]
Young woman have no jobs.
27:11 Codes: [Laborer and trading]
Sometimes they carry the mud from drained shrimp ponds.
27:12 Codes: [Decline of coastal fishery resources]
They used to catch 10 times now 3 times.
27:13
Sick shrimps released from the ponds might build up the wild population again.
27:14 Codes: [Illegal fishing/Electric fishing]
Only 2 people in Le Cam use electric fishing equipment.
27:15 Codes: [Traditional gill net fishing]
Most boats are un-motorized; there are only two bigger boats with engines.
27:16 Codes: [Poverty as reason for breaking laws and regulations]
Charcoal production as alternative but it’s illegal.
27:17 Codes: [Agriculture] [Women]
The 56 year old woman does agriculture like mango, coconut, cashew nut.
Cashew nuts are only 7000 VND per kg. She has 700 trees but they are young and have only about 1 to 2 kg each.
28:1 Codes: [Shrimp culture]

Shrimp pond owner
28:2 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
He rented the land from the government for 5 years built a shrimp pond and has failed.
28:3 Codes: [High entry costs into aquaculture prevent alternative income development]
Now someone else runs the pond.
28:4 Codes: [Laborer and trading]
He works as worker now, for cleaning out drained shrimp ponds or selling shrimp but very seasonal.
28:5 Codes: [Access to credit is constrained] [Loans and banking]
There is a small program from the UBND to give out small credits 3-5 million VND to fight poverty.
28:6 Codes: [Government regulations/Land ownership]
Every family also got 4000 sqm from the government for 20 years. Most created shrimp ponds but some also sold their land straight away, because of lack of waters. (The government loan for 20 years is 4-5 million VND per ha)
28:7 Codes: [Increase of aquaculture activities]
Most created shrimp ponds but some also sold their land straight away, because of lack of waters.
29:1 Codes: [Population and households]
There are 316 inhabitants in 61 households.
29:2 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Dragnet use and electric fishing, both from people from xa Ninh Ich destroys the resources.
29:3 Codes: [Illegal fishing/Drag net]
During the night from 20:00 until 4:00 there is drag net fishing.
29:4
“Everybody knows everybody, even the boats.”
29:5 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [New fish trap]
The no deng dey trap he claims also to be a problem, because of unselective fishing.
30:1 Codes: [Fishermen]
Village leader Mr Hai and 6 fishermen
30:2 Codes: [Traditional gill net fishing]
Everybody uses small unmotorized boats to go fishing.
30:3 Codes: [Agriculture]
One person only does agriculture (mango and cashew nuts) and breeds cows. About 100 seeds make 1 kg and there are about 7 kg per tree.
30:4 Codes: [Laborer and trading]
Charcoal production used to be very common.
30:5 Codes: [Poverty as reason for breaking laws and regulations]
Now it´s illegal but some people still do.
30:6 Codes: [Fishing regulations formulated by fishermen/village level]
“Everybody should use small boats to fish Dam Nha Phu.”
30:7 Codes: [Shrimp fishing]
They catch shrimp
30:8 Codes: [Crab fishing]
crabs
30:9 Codes: [Income]
In a good night they can make 100-150000 VND. The average catch is only about 1/2 kg of shrimp, which sell for around 40-60000 VND/kg. And they catch an additionally 1 kg of fish (ca liet, ca la, ca doi), which sells for around 5000 VND/kg.
30:10 Codes: [Decline of coastal fishery resources] [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Since 1995 catches are getting less. Drag net and electric fishing are the main reasons.
30:13 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
Shrimp pond construction and the destruction of the mangrove area is another.
30:14 Codes: [Mangroves prevented access to fishing grounds]
Besides being a spawning ground for shrimp, the mangroves also prevented many people from fishing, because there was only limited water access.
30:15 Codes: [Replanting of mangroves difficult due to land scarcity]

Replanting is a problem, because first there is no suitable land left
30:16 Codes: [Increase of aquaculture activities]
second the only suitable land people also want to construct shrimp ponds, so they will destroy replanted trees.
30:17 Codes: [Illegal fishing/Net size] [New fish trap]
Last but not least the new trap that came up in Tan Thuy and Ha Lien catches everything, because of the every fine mesh they use (fine as a mosquito net).
30:19 Codes: [High potential of coastal fishery resources]
If resources were restored possibly there would be some improvement.
30:20 Codes: [Sedimentation due to the destruction of mangroves]
he replanting of mangroves would also stop the sediments from filling up the bay. Years ago Dam Nha Phu was much deeper.
30:21 Codes: [Grouper culture]
Grouper culture (ca mhu) is also very common in the area and usually done in ponds. Almost everybody has some experiment with grouper culture. They are very hardy and have now special requirements on water quality or salinity. Nowadays the price for grouper is very low, only 37000 VND/kg. They take 8 months from a fingerling to one kilo. They eat only little live fish. But fry is costly and then it takes very long to grow. Having no market for it is the biggest problem. About 2000 grouper can be raised in a 3000 sqm pond.
30:22 Codes: [New market opportunities (shrimp, lobster,blood cockle, green mussel, grouper)]
Grouper culture (ca mhu) is also very common in the area and usually done in ponds. Almost everybody has some experiment with grouper culture. They are very hardy and have now special requirements on water quality or salinity. Nowadays the price for grouper is very low, only 37000 VND/kg. They take 8 months from a fingerling to one kilo. They eat only little live fish. But fry is costly and then it takes very long to grow. Having no market for it is the biggest problem. About 2000 grouper can be raised in a 3000 sqm pond.
30:23 Codes: [Intermediaries control fish sales and informal credits]
Everybody depends on intermediaries who borrow money and in exchange the catch has to be soled to them for a low price.
30:24
But even if they could sell where they want and to whom they want, they don't have the time to drive to markets and sell their products. The idea from me to have some traders from the village itself to trade goods on distant markets sounded new to them.
30:25 Codes: [Access to credit is constrained]
If you want to get some government money you need the "red paper" but most people have.
30:26 Codes: [Access to credit is constrained]
If only a fishermen who wants to continue fishing he will get no money but the man doing agriculture got a 10 million VND loan to breed cows.
30:27 Codes: [Fishing regulations formulated by fishermen/village level]
3 cm is the law for net sizes, he would advise bigger sizes in the future.
30:28
"Population increase, fishing techniques get better, and the resources decrease."
30:29 Codes: [Intermediaries control fish sales and informal credits]
Plus having no market.
31:1 Codes: [Women]
3 ladies
31:2 Codes: [Crab fishing] [Shrimp fishing] [Traditional gill net fishing]
Most people use gillnet for fishing shrimp and crabs
31:5 Codes: [Population and households]
There are about 5 children average per family.
31:6 Codes: [Birth control]
Nowadays many choose to only have 2 children and use contraceptives like sterilization and the spiral.
31:7 Codes: [Out-migration respectively in-migration due to lack of alternative income]
There is some out-migration to Ninh Loc and other areas.

31:8 Codes: [Agriculture]
Some people do agriculture.
31:9 Codes: [Decline of coastal fishery resources]
Fishing is getting worse.
31:10 Codes: [Increasing fishing pressure] [Population increase as reason for the decline of coastal fishery resources]
Nowadays more people go fishing, before maybe 10%, now 50% of the population.
31:11 Codes: [Fishing as last resort]
Education is low so young people choose to go fishing.
31:12 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
10 years ago there were many mangroves but they were cleared for shrimp pond construction.
31:13 Codes: [Laborer and trading]
20 girls (all older) go working in the processing company in Nha Trang for 500000 VND per month.
31:14 Codes: [Income]
The average income from fishing is about 30000 VND per day. (600000 VND/month) Every 3 months they need a new net for about 300000 VND.
31:15 Codes: [Traditional gill net fishing]
They use small un-motorized boats to go fishing.
31:16 Codes: [Loans and banking]
The poverty reduction program from the government gives out loans worth 3 million VND at an interest rate of 0.5% but to pay back in one year.
31:17 Codes: [Loans and banking]
The bank gives loans worth 5 million VND with 1,0% interest with the same payback period.
31:18 Codes: [Green mussel cultivation]
Vem xanh sell for about 5000 VND/kg.
31:19 Codes: [Illegal fishing/Electric fishing]
Few people go electric fishing.
31:21 Codes: [Mud crab culturing]
Some people now raise mud crabs.
31:22 Codes: [Grouper culture] [Poor marketing and distribution channels]
Few people tried ca muh in ponds and invested 30 million but only made 10 million, because of poor growth and the low market price.
31:23 Codes: [Poor marketing and distribution channels]
One person tried to sell vem xanh in restaurants in Nha Trang but many restaurants have sellers already and it´s very difficult.
31:24 Codes: [Access to higher education restricted]
There is only a primary school in the area until grade 9. A high school is in Ninh Hoa or Nha Trang.
32:1 Codes: [Loans and banking]
The government is encouraging people to buy bonds. They run 5 years and have an annual interest rate of 8,5%.
32:4 Codes: [Green mussel cultivation] [Positive externalities of green mussel culture]
They believe because of the vem xanh that filters the water.
32:5 Codes: [Sedimentation due to the destruction of mangroves]
Since the mangrove is cut all the water from the river can enter freely into the bay and bring in sediments.
32:6 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
The breeding grounds are destroyed.
32:7 Codes: [Positive externalities of green mussel culture]
The pillars used to culture green mussels also serve as hiding place for shrimp and fish.
32:8
This year 80% of the shrimp ponds were successful and the other 20% were balanced. They believe because of the vem xanh that filters the water.
32:9 Codes: [Positive externalities of green mussel culture]
They can catch shrimp and fish around the pillars but nowhere else.
32:10 Codes: [Positive externalities of green mussel culture]

Also the pillars serve as barrier against drag nets.
32:11 Codes: [Government fails to enforce fishing regulations]
About 7 years ago the government sunk old tyres filled with concrete to stop drag nets but it failed.
32:12
"They wasted a lot of money."
32:13 Codes: [Income]
Every day one can harvest 10 kilos to take to the market and receive some 40-60000 VND.
32:14
Before fishing was an unbalanced occupation and dangerous.
32:15 Codes: [Devolution of land management/ownership]
At the moment everybody can freely choose the culture area but has to ask the UBND for permission.
32:16 Codes: [Fishing regulations/aquaculture area claims]
100 m of free space has to be left for boat traffic.
32:17 Codes: [Devolution of land management/ownership]
In the future the UBND wants to give everybody 500 sqm.
32:18 Codes: [Green mussel cultivation]
Currently 300 sqm are enough to make a living. They put 8 pillars per sqm and because of that need not to buy fry. The green mussel settles naturally on the pillars. /Ngnoc Diem, Tan Dao, Tan Thuy raise most of the green mussel in the area) The best quality comes from Tan Dao, because of the right salinity.
32:19 Codes: [New fish trap]
Nowadays there are 5 to 7 new traps in the area (no dang day). The small net they use blocks up quickly and needs cleaning every week. It attracts shrimp tom dat and ca liet, which are the main catch.
32:20 Codes: [Illegal fishing/Net size]
The small net they use blocks up quickly and needs cleaning every week.
32:21 Codes: [Positive externalities of fish trap structures]
The good thing about the trap is that it prevents drag nets from fishing.
32:22 Codes: [Income]
They can catch 5000000 VND per night. Easy job.
32:23 Codes: [Decline of traditional fishing methods/gear net] [New fish trap]
About 40 to 50 people in Tan Thuy have this trap.
33:1 Codes: [Population and households]
1240 inhabitants and 225 households
33:2 Codes: [Shrimp culture]
80 households have shrimp ponds,
33:3 Codes: [Fishermen]
the rest goes fishing
33:4 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [New fish trap]
No Dang Day is the biggest problem according to the village leader. It catches everything and in every size.
33:5 Codes: [Decline of traditional fishing methods/gear net]
Giang the traditional trap used is more selective and doesn't pose any threat.
33:6 Codes: [Village conflicts over fishery resources]
Besides catching a lot of fish the trap also stops boat traffic and there have been incidents of traps being destroyed by angry fishermen from Tam Ich.
33:7 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Drag net and electric fishing also poses a problem.
33:8 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Especially electric fishing is bad, because it kills fish but worse also larvae and eggs in the water.
33:9 Codes: [Government fails to enforce fishing regulations] [Public awareness building by individuals]
In Tam Ich there are no illegal fishing methods being used, because he the village leader forbids strictly.
33:10

"Illegal fishing only benefits one family but destroys the living of 10 others."
33:11 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
Most shrimp ponds were built around 1985. The area where they were built used to lie above the water level and was covered with cay duoc (mangrove) and cay mam. All of the original forest cover was cleared for pond construction.
33:12 Codes: [Shrimp culture]
He owns 5 ponds each about 1 ha big.
33:13 Codes: [Income]
He makes about 30 million VND profit per pond.
33:14 Codes: [Mud crab culturing]
At the moment he raises cua (mud crab), which he buys for 2000 VND each. He has 4000 crab fry in one 13000 sqm pond. It takes about three months to raise.
33:15 Codes: [Income]
He rents out some of his ponds for 6 million VND annually per pond (used to be 10 million VND).
33:16 Codes: [Increase of aquaculture activities]
From approximately 100 ha of mangrove today there is about 3 ha left, mainly along side of shrimp pond drainage canals.
33:17 Codes: [Government structure/municipality level]
He has about 2 to 5 meetings at the UBND in xa Ninh Loc every week.
33:18 Codes: [Government regulation/Taxation on shrimp ponds]
Tax: under 2 ha pond surface, no tax. Every additional ha must pay 300000 VND per year (Classification 1). In Dam Nha Phu there is only 2, 3 and 4 classification.
34:1 Codes: [Shrimp culture]
5 Shrimp farmers
34:2 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
In the last two years 80-90% of people have failed.
34:3 Codes: [Land tenure]
Everybody in the area is legal owner of the land and has the "red paper".
34:4 Codes: [Mud crab culturing]
Mud crabs only make 10 million VND per ha.
34:5 Codes: [New developments brought in by outsiders]
The new variety of shrimp (white shrimp) is disease resistant but fry is more expensive (100 VND instead 40 VND/shrimp) and the market price is less (60000 VND/kg). Also it is not native to Vietnam so it might cause problems in the future.
34:6
"The people only look for the profit before their eyes."
34:7 Codes: [Shrimp culture]
here are about 40 ponds in this area between the two rivers. A season usually covers 4 months and there are two seasons per year.
35:1 Codes: [Fishermen]
3 fishermen
35:2
"In the future the resources will be destroyed further."
35:3 Codes: [Increasing fishing pressure]
Before 1975 only few people went fishing, today many.
35:4 Codes: [Sedimentation due to the destruction of mangroves]
The water used to be more than 2 meters deep; today it's only about 0,7 meters deep.
35:5 Codes: [Sedimentation due to the destruction of mangroves]
Two reasons: forests destroyed inlands and therefore more erosions and second the mangroves are gone that hold the sediment back.
35:6 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
Most of the mangroves have been cut nowadays.
35:7 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]
The medicine and chemicals from the shrimp ponds kill fish and crabs.
35:8 Codes: [Environmental pollution as reason for the decline of coastal fishery resources]

Lot's of plastic bags litter the environment; even on the sea floor one can see many plastic bags today.
35:9 Codes: [Lack of alternative income]
Going fishing still makes more money then anything else.
35:10
Vem xanh used to be 20000 VND/kg today only 6000 VND/kg.
35:11 Codes: [Traditional gill net fishing]
fishing with 3-layer gillnet to catch shrimp, crab and fish. Fishing takes place according to the tides. About 20 km are covered per fishing trip, with small un-motorized boats.
35:12 Codes: [Lack of alternative income]
New species introduction for aquaculture or mariculture might be good in benefiting the people and creating alternative incomes.
35:13 Codes: [Poor marketing and distribution channels]
Vem xanh used to be 20000 VND/kg today only 6000 VND/kg.
35:14 Codes: [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)] [Poor marketing and distribution channels]
Maybe one person can be trusted to develop and search for new markets. But they say they couldn't trust anyone. Saigon is maybe too far for green mussels, because they can only be stored for 2 to 3 days. Also many people dislike green mussel. Green mussel noodles as marketing idea.
35:15 Codes: [Access to credit is constrained]
But he claims no money, no investor
35:16 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
and anyhow they seem very dependent on the government to change anything.
35:17 Codes: [Replanting of mangroves difficult due to land scarcity]
All the land is owned already so there is no land for mangrove replanting, unless the government buys back land.
35:18 Codes: [Increasing fishing pressure]
No future for fishing on Dam Nha Phu, because more and more people go fishing.
35:19 Codes: [Fishing as last resort] [Lack of alternative income]
Alternative income is necessary before controlling the number of fishermen that go fishing.
35:20 Codes: [Population increase as reason for the decline of coastal fishery resources]
Population increase worsens the problem.
35:21
"The government needs to provide alternative jobs."
35:22 Codes: [Poverty as reason for breaking laws and regulations]
Even they know the law they have to catch small fish to make enough money to feed their families.
35:23 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]
Ca doi and ca la have some infection on the skin, which he claims comes from the chemicals used in the shrimp ponds.
35:24
"From about 10 fish caught near the ponds 8 have skin problems."
35:25 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]
Chlor, Saponin and Focmon effect fish. They even see dead fish. When shrimp farmers use medicine they often release that water about 2 to 4 hours later and refill the ponds with fresh water.
35:26 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]
Can not sell in the market.
36:1 Codes: [Illegal fishing/Drag net]
About 100 smaller boats (value: 150 million VND) are in this village. They all go drag net fishing but can't go out far as the bigger drag net fishing boats that fish off the coast. That means that 100 boats only go fishing inside Dam Nha Phu.
36:2 Codes: [Corruption] [Government fails to enforce fishing regulations]
They also get caught sometimes but mainly the police don't care.
36:3 Codes: [Lack of alternative income]
There is also no alternative income for them.

36:4 Codes: [Local INRM approaches/Off shore fishing development]
They would perhaps need bigger boats to also go fishing off the coast.
36:5 Codes: [Laborer and trading]
One man has changed profession and now drives a mini bus between Luong Son and Saigon.
36:6 Codes: [Poverty as reason for breaking laws and regulations]
He mentioned that it's impossible to stop this people from continuing to go fishing in Dam Nha Phu, because they have no alternative and they will just continue.
37:1 Codes: [Population and households]
2751 inhabitants and 453 households (1530 female/1062 male)
37:2 Codes: [Agriculture]
70% agriculture, traders (sugarcane, mango, pineapple, corn, cashew)
37:3 Codes: [Fishermen]
30 fishermen
37:4 Codes: [Off shore fishing/Drag net]
There are 50 big boats in Vo Tanh that go fishing with drag nets off shore.
37:5 Codes: [Illegal fishing/Drag net]
there are 30 smaller boats which can not leave the bay.
37:6 Codes: [Fishing regulations/fishing area]
He says that they fish between the village and the end of the peninsula but even this area is prohibited for drag net use.
37:7 Codes: [Government fails to enforce fishing regulations]
The police has not enough staff at the police station and they need a faster boat to work effective.
37:8 Codes: [Fishing regulations formulated by fishermen/village level]
The police has not enough staff at the police station and they need a faster boat to work effective.
38:1 Codes: [Population and households]
4212 inhabitants and 798 households

- 273 agriculture and traders
- 250 fishing

38:2 Codes: [Agriculture]

- 273 agriculture and traders

38:3 Codes: [Laborer and trading]

- 273 agriculture and traders

38:4 Codes: [Fishermen]

- 250 fishing

38:5 Codes: [Off shore fishing/Drag net]
About 50 households use 70 large boats, between 45-210 cv.
38:6 Codes: [Traditional gill net fishing]
The other 200 households use small boats, between 12-20 cv and go fishing with gill nets.
38:7 Codes: [Shrimp culture]
5 households do aquaculture (shrimp ponds) only little land is available for this.
38:8 Codes: [Shrimp hatcheries]
There are about 30 to 40 shrimp hatcheries that belong to villagers.
38:9
Two to three years ago there was drag net fishing in DNP but it was stopped. (The village leader sounds honest about this.)
38:10 Codes: [Land ownership vague]
Since about one year there is the discussion about the division of the water surface for aquaculture but with no result.
38:11 Codes: [Off shore fishing/Drag net] [Traditional gill net fishing]
The small boats go fishing in Dam Nha Phu and the bigger ones off shore.
39:1 Codes: [Government structures and organization]
We are able to talk to Mr. Tham of the Don Bien Phong. They have control over all the boats in Dam Nha Phu.
39:2 Codes: [Government structures and organization]
He will be happy to invite us again and even take us on his boat when we come back with some letter of introduction from the Bo Chi Huy Bien Phong in 9 Le Thanh Ton in Nha Trang.

40:1 Codes: [Women]

- 9 market woman:
- 3 buy in Luong Son
- 2 buy in Ninh Hoa
- 1 buy in Ha Lien
- 1 buy from the harbor Xom Bong (Nha Trang)
- 2 buy from the fish market CU Lao (Nha Trang)

40:2 Codes: [Market structures/Fish sales]

- 3 buy in Luong Son
- 2 buy in Ninh Hoa
- 1 buy in Ha Lien
- 1 buy from the harbor Xom Bong (Nha Trang)
- 2 buy from the fish market CU Lao (Nha Trang)

40:3 Codes: [Market structures/Fish sales]

Mostly they buy directly from the fishermen

40:4 Codes: [Intermediaries control fish sales and informal credits]

Only one very old woman buys from a middleman.

40:5 Codes: [Market structures/Fish sales]

Quantities range from 10 to 100 kg of fish.

40:6 Codes: [Off shore fishing/Drag net]

Most fish are caught by drag net.

40:7 Codes: [Off shore fishing/Hook and line]

some tuna by hook and line

40:8 Codes: [Off shore fishing/Gill net (Mackerel)]

and gill net

40:9 Codes: [Market structures/Fish sales]

		Fish Varieties
ca thu lon	tuna fish (be dang)	30-40000 VND/kg
ca com	long-jawed anchovy	15-20000 VND/kg
muc	cuttlefish	30000 VND/kg
muc nang		25000 VND/kg
ca thu	mackerel	30-35000 VND/kg
ca ngu	tunny (horse mackerel)	
ca liet		15000 VND/kg
ca hoc		20000 VND/kg
ca chim	butterfish	15000 VND/kg
ca ho	(long fish)	15000 VND/kg
tom su	black tiger shrimp	40-50000 VND/kg
tom dat	land shrimp	30000 VND/kg

41:1 Codes: [Off shore fishing/Drag net]

He has 3 big boats and only goes fishing outside the bay to catch fish.

41:2 Codes: [Fishing regulations/boat size] [Fishing regulations/fishing area]

He also mentions that there is a law that forbids fishing in DNP.

41:3 Codes: [High potential of coastal fishery resources]

10 years ago many shrimp and big fish in DNP.

41:4 Codes: [Decline of coastal fishery resources]

Today few fish

41:5 Codes: [Decline of coastal fishery resources]

He used to catch ca heo (porpoise or dolphin; Kleiner Tümmler oder Schweinswal *Phocoena phocoena*), there used to be many in the bay and he caught 1 or 2 a night.

41:6 Codes: [Income]

One fish was worth 500-700000 VND.

41:7 Codes: [Increasing fishing pressure]

There are 600 boats together in xa Vinh Luong. 10 years ago he had only a small boat but today

he has 3.
41:8 Codes: [High potential of coastal fishery resources]
"Dam Nha Phu made me rich."
41:9 Codes: [Poverty as reason for breaking laws and regulations]
Drag net fishing is illegal nowadays but secretly many go fishing anyhow. Especially poor people depend on this.
41:10 Codes: [Local INRM approaches/Off shore fishing development]
If the law is enforced it needs to be accompanied with some government measures, e.g. bigger boats.
41:11 Codes: [Increasing fishing pressure]
But maybe then too many fishermen are exploiting the resources off shore.
41:12 Codes: [Lack of alternative income]
So maybe alternative jobs.
41:13 Codes: [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)] [Rural development is inequitable]
The prosperty of the people here is because of their proximity to Nha Trang.
41:14 Codes: [High potential of coastal fishery resources]
The future looks bright, they will use bigger boats and go further.
41:15 Codes: [Access to credit is constrained]
Poor people can´t get credits.
41:16 Codes: [Government structure/district level]
Since 10 years he is a member of the Hoi Dong Nhan Dan (HDND) in xa Vinh Luong.
41:17 Codes: [Social exclusion/marginalisation through village elites]
The HDND has 24 members and 1 president.
41:18 Codes: [Government structure/district level]
The HDND controls the members of the UBND. He represents the fishermen.
41:19 Codes: [New developments brought in by outsiders]
The EU (chau Au) has just invited for a training course in environmental fishing practices (asking it turned out to be more about handling of the catch!) at the Fishery Department in Nha Trang.
42:1 Codes: [Women]
Vanh Dang: 8 woman
42:2 Codes: [Laborer and trading]
The woman repair drag nets for other people and also make new ones if they have the time.
42:3 Codes: [Income]
They get 50000 VND per day per woman. 4 woman are working on one drag net. Net repairs maybe make 20000 VND a day. A new dragnet sells for about 1 million VND.
42:4 Codes: [Population and households] [Shrimp culture]
- 1 husband works as shrimp pond farmer (2kids)

42:5 Codes: [Laborer and trading] [Population and households]
- 1 husband works on a fisher boat (1 kid)

42:6 Codes: [Laborer and trading] [Population and households]
- 1 husband works as a mechanic at a garage in Nha Trang (1 kid)

42:7 Codes: [Birth control]
- 1 husband works as shrimp pond farmer (2 kids)
- 1 husband works on a fisher boat (1 kid)
- 1 husband works as a mechanic at a garage in Nha Trang (1 kid)
- not married
- Few kids!

42:8
"More children make poor."
42:9 Codes: [Environmental pollution as reason for the decline of coastal fishery resources] [Increasing diseases and financial losses in shrimp culture (since 2000)]
The woman whose husband farms shrimps, says shrimp farming is bad, because the water is polluted from the factories.
43:1 Codes: [Diving]
He goes diving for big lobsters.
43:2 Codes: [Lobster fry catching/coral block]

other techniques to catch small lobsters and sometimes groupers.
43:3 Codes: [Seasonal fishing techniques]
The main season lasts from Nov.-May.
43:4 Codes: [Laborer and trading]
The rest of the year he does some wood-work and also helps his wife in the shop.
44:1 Codes: [Fishermen]
I fishermen
44:2 Codes: [Population and households]
amily (10 household members)
44:3 Codes: [Off shore fishing/Drag net]
The father and his oldest son go fishing using a small boat (11 m & 90 million VND) and a small drag net. The fishing trips vary between 1 to 4-5 days depending on the weather and money for gasoline. But even the one day trips go outside the bay to Hon Cha La Island. The mainly catch ca liet, ca ho, ca thoc, ca dong, muc ong and muc nang.
44:4 Codes: [Market structures/Fish sales]
The mother, sometimes assisted by her daughter, sells the fish to traders at the beach, mainly from Nha Trang.
44:5 Codes: [Government regulations/Taxation on fish sales]
They have to pay 5000 VND per day to the xa (tax) possibly some port handling fee.
44:6 Codes: [Local perception of livelihoods/pessimistic] [Local perception of livelihoods/Poverty has increased]
She considers her life poor, even 5 or 10 years ago there was no change compared with today.
44:7 Codes: [Access to higher education restricted]
2 children go to high school in Nha Trang. Altogether she has 8 children, between 3 and 25 years old. The daughter helps building nets.
44:8 Codes: [Loans and banking]
She got a credit for 50 million VND from the bank. Every month she repays about 1 to 2 million.
44:9 Codes: [Fishing regulations/illegal fishing methods]
The don´t go fishing inside the bay, because if the police catch them they have to pay 4-5 million VND.
44:10
“Other boats go fishing inside the bay, because if the sea is rough they can´t go outside the bay.”
44:11 Codes: [Illegal fishing/Drag net] [Off shore fishing/Drag net]
In the village they only use drag nets, no other net type is used. The size of the drag net varies according to the size of the boat.
44:12 Codes: [Lack of alternative income]
There is little job opportunities in the village.
44:13
“I hate people that use dynamite or cyanide for fishing.”
44:14 Codes: [Laborer and trading]
Many people go to work in Nha Trang.
44:15 Codes: [Devolution of land management/ownership]
The house and land belong to them.
44:16 Codes: [Out-migration respectively in-migration due to lack of alternative income]
There is some in migration from Phu Yen Province.
45:1 Codes: [Government structure/district level]
It controls the UBND on the xa level.
45:2 Codes: [Government structures and organization]
In General: the HDND (Hoi Dong Nhan Dan) or peoples´council makes the law and the UBND enforces it.
45:3 Codes: [Government structures and organization]
UBND Agriculture and Fishery Department
45:4 Codes: [Government structures and organization]

Government Structure (Fishery)

National:	Bo Thuy San, Ministry of Fisheries (Mofi)
	Cuc Bao ve Nguon loi Thuy San
Province:	So Thuy San, Fisheries Department

Chi Cuc BVNLTS, Fisheries Resources Conservation Department
District: UBND, Peopel's Council
46:1 Codes: [Government structures and organization]
Institute of Oceanography
46:2 Codes: [Polyculture/Crabs and shrimp]
Polyculture of shrimp and lobster together with green mussel to reduce pollution.
47:1 Codes: [Lobster fry catching/coral block]
They catch lobster fry in drilled corals hanging from wooden constructions in the sea.
47:2 Codes: [Seasonal fishing techniques]
The main season lasts from November to February.
47:3 Codes: [Market structures/Fish sales]
They catch about 1 small lobster per day on average. There are about 200 to 300 fishermen like them in the bay. They sell the fry to middleman who re-sell to the fishermen who farm the lobster to a bigger size. They just make enough money to live.
47:4 Codes: [Income]
Maybe 500-700000 VND per month.
47:5 Codes: [Market structures/Fish sales]
One lobster sells for about 60-130000 VND depending on the market.
47:6 Codes: [Intermediaries control fish sales and informal credits]
They have to few lobsters to sell to other fishermen, so middlemen are the buyers.
47:7 Codes: [Low quality of lobster fry caught by light]
The middlemen mix their good lobsters with the weaker ones caught by strong light fishing.
47:8 Codes: [Material and production costs (economics of aquaculture and fishing)]
Their construction covers about 40 sqm and is enough to live of. Material cost is about 1,5-2 million VND and together with labor costs totals around about 3 million VND.
47:9 Codes: [High potential of coastal fishery resources]
Overall catches have stayed stable
47:10 Codes: [Low quality of lobster fry caught by light]
but there is a strong competition, because fishermen catch lobster fry with strong light and also sell on the same market. Those cost 10000 VND less.
47:11 Codes: [Local INRM approaches/Off shore fishing development]
In the future they rather have big boats and go off-shore fishing.
47:12 Codes: [Local INRM approaches/Land allocation for aquaculture]
the other alternative they favor is to grow out lobster on there own.
47:13 Codes: [Agriculture]
Some families, wives also do agriculture and make about 30-40000 VND per day like that. This applies for two of the six fishermen. So there income is more stable.
47:14 Codes: [Income] [Seasonal fishing techniques]
The others makes the main money in the short four month season and earn maybe 8-9 million VND.
47:15 Codes: [Lobster fry catching/coral block]
6 lobster fry fishermen from Van Dang (meet at the road side)
48:1 Codes: [Lobster culture]
There are about 100 lobster farmers in the area.
48:2 Codes: [Material and production costs (economics of aquaculture and fishing)]
They catch or purchase lobster juveniles with about 2 cm (70000 VND) and ongrow them to 10 cm (140-150000 VND).
48:3
Then they sell them to lobster farmers from Cam Ranh and Van Ninh. They do this, because the area is not suitable for lobster fattening, because of the many rivers entering Dam Nha Phu and reducing its salinity. Lobster fattening takes 18 months.
48:4 Codes: [Seasonal fishing techniques]
The only season when lobsters can be cultured in the area is from November to February ($ months). The rest of the time they repair equipment and have leisure time.
48:5 Codes: [Local perception of livelihoods/Lives have improved]
The lobster nursing has improved lives a lot.

48:6 Codes: [Increase of aquaculture activities]
Many people have jobs now related to the lobster culturing.
48:7 Codes: [Social structures are eroding (local competition and envy)]
10 years ago everybody was poor but they had strong social ties.
48:8 Codes: [Local perception of livelihoods/Lives have improved] [Social structures are eroding (local competition and envy)]
The lobster culture has the advantage that it makes the people richer but the disadvantage that social structures between people are disappearing more and more.
48:9
"People are no longer working together."
48:10
"People hate each other for high income and possessions."
48:11 Codes: [Social structures are eroding (local competition and envy)]
Only people culturing close to each other might care and look after each other but people further away they don't care about any more.
49:1 Codes: [Babylon snail culture]
He mentions that Babylon snail (Oc huong) is more profitable than lobster rearing. Currently 6 families culture Babylon, 140000 VND/kg.
49:2 Codes: [Grouper culture]
One family cultures ca muh (grouper) for 80000 VND/kg.
50:1 Codes: [Shrimp culture]
3 are shrimp farmers
50:2 Codes: [Fishermen]
1 is fishermen (shrimp and crabs with light)
50:3 Codes: [Increase of aquaculture activities]
Most of the ponds were constructed around 1980, although for example the shrimp pond from the village leader has been around for much longer, before 1975.
50:4 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]
There were about 200 to 250 ha of mangroves before, in which they went fishing.
50:5 Codes: [Decline of coastal fishery resources]
The fishermen are catching less nowadays.
50:6 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Electric fishing, which started about 3 to 4 years ago, has destroyed a lot of resources.
50:7 Codes: [New fish trap]
Since 3 months there is the new fishing trap, which catches everything, even the eggs of fish.
50:8 Codes: [Illegal fishing/Electric fishing]
Mostly people from Than Thuy, Tan Dao and Ngnoc Diem engage in this methods, electric fishing and traps.
50:9 Codes: [Illegal fishing/Drag net]
The drag net fishing is another problem, which has been around for a long time.
50:10 Codes: [Government fails to enforce fishing regulations]
Especially drag net and electric fishing are done at night and they stop their activity when police approaches.
50:11 Codes: [Government fails to keep up with new developments]
But the trap catches 24/7.
50:12
"These three fishing methods make the fishery resources rare."
50:13 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
They just got an announcement from the Chi cuc to solve the "trap problem".
50:14 Codes: [Positive externalities of fish trap structures]
Looking at catch rates doesn't allow accurate comparison. The problem is that before the traps were constructed, drag net and electric fishing was common, now only the traps remain.
50:15 Codes: [Illegal fishing/Net size]
The traps catches also the eggs, because its fine netting quickly clogs up and so catches even smallest objects.
50:16 Codes: [Responsibility for fishery resources is at district level]
Responsible on the commune level is the president from the UBND from xa Ninh Loc, Mr. Han,

Mr. Nguyen Xan Cao from the Bi thu and the vice Bi thu, Mr. Phan Thanh Phuong.
50:17
"I could have a strong voice and talk to the Chi cuc and the So Thuy san, as well as to the commune levels authority named above."
51:1 Codes: [Lobster fry catching/coral block]
At the moment the village is very busy and everyone is trying to catch lobsters however possible.
51:2 Codes: [Seasonal fishing techniques]
The 4 month season lasts from 20. October to March and it will be very difficult to find some time for resource mapping. In this time the fishing activity nearly stops completely, because of the significant higher income from lobster fry fishing.
51:3 Codes: [Lobster fry catching/Lift net & light]
The main method is through using a manh. This fishing technique is made up by a triangular shaped net, which is anchored to the ground and at two ends is lifted to the surface by buoys. On this end a strong light is used to attract the small lobsters and after some time the other end of the net is lifted from the bottom and the lobsters trapped.
51:4 Codes: [Low quality of lobster fry caught by light]
The lobsters caught this way seem to be less healthy, because they suffer some damage from the strong light they use.
51:5
"They know about this and don't care, because they are not the ones raising them."
51:6 Codes: [Market structures/Fish sales]
The price is also just insignificant lower than if they were caught in coral holes, only 5-7000 VND cheaper.
51:7
"Tan Than is the strongest fishing village in Dam Nha Phu and in Huyen Ninh Hoa." "Xa Vinh Luong is stronger in off-shore fishing."
52:1 Codes: [Decline of coastal fishery resources] [High potential of coastal fishery resources]
In 1997 green mussel was wiped out completely and then was reestablished by RIA 3.
52:2 Codes: [Green mussel cultivation]
He only cultures green mussel and sells about 20 to 30 kg a day for about 7-8000 VND/kg.
52:3 Codes: [Increasing fishing pressure] [New fish trap]
In about two months, 100 traps were built by villagers in Tan Thuy.
52:4 Codes: [Income]
About 70-200000 VND can be made by trap per day.
52:5 Codes: [Material and production costs (economics of aquaculture and fishing)]
The construction costs are about 3 million VND.
52:6 Codes: [New fish trap]
Rich and poor people equally engage in the trap fishing.
52:7 Codes: [Crab fishing]
Most people in Tan Thuy go fishing for crabs and catch about 4 to 10 kg of crabs each. About 100 fishermen catch 400 to 500 kg of mud crabs daily.
52:8 Codes: [Population and households]
There are 250 households in Tan Thuy of which 50 are doing trading and 200 are involved in fishing.
52:9 Codes: [Laborer and trading]
50 are doing trading
52:10 Codes: [Fishermen]
200 are involved in fishing.
52:11 Codes: [Fishing as last resort]
On average one person per household goes fishing.
52:12 Codes: [Market structures/Fish sales]
Big crabs are about 30-40000 VND/kg the smaller ones are used for lobster feed.
52:13 Codes: [New fish trap]
The NO is a good technique to catch the land shrimp but also needs a lot of labor to clean the net weekly.
52:14 Codes: [New fish trap]

In the No one can catch about 4 kg of land shrimp daily.
53:1 Codes: [Green mussel cultivation]
He also cultures green mussel
53:2 Codes: [New fish trap]
but also owns two No. The trap catches mainly land shrimp (2 kg/day), a few fish (ca bong, ca son/together 40) of which he throws back the small ones and keeps the bigger ones for his family. He catches no small crabs every now and then he catches a big one. He also doesn't see any small eggs or larvae being caught.
53:3 Codes: [Illegal fishing/Net size]
The only illegal thing is mainly the use of the small net size of 4 mm compared to the legal 1,8 cm.
53:4 Codes: [Public awareness building by individuals]
He is willing to do some research work and also he has sent some letters to the Chi cuc and So Thuy san to justify the use of the No.
53:5 Codes: [Responsibility for fishery resources is at district level]
He had people visiting him from the Chi cuc and RIA 3 and look at his trap and his catch.
53:6
He also doesn't see any small eggs or larvae being caught.
He had people visiting him from the Chi cuc and RIA 3 and look at his trap and his catch. He doesn't think it's anything bad and harms the environment or resources. He is willing to do some research work and also he has sent some letters to the Chi cuc and So Thuy san to justify the use of the No. The only illegal thing is mainly the use of the small net size of 4 mm compared to the legal 1,8 cm.
53:7 Codes: [Material and production costs (economics of aquaculture and fishing)]
Anyhow, the number of No is decreasing again, because many people don't have the money to pay for the maintenance costs. After 3 months the wooden polls need to be exchanged. Even he has only 1 trap left, because he makes too little money to pay for the maintenance cost.
53:8 Codes: [Fishing regulations/fishing area] [Government fails to keep up with new developments]
He thinks the ones in the waterways will be destroyed soon, because they cause problems for the boat traffic,
53:9
Some are set up in areas where they catch only little, so don't pay off after all. He thinks the number will stabilize itself.
Other reasons is that the crab fishermen are making more money then the tray fishermen nowadays, because former crab fishermen now use the No so they don't go catch crabs any more, so the other fishermen catch more crabs.
53:10 Codes: [Positive externalities of fish trap structures]
Also the fishermen using cast nets catch a lot of fish that hide and live close to the wooden pools of the trap.
53:11 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [Illegal fishing/Electric fishing]
About 10 people in Tan Thuy go electric fishing. He thinks electric fishing is the most serious problem, much bigger then the No, because it kills eggs and larvae when used.
53:12 Codes: [Social structures are eroding (local competition and envy)] [Village conflicts over fishery resources]
There is some conflict within the village, because they disagree with electric fishing.
53:13 Codes: [Income]
The electric fishermen can make 80-100000 VND per day, which is the main reason they engage in it.
53:14 Codes: [Community (self-help) organization to initiate natural resource management] [Low entry costs into illegal fishing activities/electric fishing]
They are becoming nervous because enforcement is getting stronger and they don't just take away the equipment (400000 VND) but also the boat (1 million VND).
53:15 Codes: [Village conflicts over fishery resources]
And when they meet other fishermen those will start arguing and fighting with the electric fishermen.
53:16 Codes: [Illegal fishing/Electric fishing]

Electric fishing only works in water which isn't deeper than the chest and so fish according to the tides.

54:1 Codes: [Fishermen] [Income]

The fishermen catches crab, shrimp and fish, about 2 kg per day, worth 30-40000 VND. The small fish he keeps for his family.

54:2 Codes: [Fishing regulations/net size]

He uses small nets with the requested net diameter of 1,8 cm, which last for one year.

54:3 Codes: [Traditional gill net fishing]

The nets are only set for about 1 to 1,5 hours. He uses a small rowing boat for one person. The area he fishes is about 1 square kilometer.

54:4 Codes: [Collect shells]

His wife and son go and collect shells during low tide during her free time she repairs the nets.

54:5 Codes: [Lack of alternative income]

They have no other income.

54:6 Codes: [Intermediaries control fish sales and informal credits]

The shell they collect is used as lobster feed and called Phi. They can collect about 5-6 kg daily and then sell to a middleman who buys all the shells for 3500 VND/kg. He also sells all his crabs to a middlemen.

54:7 Codes: [Market structures/Fish sales]

Prices range from 70000 VND to 20000 VND/kg.

54:8 Codes: [Population and households]

He has three kids and was borne in Ha Lien (50).

54:9 Codes: [Local perception of livelihoods/Lives have improved]

The life is getting better, income raises and kids go to school nowadays.

54:10 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources] [Increase of aquaculture activities]

There used to be about 40 ha of mangroves but they destroyed all to construct the shrimp ponds 20 years ago.

54:11 Codes: [Decline of coastal fishery resources]

The fishery resources have been destroyed by 60-70% in the last 30 years.

54:12 Codes: [High potential of coastal fishery resources]

He used to be able to catch enough to feed a 10 head family easily but now he has trouble feeding his.

54:13 Codes: [Local perception of coastal habitats/Mangroves] [Seasonal fishing techniques]

When a storm came they could always continue to fish in the mangroves, because it was sheltered, now they have to wait.

54:14 Codes: [Destruction of mangroves for shrimp pond development as reason for the decline of coastal fishery resources]

The main reason for the decrease of the fishery is the destruction of mangroves.

54:15

"Replanting would be very important to restore the environment for many generations later."

54:16 Codes: [Local INRM approaches/Mangrove replanting] [Local perception of coastal habitats/Mangroves]

He says any replanting effort would be good, because the mangrove create a good environment for fish.

54:17 Codes: [Replanting of mangroves difficult due to lack of knowledge and organization]

They would like to replant mangroves together but they lack organization and knowledge.

54:18 Codes: [Local INRM approaches/Mangrove replanting]

He replanted a small area himself and produced about 1000 trees.

54:19 Codes: [Community (self-help) organization to initiate natural resource management]

One year ago there was a lot of electric fishing, now it has almost disappeared completely. They now have the right to punish anyone and stopped many people like this. Violators come mainly from Le Cam (xa Ninh Phu).

54:20 Codes: [Local perception of coastal habitats/Mangroves]

The main breeding area are the mangroves, they are vital for the fish population.

54:21 Codes: [Replanting of mangroves difficult due to land scarcity]

There is only 1-2 ha left which are suitable for replanting.

54:22 Codes: [Local INRM approaches/Mangrove replanting]

Most of the shrimp pond owners here have replanted mangroves to protect the banks of their ponds from wind and waves.

54:23 Codes: [New fish trap]

The No doesn´t effect the fishers resources, its only a hindrance, because its in the way of the fishing boats. They are badly marked, so at high tide its difficult to see the construction and avoid bumping into it.

55:1 Codes: [Income] [Traditional gill net fishing]

He catches shrimp (black tiger) and fish (ca doi - mullet, ca la) 1 kg per day for about 40000 VND.

55:2 Codes: [Collect shells]

If flood they collect shells.

55:3 Codes: [Fishing regulations/illegal fishing methods]

He never done electric fishing, because the Chi cuc forbids. (Chi cuc in Luong Son)

55:4 Codes: [Community (self-help) organization to initiate natural resource management]

If they hear of electric fishing going on they go there as a group and take away the equipment. The fishery group (TO bao ve) in Ha Lien is very special in this area and even has been on KTV. There are 19 group members and two leaders that go out to punish people doing electric fishing.

55:5 Codes: [Fishing regulations formulated by fishermen/village level] [Village conflicts over fishery resources]

There has been some fighting when they take away the equipment from the electric fishermen.

55:6 Codes: [Community (self-help) organization to initiate natural resource management]

They formed the group, because electric fishing went out of control when it was first introduced to the area some years ago.

55:7 Codes: [Decline of traditional fishing methods/gear net]

From the 200 households in Ha Lien about 50 engaged in electric fishing at that time.

55:8 Codes: [Social structures are eroding (local competition and envy)] [Village conflicts over fishery resources]

There was a strong social conflict within the village between the electric fishermen and the traditional. The village leader could not move freely in the village anymore, because there were disputes everywhere and between many families.

55:9 Codes: [Public awareness building by individuals]

The biggest success was to solve this conflict and now they work closely together again.

55:10 Codes: [Local organization and decision-making]

The final decision to establish the group was made by all of the villagers and that is the reason for the success of it.

55:11 Codes: [Fishing regulations formulated by fishermen/village level]

All the fishermen around Dam Nha Phu have to know about the fishery and put back the small ones and also apply the right fishing methods.

55:12 Codes: [Fishing regulations formulated by fishermen/village level]

They need to keep the environment clean.

55:13

“The net size also needs to be right, so it catches the fish with the right size. Now they use any technique to catch fish of any size.”

55:14 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)] [Social structures are eroding (local competition and envy)]

The shrimp farmer farm at different times so that if they have problems with diseases, they release the water and other take it to freshly fill their ponds.

55:15 Codes: [Fishing regulations formulated by fishermen/village level]

They should all start farming at the same time.

55:16 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]

There have even been some meetings on this issue and some agreement but the owners decide differently when they start farming.

55:17

They formed the group, because electric fishing went out of control when it was first introduced to the area some years ago. From the 200 households in Ha Lien about 50 engaged in electric fishing at that time. There was a strong social conflict within the village between the electric fishermen and the traditional. The village leader could not move freely in the village anymore,

because there were disputes everywhere and between many families.
The biggest success was to solve this conflict and now they work closely together again.
The final decision to establish the group was made by all of the villagers and that is the reason for the success of it.
All the fishermen around Dam Nha Phu have to know about the fishery and put back the small ones and also apply the right fishing methods. They need to keep the environment clean.
“The net size also needs to be right, so it catches the fish with the right size. Now they use any technique to catch fish of any size.”
The shrimp farmer farm at different times so that if they have problems with diseases, they release the water and other take it to freshly fill their ponds. They should all start farming at the same time. There have even been some meetings on this issue and some agreement but the owners decide differently when they start farming.

56:1 Codes: [Illegal fishing/Electric fishing]
He goes electric fishing since 2 to 3 years.

56:2 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
Before he went fishing for crabs but decided to change, because he can make about 20000 VND more per day with electric fishing.

56:3
He catches mainly land shrimp; black tiger shrimp jump out of the water when using electric fishing equipment and escape the net. In his opinion the electricity only stun fish for a short time but doesn’t kill them. He catches some baby fish (1-2 cm) about 40-50, which he sells and they are used to feed ducks or pigs.

56:4 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]
He catches some baby fish (1-2 cm) about 40-50, which he sells and they are used to feed ducks or pigs.

56:5 Codes: [Illegal fishing/Net size]
The net he uses has a mesh size of about 4mm.

56:6 Codes: [Social structures are eroding (local competition and envy)] [Village conflicts over fishery resources]
The relationship with the neighbor is not good, because they disagree with electric fishing. For this reason he goes mainly fishing at night.

56:7 Codes: [Seasonal fishing techniques]
Also he only goes fishing about 3 to 4 months of the year to supplement his usually crab fishing efforts.

56:8 Codes: [Laborer and trading]
His wife works as a middleman buying and selling fish on the market.

56:9 Codes: [Laborer and trading]
He also works as a construction worker sometimes building houses when the fishing season is bad.

56:10 Codes: [Market structures/Fish sales]
He catches about 2-3 kg of land shrimp and sells them for about 10000 VND/kg.

56:11 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]
The reason for the low price is the small size of the shrimp he catches, about 2-3 cm.

56:12 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
If he would be catching shells he would spend 8 hours working but using electric fishing methods he only works for 4 hours. In his free time he stays at home and does house work, while his wife is selling fish.

56:13 Codes: [Animal husbandry as alternative income]
He would like to raise chicken or ducks instead.

56:14
He goes electric fishing since 2 to 3 years. Before he went fishing for crabs but decided to change, because he can make about 20000 VND more per day with electric fishing. He catches mainly land shrimp; black tiger shrimp jump out of the water when using electric fishing equipment and escape the net. In his opinion the electricity only stun fish for a short time but doesn’t kill them. He catches some baby fish (1-2 cm) about 40-50, which he sells and they are

used to feed ducks or pigs.
The net he uses has a mesh size of about 4mm.
The relationship with the neighbor is not good, because they disagree with electric fishing. For this reason he goes mainly fishing at night. Also he only goes fishing about 3 to 4 months of the year to supplement his usually crab fishing efforts. His wife works as a middleman buying and selling fish on the market. He also works as a construction worker sometimes building houses when the fishing season is bad. He catches about 2-3 kg of land shrimp and sells them for about 10000 VND/kg. The reason for the low price is the small size of the shrimp he catches, about 2-3 cm. The ones caught by No are bigger. If the tide is high he sometimes catches double the amount named above.
If he would be catching shells he would spend 8 hours working but using electric fishing methods he only works for 4 hours. In his free time he stays at home and does house work, while his wife is selling fish.
He would like to stop electric fishing, because he is 40 now and doesn't want to stand in the water anymore. He would like to raise chicken or ducks instead. According to him the UBND leader Mr. Han doesn't do his job well. They meet once a year to talk about the electric fishing problem but don't act. There is even a program to give out credit to the fishermen who stop but none of this has been implemented.
Since 7 years electric fishing is going on but the fishery resource have not really decreased in this time (land shrimp). He thinks it is really no problem and the small shrimp would die anyhow very soon, if he doesn't catch them.
56:15 Codes: [Discontent over authorities]
According to him the UBND leader Mr. Han doesn't do his job well.
56:16 Codes: [Insufficient implementation of policies and resolutions]
There is even a program to give out credit to the fishermen who stop but none of this has been implemented.
56:17 Codes: [Insufficient implementation of policies and resolutions]
They meet once a year to talk about the electric fishing problem but don't act
56:18 Codes: [High potential of coastal fishery resources]
Since 7 years electric fishing is going on but the fishery resource have not really decreased in this time (land shrimp).
56:19 Codes: [Local perception of electric fishing]
He thinks it is really no problem and the small shrimp would die anyhow very soon, if he doesn't catch them.
57:1 Codes: [Government structures and organization]
Chi cuc Bao ve Nguon loi Thuy san
Fishery Resources Conversation Department
57:2 Codes: [Government restocking efforts show no effect]
The Chi cuc restocks 1 million black tiger shrimp yearly.
57:3 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)] [Responsibility for fishery resources is at district level]
It's the same story I heard from fishermen where they were making jokes about the fish feeding they do with the shrimp fry, because they release in deep water area.
57:4
The story about the vem xanh and how it was wipped out completely due to over fishing and reestablished by RIA 3 could also be a nice example for my thesis.
57:5 Codes: [Local INRM approaches/Off shore fishing development]
He would like to change the drag net and electric fishing careers of people through funding.
57:6 Codes: [Fishing regulations/fines]
The fine for illegal drag net fishing is between 2 to 5 million VND.
57:7 Codes: [Illegal fishing/Drag net]
In recent years drag net fishing has declined.
57:8 Codes: [Responsibility for fishery resources is at district level]
The xa leader is responsible for the enforcement of fishing laws. The next responsible person is

the leader of the UBND on huyen level. If the fine for illegal fishing activities exceeds 500000 VND the xa leader has to report to the huyen level and it is not his responsibility anymore.

57:9 Codes: [Fishing regulations/fines] [Government failure to enforce laws and regulations]

If the fine for illegal fishing activities exceeds 500000 VND the xa leader has to report to the huyen level and it is not his responsibility anymore.

57:10 Codes: [Government structures and organization]

There is a small branch of the Chi cuc in Tan Than, xa Ninh Ich run by Mr. Nguyen Nhu Dao (Tel: 090-3573635), who will soon be replaced by Mr. Vinh.

58:1 Codes: [Government structure/district level]

They work together with the Chi cuc to catch fishermen using drag net in Dam Nha Phu.

58:2 Codes: [Fishing regulations/fishing area] [Illegal fishing/Drag net] [Off shore fishing/Drag net]

The drag net fishermen go fishing off-shore but if the weather is bad they go fishing in the bay, which is strictly forbidden.

58:3 Codes: [Seasonal fishing techniques]

This happens especially in the winter season.

58:4 Codes: [Conflicts between fishermen and authorities] [Government fails to enforce fishing regulations]

They had some conflicts with fishermen, because they didn´t want to give up their catch nor their gear.

58:5 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]

They also don´t understand why it is illegal.

58:6 Codes: [Conflicts between fishermen and authorities] [Government fails to enforce fishing regulations] [Increasing participation and awareness building between the government and the public]

5 years ago the conflict was very strong, now its decreasing, because they talk a lot to the fishermen and inform them about their illegal action.

58:7 Codes: [Increase of aquaculture activities]

The government also encourages aquaculture.

58:8 Codes: [Loans and banking] [Women]

There are women credit groups (Qui cua hoi phu nu…) in each village that hand out small credits to households. There are also credits available from the bank for 20 million VND.

58:9 Codes: [Fishing regulations/fines]

The maximum fine for drag net fishing is 20 million VND but it was never imposed.

58:10 Codes: [Increasing participation and awareness building between the government and the public] [Insufficient implementation of policies and resolutions]

In general he talks to drag net fishermen, if he sees them the first time and informs them of their illegal action.

58:11 Codes: [Government fails to enforce fishing regulations]

Only the second time he will punish them.

58:12 Codes: [Illegal fishing/Drag net]

So far there have been only few fishermen he has caught twice. This year 4 cases and he has confiscated 5-8 nets.

58:13 Codes: [Corruption]

The action he takes depends on how poor they are.

58:14 Codes: [Government fails to enforce fishing regulations] [Insufficient implementation of policies and resolutions]

He writes down the number of the boat and the people from Tan Thanh who don’t have numbers, he all knows by heart.

58:15 Codes: [Traditional gill net fishing]

Some of the smaller boats also use other fishing techniques besides drag net.

58:16 Codes: [Income] [Material and production costs (economics of aquaculture and fishing)]

The drag net fishermen can make maybe 200000 VND a day but have lots of expenses; if they catch lobster they can make the same money.

58:17 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [Illegal fishing/Net size]

They use small net sizes, so catch everything

58:18 Codes: [Illegal drag net fishing destroys the sea floor through dredging]

It scrapes the sea bed and destroys the Tao (Algae)

58:19 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]

They catch very small fish, only 25% are of big size, the other 75% are very small and used as

animal feed.
58:20 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [Increasing fishing pressure]
They effect the fishery in DNP strongly, because they catch a lot
58:21 Codes: [Fishing regulations/illegal fishing methods]
In the spawning season drag net can be illegal by special government decisions.
- Key role is played by the Chi cuc in Tan Thanh

58:22
"If illegal fishing can be controlled it will increase the fishery in DNP again."
58:23
The enforcement also depends a lot on the financial resources they have. He would never impose the maximum fine of 20 million VND and drive people against the wall.
58:24 Codes: [Government fails to enforce fishing regulations]
He would never impose the maximum fine of 20 million VND and drive people against the wall.
58:25 Codes: [Corruption]
The enforcement also depends a lot on the financial resources they have.
59:1 Codes: [Lobster culture]
From August to November the Giang River brings lots of fresh water, which changes the salinity in the bay. They have tried to culture lobster but they grow slowly and at the end they are much lighter than lobsters grown elsewhere.
59:2 Codes: [Low quality of lobster fry caught by light]
Mixing lobster seed is a big problem and the survival rate of the ones caught by light is very low, maybe 6 from 10 die.
59:3 Codes: [Intermediaries control fish sales and informal credits]
There are only 3 middlemen and nothing can be changed.
59:4 Codes: [Culture and values] [Poor marketing and distribution channels]
The idea of a quality lobster fry from Cat Loi, which sells for a higher price, cannot be realized, because they say Vietnamese are very deceitful. It is the Asian culture to not trust each other.
60:1 Codes: [Farmer group] [Government structure/village level]
He is member of the farmers group (Hoi nong dan), which is the most powerful group in the villages. It exists on every level: thon, xa, huyen, t.p., tinh. The other groups have to report to the farmers group or ask for assistance in problem solving.
60:2 Codes: [Women group]
The next powerful is the women group.
60:3 Codes: [Fishery group]
The fishery group (Chi hoi nghe ca) is like a branch of the farmers group. The head of the fishery group in xa Vinh Luong is Mr. Nguyen Ton, Tel: 839224. They share experience, e.g. how to feed lobster.
61:1 Codes: [Fishermen] [Population and households]
55% of the people in Xa Vinh Luong depend on fishing.
61:2 Codes: [Government fails to enforce fishing regulations] [Poverty as reason for breaking laws and regulations]
They cannot enforce strictly, because many lives are so poor
61:3 Codes: [Access to credit is constrained]
They cannot enforce strictly, because many lives are so poor and they cannot borrow any money from the bank.
61:4 Codes: [Population and households]
All together there are 31 poor families (what a joke!) in xa Vinh Luong.
61:5 Codes: [Rural development is inequitable]
They are working together closer with Bien Phong and Chi cuc to solve the problem.
61:6 Codes: [Increase of aquaculture activities]
He thinks there should be more aquaculture.
61:7
"We can't enforce strictly, because it will drive poor people against the wall."
61:8 Codes: [Laborer and trading]
50% of the labor force finds jobs at the 6 big companies in VL. People from Nha Trang supply the rest of the jobs, because they need skilled workers.
61:9 Codes: [Culture and values]

The drag net fishing has been around for 100 years, so it takes long to change the habits.
61:10 Codes: [Animal husbandry as alternative income] [Farmer group] [Women group]
The most important project at the moment is to lend some money through the farmers/woman group to change the job to farming or trading.
61:11 Codes: [Access to credit is constrained]
As I understand the money that is handed out is very little.
61:12 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]
And of course the incentive to change the job is low.
61:13 Codes: [New developments brought in by outsiders] [Tourism as future markets]
In the future, 2010 a huge tourist resort will be constructed on Dam Nha Phu, covering 200 ha. It will lie on the peninsula of xa Vinh Luong. He thinks there will be great changes in fishing because of this but also he admits maybe not.
61:14
Things can only changed slowly step by step, from generation to generation. Confiscating gear doesn't solve the problem it has no long-term effect. Education is the right method!
62:1 Codes: [Fishery group]
The fishery group exchanges ideas amongst the group members. They advice the small boat owners to change to a bigger boat but firstly it is hard to get credit from the bank and secondly the government also doesn't want to buy any small boats anymore.
62:2 Codes: [Access to credit is constrained]
They advice the small boat owners to change to a bigger boat but firstly it is hard to get credit from the bank and secondly the government also doesn't want to buy any small boats anymore.
62:3 Codes: [Fishing regulations formulated by fishermen/village level]
The government should give money for bigger boats and the Chi cuc should allow bigger engines.
62:4 Codes: [Traditional gill net fishing]
100 use standard nets
62:5 Codes: [Illegal fishing/Drag net]
200 small boats go fishing in DNP. 100 use standard nets, the other go drag net fishing
62:6 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
General the gill net fishing is more strenuous and less economic; 10 days fishing = 1 day drag net fishing.
62:7 Codes: [Traditional gill net fishing]
These 100 boats go fishing, because they don't have to worry about the Bien Phong or Chi cuc, as the do legal fishing.
62:8 Codes: [Village conflicts over fishery resources]
There is some conflict between gill net fishing and drag net fishing, i.e. between xa Vinh Luong and the other xa on DNP for a long time, especially between the village leaders, because they take the stand of their fishermen.
62:9
"Generally the knowledge of fishermen is really low and they just go fishing in DNP without thinking."
62:10
"If you want to try to understand something, try to change it."
63:1 Codes: [Population and households]

- 650 households and 3398 inhabitants
- 200 households are in fishing
- 300 households engage in trading, small businesses and services
- 150 households are farmers

63:2 Codes: [Fishermen]

- 200 households are in fishing

63:3 Codes: [Laborer and trading]

- 300 households engage in trading, small businesses and services

63:4 Codes: [Agriculture]

- 150 households are farmers

63:5 Codes: [Off shore fishing/Drag net]
The main occupation amongst fishers is drag net fishing (60 big boats) and
63:6 Codes: [Traditional gill net fishing]
- 140 small boats with engine go gill net fishing

63:7 Codes: [Off shore fishing/Hook and line]
- fishing with hook and line

63:8 Codes: [Lobster fry catching/Lift net & light]
- light fishing for lobster fry.

64:1 Codes: [Off shore fishing/Drag net]
Drag net fishermen and family: His main fishing area is around Hon Ca La, it takes him 1 hour to get there.
64:2 Codes: [Market structures/Fish sales]
He catches 70 kg of fish per trip and about 2-3 kg of shrimp. 50 kg are trash fish, because of their small size and are used for shrimp and lobster feed (3000 VND/kg). Only the small rest is for human consumption.
64:3 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)] [Trash fish]
50 kg are trash fish, because of their small size and are used for shrimp and lobster feed (3000 VND/kg).
64:4 Codes: [Fishing history] [Off shore fishing/Drag net]
He goes drag net fishing since 40 years. Drag net fishing has been around for 70 years.
64:5 Codes: [Decline of coastal fishery resources]
They catch 50% less than before, since 5 years.
64:6 Codes: [Weather changes as reason for the decline of coastal fishery resources]
- Reasons: 1. Weather

64:7 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources] [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]
- 2. Drag net use, because it catches small and big fish alike.

64:8
“He says they can’t grow up any more and can’t lay eggs.”
64:9 Codes: [Seasonal fishing techniques]
Depending on the weather they catch more or less.
64:10
“He says the fishing resources will decrease further to zero and then he will have to change the job.”
64:11 Codes: [Off shore fishing/Drag net]
There are 300 big boats
64:12 Codes: [Illegal fishing/Drag net]
100 small boats in xa Vinh Luong. All the small boats go drag net fishing in DNP. You need about 30 HP to pull a drag net. About 100-150 of the small boats have that.
65:1 Codes: [Fishermen]
6-7 fishermen at the beach
65:2
“All the boats have drag nets here.”
65:3 Codes: [Illegal fishing/Drag net]
They have too small boats to go outside the bay (100 boats). They all go fishing in Dam Nha Phu.
65:4 Codes: [Material and production costs (economics of aquaculture and fishing)]
They maybe make 150000 VND a night but spend 110000 VND on gas and oil.
65:5 Codes: [Village conflicts over fishery resources]
They don’t dare to go in the bay past Hon Cu Lao (monkey island), because of villagers from Ngoc Diem and Tan Dao and the Chi cuc.
65:6 Codes: [Fishing regulations/fines]
One man was just caught by the Chi cuc and fined 1 million VND. It is the second time in a row for him.
65:7 Codes: [Intermediaries control fish sales and informal credits]
It is difficult to make 1 million a month; they need to borrow money from middleman.
65:8 Codes: [Government fails to enforce fishing regulations] [Government fails to keep up with new developments]
The Chi cuc comes about every 10 days from the port in Nha Trang to control fishing activities.

The boats warn each other using radio. “Every boat has radio onboard.” Usually the Chi cuc comes at night between 11 and 3 P:M.

65:9

“Every boat has radio onboard.”

65:10 Codes: [Village conflicts over fishery resources]

They mostly have conflicts with Ngoc Diem and fear the rage of the people there.

65:11 Codes: [Local INRM approaches/Off shore fishing development]

They would like to have money from the government to run bigger boats. They believe the fishery resources offshore is immense.

65:12 Codes: [Local INRM approaches/Aquaculture development]

As another alternative they see culturing lobster or Babylon snail.

65:13 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]

They maybe make 150000 VND a night

65:14 Codes: [Fishing history] [Fishing regulations/fishing area]

In 1998 the law was introduced that prohibits drag net fishing inside Nha Phu Lagoon.

65:15 Codes: [Increasing participation and awareness building between the government and the public]

When caught the Chi cuc gives them advise to change to another job but they don’t specify.

65:16 Codes: [Access to higher education restricted] [Local perception of livelihoods/pessimistic]

He sees only little future for the children.

65:17 Codes: [Boat sales difficult (government program stoped) reorganization of the fishery sector impeded]

He tries to sell his boat, just like all of the other small boats are on sale but nobody wants to buy it.

65:18 Codes: [Local perception of livelihoods/Poverty has increased]

Since this law was introduced they have become poorer and poorer.

65:19 Codes: [Local INRM approaches/Off shore fishing development]

What needs to be done: 1. Buy boats

65:20 Codes: [Local INRM approaches/Create alternative incomes]

2. Provide small jobs

65:21 Codes: [Fishermen]

- 50% are fisher

65:22 Codes: [Agriculture]

- 50% are farmers in Vo Thanh.

65:23 Codes: [Fishing regulations/fishing area] [Fishing regulations/illegal fishing methods]

Drag net fishing is forbidden nation wide and in every lagoon.

65:24 Codes: [Boat sales difficult (government program stopped) reorganization of the fishery sector impeded]

That also means that it is hard to sell their boat anywhere, because he thinks everywhere they go drag net fishing and try to change to bigger boats. It is also risky to sell the boat, driving somewhere and maybe not finding a buyer.

65:25 Codes: [High entry costs into aquaculture prevent alternative income development] [Increase of aquaculture activities] [Local INRM approaches/Aquaculture development]

If he could sell his boat he would take the money and invest in lobster culture on the other side of the bay, basically where there is still some of the best coral left! He would keep back some money to supply his family for the period in which he has no income yet.

66:1 Codes: [Off shore fishing/Drag net]

2 drag net fishermen

66:2 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]

Insecticides and shrimp medicine kill fish and one reason for the degradation of resources.

66:3 Codes: [Environmental pollution as reason for the decline of coastal fishery resources]

Every time it rains the insecticides from the fields are washed into the bay.

66:4 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]

Drag net catches many undersized fish.

66:5 Codes: [Boat sales difficult (government program stopped) reorganization of the fishery sector impeded] [Local INRM approaches/Off shore fishing development]

If fishery resources should be restored all the small boats will have to be destroyed, compensating them and giving them big boats so they can go off shore fishing.

66:6 Codes: [High potential of coastal fishery resources] [Local perception of livelihoods/Lives have improved]

He owns 1 boat and his son another 3, 200 million VND each. Over the last 20 years he has made

so much money through fishing that he has been able to buy a bigger boat every 5 years.
66:7 Codes: [Decline of coastal fishery resources] [Increasing fishing pressure]
Now the resources are degraded and with his 4 boats it will take him 5 years to be able to buy a bigger boat. (Increased effort per unit catch)
66:8 Codes: [Off shore fishing/Drag net]
He goes fishing in about 200 to 300 m depth of water.
66:9 Codes: [Loans and banking]
The Agriculture Bank, Dung De gives credits from 50 to 150 million VND.
Also the Foreign Trade Bank hands out credits.
67:1 Codes: [Loans and banking]
BIDV Bank of Investment and Development in Vietnam
67:2 Codes: [Fishing history] [High potential of coastal fishery resources]
He himself comes from Van Dang and remembers Dam Nha Phu as a very rich bay about 20 years ago. They also only used small rowing boats at that time in xa Vinh Luong. When he went swimming he would see many crabs and fish.
67:3 Codes: [Traditional gill net fishing]
They also only used small rowing boats at that time in xa Vinh Luong.
67:4 Codes: [Loans and banking]
If someone has 1 billion VND worth of property, they will allow a 500 million VND loan. The maximum duration of the loan is 5 years. The interest rate is 0,85% per month.
67:6 Codes: [Bureaucratic hurdle to obtain legal land rights]
Usually you will need the “red paper” So Do to apply for credit. To get the So Do you need to go to your UBND at the xa and then get in contact with the So Dia Chinh (Department of Land).
67:7 Codes: [Loans and banking]
They have fishermen that have credits at their bank.
68:1 Codes: [Loans and banking]
Agribank
80% of your capital asset value can be borrowed, if you have So Do.
If I have a boat for 100 million VND but no So Do they will loan me 50%.
68:3 Codes: [Access to credit is constrained] [Loans and banking]
Without any assets it is possible to get a credit up to 20 million VND, for max. 5 years and at 1,1% interest/month. But they will check my business plan very thoroughly especially for the repayment time or the capital recovery rate.
68:4 Codes: [Access to credit is constrained] [Bureaucratic hurdle to obtain legal land rights] [Loans and banking]
But without So Do I have to be:

1. Lived in Khanh Hoa for a long time
2. Have a good business idea, a plan and low risk
3. Have property, preferred with So Do

68:5 Codes: [Access to credit is constrained] [Farmer group]
The farmers group can also borrow money easily but only up to 10 million VND.
69:1 Codes: [Devolution of land management/ownership]
About 90% of the households have a So Do.
69:2 Codes: [Access to credit is constrained]
Their neighbor has a So Do and wants to borrow money but can’t. After all he doesn’t have any investment plan but needs the money for food and his family.
69:3 Codes: [Access to credit is constrained]
Another one has borrowed 8 million repayed and wants to borrow another 10 million but until today his credit hasn’t been approved.
69:4 Codes: [Fishing as last resort] [Local perception of livelihoods/pessimistic]
Offshore fishing has no future many fishermen are unsuccessful and poor… no they are unsuccessful, because they are young and inexperienced.
69:5 Codes: [Fishing history]
Offshore fishing has no future many fishermen are unsuccessful and poor… no they are unsuccessful, because they are young and inexperienced. The other ones catch a lot of fish.
69:6 Codes: [Fishing regulations/net size]

If the 1,8cm ban would be imposed they will loose their job.
69:7 Codes: [Off shore fishing/Drag net]
The richest people in Luong Son are offshore fishermen.
69:8 Codes: [Loans and banking]
Nobody helps with business plans!
70:1 Codes: [Fishing regulations/fines]
They have been caught 3 times by the Chi cuc and have paid 12 million VND fine altogether (fine = 4 million VND).
70:2 Codes: [Boat sales difficult (government program stopped) reorganization of the fishery sector impeded]
She has tried to sell their boat to the government but unsuccessful.
70:3 Codes: [Loans and banking] [Off shore fishing/Drag net]
They borrowed 50 million VND at the bank and had 50 million themselves to build a bigger boat to go off shore fishing but unsuccessful.
70:4
They don't have their own labor force (family) to run the boat and still had the smaller boat. The man decided to go fishing with the small boat like before and turned over the bigger boat to a friend. This "friend" ran the boat very bad and because it was not theirs they didn't care much about how much they caught or not. After some time they soled the big boat off and ended up in depth.
70:5 Codes: [Fishing regulations/illegal fishing methods]
The man has been chased many times by the chi cuc. Once he abandoned his boat and took his family and fled to the mountain but they took his boat. Another time he was beaten with a stick.
70:6 Codes: [Fishing regulations/fishing area]
He was caught one time when he was fishing the border of the restricted area, his favorite fishing area and although it is a buffer zone the Chi cuc also fined him.
70:7 Codes: [Poverty as reason for breaking laws and regulations]
The man has been chased many times by the chi cuc. Once he abandoned his boat and took his family and fled to the mountain but they took his boat. Another time he was beaten with a stick.
He was caught one time when he was fishing the border of the restricted area, his favorite fishing area and although it is a buffer zone the Chi cuc also fined him.
70:8 Codes: [Material and production costs (economics of aquaculture and fishing)]
His boat is worth maybe 50 million VND.
70:9 Codes: [Local INRM approaches/Off shore fishing development]
He thinks it would be best if the government bought all small boats. He would buy a bigger boat and go offshore fishing, maybe consider lobster culture.
70:10 Codes: [Lobster culture]
There is an area across from Luong Son designated for lobster culture for people from xa Vinh Luong. There are about 100 people there.
70:11
"A boat for offshore fishing costs minimum 200 million VND."
70:12 Codes: [Illegal fishing/Drag net]
He goes fishing mainly between the two capes.
70:13 Codes: [Illegal drag net fishing destroys the sea floor through dredging] [Material and production costs (economics of aquaculture and fishing)]
"The maintenance cost are quite high, because the drag net often gets damaged on the coral."
70:14 Codes: [Market structures/Fish sales]
He catches mainly ca du, which are about 5cm big. Other fish are ca bong, ca son (goby, cardinal), ca muh (grouper), ca chim (butterfish), tom su (black tiger shrimp), tom yam, tom tith and crabs.
Crabs grow very fast in this area.
70:15 Codes: [High potential of coastal fishery resources]
"Even the fishing pressure is very high and the fishery resources have declined, Dam Nha Phu still maintains a large fishery."
70:16 Codes: [Loans and banking]
Credits from the bank have to be repayed on a quarterly basis, which is too much for them.

70:17 Codes: [Shrimp hatcheries]
Somebody is carrying a bag with two very big black tiger shrimps along the beach. They are soled to the hatcheries and they can get between 5 and 10 million VND for one!
70:18 Codes: [Market structures/Fish sales] [Material and production costs (economics of aquaculture and fishing)]
A drag net catch is landed. It is worth 300000 VND. Fishing time was about 4-5 hours, probably offshore.
70:19 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)] [Market structures/Fish sales] [Trash fish]
There are 10 plastic bags, each 3-4 kg and they contain the trash fish. Mostly undersized crabs, shrimp and fish. One bag is 9000 VND.
70:20 Codes: [Trash fish]
I buy one bag and try to count half of the bag:

- Tom thich: 200
- Other shrimp: 200
- Crabs: 250
- Fish: 15 (eels, puff fish, flounders,…)

I estimate 1200 undersized crabs, shrimp and fish per plastic bag and this when counting careless! (added 08.09. 2004: bigger drag nets fished with two boats catch around 100 of these plastic bags)
70:21 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]
I estimate 1200 undersized crabs, shrimp and fish per plastic bag and this when counting careless!
71:1 Codes: [Traditional gill net fishing]
They use small boats (not capable of pulling a drag net) and small boats but the same as in Vo Thanh and Luong Son. But they use small nets to catch fish, shrimp and crabs. They catch mainly Ca mai, ca trich (Herring) and many types of shrimp.
The main fishing area is mainly between the cape Ke Ga and the lobster culture area from Xa Vinh Luong.
71:2 Codes: [Decline of coastal fishery resources]
Todays catches are only 40% of what they caught 5 years ago.
71:3 Codes: [Increasing fishing pressure]
One main reason is that today more people go fishing then than before.
71:4 Codes: [Fishing offers high income (drag net)] [Incentives to engage in illegal fishing (higher income, less labor)]
Fishing also makes more money than alternative jobs.
71:5 Codes: [Fishing offers high income (drag net)]
Going fishing they can make more money than from agriculture, sometimes they can make 1 million VND a day.
71:6 Codes: [Culture and values]
They inherit their jobs from their parents.
71:7 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
Also they only go 3 hours of fishing a day.
71:8 Codes: [Fishing regulations/illegal fishing methods] [Traditional gill net fishing]
In Van Dang most people with small boats use a gill net (luoi mai with 1-layer and luoi cuoc with 3-layers), because they don´t want to be caught by the chi cuc. They prefer going fishing everywhere they choose with a good feeling.
71:9 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
Maybe in the other villages they don´t want to change their jobs (drag net) to traditional fishing, because they would make little or less money.
71:10 Codes: [Traditional gill net fishing]
He goes fishing every day and makes about 80000 VND/day. They usually set 20 to 25 nets, each over 0,6 km long and 2 m wide. They are set for 20 minutes and then hauled back in.
Interestingly these gill nets are not known in Vo Thanh and Luong Son. In Van Dang about 40 to 50 people use them.
72:1 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
They say the biggest problem is the drag net fishing and the electric fishing.
72:2 Codes: [Green mussel cultivation] [Lobster fry catching/coral block]

They culture green mussel and catch lobster fry in the same construction. The poles are used to culture green mussel and in between they hang drilled coral blocks.

72:3 Codes: [Grouper culture]

There are also 4-5 families culturing grouper.

72:4 Codes: [Intermediaries control fish sales and informal credits]

Middlemen own most small boats and the fishermen who use them have to sell their catch to them. The catch (shrimp and crabs) is then brought to Nha Trang; they believe it ends up in Factory 17. Most fishermen are dependent on the middlemen here.

72:5 Codes: [Traditional gill net fishing]

We meet a fisherman who just comes back from fishing. He was out for 6 hours and has caught crab and shrimp worth 45000 VND, which he sells to the middlemen. He also keeps back a small portion of the catch, mainly fish and some shrimp. These he sells for another 30-40000 VND, so he totals 80000 VND a day.

72:6 Codes: [Intermediaries control fish sales and informal credits]

He was out for 6 hours and has caught crab and shrimp worth 45000 VND, which he sells to the middlemen. He also keeps back a small portion of the catch, mainly fish and some shrimp. These he sells for another 30-40000 VND

72:7 Codes: [Intermediaries control fish sales and informal credits] [Shrimp culture]

Across from Ngoc Diem there are shrimp ponds, which are accessed by foot and by boat during harvest time. Middlemen have constructed them and they have re-rented their ponds to some people.

73:1 Codes: [Shrimp culture]

He used to be a fisherman but now owns shrimp ponds.

73:2 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]

Since three years he had a lot of diseases and used a lot of medicine but made only little money from shrimp farming. The main reasons are:

1. Pollution from other ponds (diseases)
2. Weak shrimp fry, because according to him the female shrimp are forced to spawn early

73:3 Codes: [Lack of specific knowledge]

He has rented out one pond to a man who has been always successful. This is because this man prepares the pond carefully. He lets it dry thoroughly and never rushes but takes his time. He then buys his shrimp from his relatives and they are very healthy.

73:4 Codes: [Culture and values]

Since two years his son has established a business connection to the shrimp fry supplier and gives them presents when he is successfully. So far he had two good runs.

73:5 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]

The fishery resources have decreased in Dam Nha Phu, because many people go electric fishing.

73:6 Codes: [Poverty as reason for breaking laws and regulations]

Many people in Tan Dao go electric fishing, because they are so poor.

73:7 Codes: [Village conflicts over fishery resources]

They have had much trouble with the chi cuc and nowadays they go fishing in other areas where they have conflicts. (Ha Lien)

73:8 Codes: [Population increase as reason for the decline of coastal fishery resources]

The second man mentions the main reason for declining resources is:

- Population increase (more people going fishing)

73:9 Codes: [Market structures/Fish sales]

His catch consists of ca liet and ca lat about 8 kg, which he sells for 4000 VND/kg.

73:10 Codes: [Laborer and trading]

His wife also goes working so they have a double income.

73:11 Codes: [Fishing as last resort] [Lack of specific knowledge]

He says the electric fishermen also have no other profession, because there are no jobs and when they go fishing they cannot catch anything, because they do not have the knowledge.

73:12 Codes: [Lack of specific knowledge]

Fishing needs a lot of knowledge. Electric fishing was introduced 5-6 years ago.

74:1 Codes: [Intermediaries control fish sales and informal credits]

This first lady is new in the business, so she does not know to well about everything. She buys from about 10-20 fishermen and sells to Mr. Trang and Mr Quang who again sell to Factory 17 in Nha Trang.

There are 2 middlemen for crabs, >10 for tom bac and 2 for lobster fry.

75:1 Codes: [Intermediaries control fish sales and informal credits]

She has been in this business for 13 years. Her business is based on family labor, her husband and her two sons.

75:2 Codes: [Grouper culture]

She not only acts as a buyer but also raises grouper near Nua Island.

75:3 Codes: [Intermediaries control fish sales and informal credits] [Poor marketing and distribution channels]

She cannot sell directly to Factory 17, because there are middlemen, like Mr. Trang and another man, who are the only ones allowed to sell to the factory. They stand at the gate and let knowbody in. Also the factory could only pay her once a month but she needs to get payed right away, because she needs the money. Mr. Trang is paid only monthly by the factory but pays her right away.

75:4 Codes: [Market structures/Fish sales]

She trades:

- So long 100kg/day (trading like green mussel)
- Ngheu 300kg/month (private middlemen who store them and resell to restaurants)
- Crabs 70kg/day (Factory 17)
- Green mussel 50kg/day (Dam market, other markets and the mollusk lady at the bridge)

75:5 Codes: [Market structures/Fish sales]

During the SEA Game season the grouper price was 90000 VND/kg but usually it is around 60000 VND.

75:6 Codes: [Grouper culture]

The seed can be bought for 1000 VND each but maybe only 2 or 3 a day.

75:7 Codes: [Decline of coastal fishery resources]

7 years ago she could buy 70 a day.

75:8 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]

She says grouper culture is very suitable for Dam nha Phu, although she had problems with shrimp pond effluence that killed all her fish.

75:9 Codes: [New market opportunities (shrimp, lobster, blood cockle, green mussel, grouper)]

1994 the price for crab was 24000 VND/kg and today it is 40000 VND/kg.

75:10 Codes: [Decline of coastal fishery resources] [Decline of traditional fishing methods/gear net] [Increasing fishing pressure]

At that time you could catch a lot with a 1-layer net but nowadays you need 3-layers.

75:11 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]

The main reason are electric fishing and drag net fishing.

75:12 Codes: [Intermediaries control fish sales and informal credits]

She “supports” poor fishermen and gives them small loans worth 500-800000 VND. They need not pay back the money but have to sell their catch to her. She buys only the crabs from them, for 32000 VND/kg and resells for 40000 VND/kg. The fish and especially high value tom dac (60000 VND/kg) they can sell to others. Like this she has about 50-80 fishermen working for her.

75:13 Codes: [Government restocking efforts show no effect]

The so Thuy San restocks grouper and shrimp seed every years but they see no effect.

75:14 Codes: [Public awareness building by individuals]

“Electric fishing cannot be controlled but only the minds of the people changed through telling them how bad it is.”

75:15 Codes: [Illegal fishing/Electric fishing]

There are about 10-15 families in Ngoc Diem who go electric fishing.

75:16 Codes: [Village conflicts over fishery resources]

The villagers once got angry at one and threw stones at his house. He then went to the UBND and they fined the people who threw the stones.

75:17 Codes: [Conflicts between fishermen and authorities]

On another occasion a policeman got injured from on of the boats doing electric fishing. Since then the police has been very vigorous in catching and stopping this fishing method with great success.

75:18 Codes: [Local INRM approaches/Training and extension]

- You need to give the people knowledge

75:19 Codes: [Local INRM approaches/Create alternative incomes]

credit and assist them to change to another job

75:20 Codes: [Local INRM approaches/strictly enforce existing laws]

strictly enforce electric fishing, especially the possession of equipment

76:1 Codes: [Illegal fishing/Electric fishing]

There are about 40 electric fishermen in Tan Te.

76:2 Codes: [Government structures and organization] [Insufficient implementation of policies and resolutions] [Lack of public awareness building and extension]

This year the fishery department had a 1-2 hour training course on the negative effects of electric fishing, which most of the fishermen attended. After the training course electric fishing stopped for maybe 1 1/2 months but after that time returned to its current level.

76:3 Codes: [Government fails to enforce fishing regulations]

In addition, when the village leader reports to the fishery department, they will tell the marine police to go around and the activities stop but 4-5 days later everything returns to normal.

76:4 Codes: [Corruption]

When the marine police controls illegal fishing, they never impose the maximum fine, e.g. 10 million VND but instead maybe 2 million, which they put in their own pocket and report back that everything was quiet today and no activities could be observed.

76:5 Codes: [Local INRM approaches/strictly enforce existing laws]

Strict enforcement could work if the marine police would have the right, responsibility and administrative power.

76:6 Codes: [Government failure to enforce laws and regulations] [Responsibility for fishery resources is at district level] [Social exclusion/marginalisation through village elites]

The different government administrative structures, like the fishery department, fishery resource protection department and the marine police prevent effective action.

And because it would make some people poorer in the villages that vote for the representatives, village and xa leaders are not very interested in strict enforcement.

77:1 Codes: [Traditional gill net fishing]

The fisherman catches ca dia, doi, liet and la. He can make about 60000 VND/day. But he works 14 hours.

77:2 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]

Electric fishing you can make the same money but in about 2 hours.

77:3 Codes: [Illegal fishing/Electric fishing]

They spend little time electric fishing, because it is an illegal activity. If it would be legal they would fish much longer and catch more to make more money.

77:4 Codes: [Local INRM approaches/clear responsibilities and restructuring of the departments]

The marine police should have all the power to control and stop any illegal fishing activity, without being dependent on the fishery department or the fishery resource protection department. Like this they could quickly stop all illegal fishing activities.

78:1 Codes: [New fish trap]

Their owners have already abandoned 30% of the No.

78:2 Codes: [Positive externalities of fish trap structures]

No do not prevent drag net fishing, because the water is not very deep in the first place.

78:3 Codes: [Village conflicts over fishery resources]

There was a battle in front of Ha Lien village between the traditional and the electric fishermen. They went to the court of Khanh Hoa to solve this problem and after that most electric fishing stopped in Ha Lien. Today there are only 2 families left.

78:4 Codes: [Shrimp culture]
60% of the population has a shrimp pond and was farming shrimp at some time sooner or later. Nowadays they all are in depth by the bank, between 10-100 million VND. Many have returned to their original job, fishing and catching shell so they say their profession is fishing. They keep on farming shrimp but very unprofessional not as before.
78:5 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
Nowadays they all are in depth by the bank, between 10-100 million VND.
78:6 Codes: [Shrimp culture]
Renting out the pond is no option, because nobody wants to take the risk to loose money. This year they have been successful but they all invested little so the return is little.
78:7 Codes: [Seasonal fishing techniques]
They work about 6 months in the shrimp ponds (February-July).
78:8 Codes: [Shrimp culture]
60% own a shrimp pond
78:9 Codes: [Fishermen]
20% go fishing
78:10 Codes: [Laborer and trading]
20% do trading or work as middleman.
78:11 Codes: [High entry costs into aquaculture prevent alternative income development]
They would need low input technologies to utilize their ponds.
78:12 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
He believes the main reason for failure is the weak shrimp fry they purchase. Another but smaller problem, is polluted water from neighboring ponds.
78:13 Codes: [Local INRM approaches/Compulsory shrimp pond effluence]
His idea is they should all agree to take in water at the same time and announce to each other when they release polluted water.
78:14 Codes: [Culture and values]
But if one is unsuccessful and looses his shrimp he does not want to see any other to be successful.
78:15 Codes: [Local INRM approaches/form shrimp farm groups]
His idea is that they should form a government shrimp farmer group and everybody who joins has to follow good rules of practice.
78:16 Codes: [Shrimp pond effluence as reason for the decline of coastal fishery resources]
He believes that all the “medicine” they use builds up in the shrimp pond bottom and walls and contaminates the water years later.
78:17
They used to feed shrimp by fish but others said: “oh, you have to change to shrimp food, because otherwise you need to clean them better when selling and you waste a lot of time for feeding.”
78:18
Mr. Sy: “if you want to stop illegal fishing, you need to involve xa leader, thon leader and all agree at the same time.”
78:19
"If you sit on the back of the Tiger you have to follow him."
79:1 Codes: [Illegal fishing/drag net equipped with electric gear]
He has been doing electric drag net fishing and has stopped, because the enforcement has gotten strong.
79:2 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
He could make many hundred thousand Dongs a night but now has maybe half of the income than before.
79:3 Codes: [Traditional gill net fishing]
Nowadays he goes gill net fishing with a 3-layer gill net. Basically he goes fishing everywhere in the bay.
79:4 Codes: [Lobster fry catching/coral block]
Besides that he goes fishing for lobster fry with drilled coral blocks.

79:5 Codes: [Lobster culture]
If he wanted to start to rear lobster until 10 cm, he will need about 100 million VDN investment. They would do it together as one always has to watch over the lobster and you need some labor. Also each could borrow maybe 20 million VDN and put it together. If they wanted to farm lobster until the big size the initial investment would have to be much bigger. About 200 million for the big cage alone.
79:6 Codes: [Loans and banking]
Also each could borrow maybe 20 million VDN and put it together.
79:7 Codes: [High entry costs into aquaculture prevent alternative income development]
If he wanted to start to rear lobster until 10 cm, he will need about 100 million VDN investment.
79:8 Codes: [High entry costs into aquaculture prevent alternative income development]
If they wanted to farm lobster until the big size the initial investment would have to be much bigger. About 200 million for the big cage alone.
79:9 Codes: [Illegal drag net fishing destroys the sea floor through dredging]
He says drag net fishing is good because it stirs up the bottom of the bay like the farmer preparing his field and fertilizing the water body.
79:10 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
He mentions illegal fishing as the biggest problem
79:11 Codes: [Population increase as reason for the decline of coastal fishery resources]
followed by population increase.
79:12 Codes: [Government fails to enforce fishing regulations] [Illegal fishing/drag net equiped with electric gear]
The chi cuc is not very serious about illegal drag net fishing, as they were with illegal electric drag net fishing, so he and others assume, drag net fishing is not so bad after all.
79:13 Codes: [Traditional gill net fishing]
One reason why he probably follows gill net fishing, is his good knowledge and education.
80:1 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
As one reason for declining catches, he names cyanide fishing. The area where cyanide is used is not occupied any more by fish.
80:2 Codes: [Diving] [Government fails to enforce fishing regulations]
Today he, respectively his son still uses cyanide.
80:3 Codes: [Government failure to enforce laws and regulations] [Intermediaries control fish sales and informal credits]
Nowadays it has got difficult to buy it but he is supplied by his middlemen.
80:4 Codes: [Diving]
his son still dives
80:5 Codes: [Lobster culture]
today aquaculture
80:6 Codes: [Market structures/Fish sales] [New market opportunities (shrimp, lobster,blood cockle, green mussel, grouper)]
From May to July the grouper move from the open ocean to the inshore reefs. At this time middlemen demand large quantities of live grouper (200000 VND/kg), dead only 100000 VND/kg.
80:7 Codes: [Intermediaries control fish sales and informal credits]
The middlemen supply the divers at this time with cyanide. It can only be bought in one Province in the north nowadays.
80:8 Codes: [Diving]
He does not use dynamite for fishing. When he used to much cyanide, he feels like drunk for a short time.
The fish he spears have a minimum size of 0,5 kg.
80:9 Codes: [Lobster culture]
He just bought some tom thich (10000 VND/kg) to feed his 10 cm lobsters. It will be enough for 400 lobsters.
He sells directly lobsters at all sizes to markets in Cam Ranh and Van Phong bay. For the money he feeds up some of his lobsters to market size.
81:1 Codes: [Traditional gill net fishing]
When he sees a lot of fish he calls the others over radio to share the fish.
They have self-organized groups, depending on the engine size, for example the 8 d group or the

15 d group. They go fishing at the same time and search for the fish swarms together.
81:2 Codes: [Responsibility for fishery resources is at district level]
There is no government To bao ve (fishery group), because the Bien Phong takes care of the resource protection issues.
81:3 Codes: [Traditional gill net fishing]
Fishermen from Nha Trang (Bon Bridge or Dung De) listen to the same radio frequency and also report frequently over the occurrence of fish or shrimp schools and then gather together to catch. "The fish are for everyone."
81:4
"The fish are for everyone."
81:5
"Many small boats (18-20 d engine) go fishing with drag net inside the bay."
81:6
"They can´t go outside the bay and mainly participate in drag net fishing, because it makes a lot of money."
81:7
"If I had the money and a big boat I would do the same."
81:8 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
"If I had the same boat I would continuo my fishing, because with a drag net I can only earn little more per day."
81:9 Codes: [Material and production costs (economics of aquaculture and fishing)]
The drag net might make 300000 VND/day but spend 200000 VND on gasoline. He makes 150-200000 VND/day but only spends 50000 VND on gas.
81:10 Codes: [Devolution of land management/ownership]
Most people in Van Danh have a So Do (red paper).
81:11 Codes: [Bureaucratic hurdle to obtain legal land rights]
Last year the paper cost 120000 VND per paper, this year it cost about 5 million VND per paper. A reason was mainly, because many people let their house register at the same time, instead of doing it independently.
81:12 Codes: [Corruption]
Costs include measuring of the house and garden but especially bribes for government officials.
81:13 Codes: [Corruption]
If a new resident wants to buy land he will need a So Do right away to proof his possession. He will have to pay a sort of middlemen to help him organize the document and this person will pay the "right" people money to get the paper quickly. The amount of money you will have to spend depends on how rich I am, between 2-5 million VND. Trying to get the document on himself it would be much cheaper but the process might take one year or longer.
81:14 Codes: [Bureaucratic hurdle to obtain legal land rights]
Trying to get the document on himself it would be much cheaper but the process might take one year or longer.
82:1 Codes: [Intermediaries control fish sales and informal credits]
He buys feed for lobsters from middleman, like everybody in Cat Loi. The middlemen buy from the drag net fishermen in xa Vinh Luong and Vang Gia (xa Vah Ninh). Mainly it comes from Luong Son.
82:2 Codes: [Material and production costs (economics of aquaculture and fishing)]
The mortality is quite high, about 20%. He buys in most of his lobster fry for 70000 VND and sells for 150000 VND at about 10 cm size. Each year he has about 20 million VND repair cost.
82:3 Codes: [Seasonal fishing techniques]
In the 8 months of the year not culturing lobster, he maintains his equipment.
82:5 Codes: [Lobster culture]
He can only culture lobster for about 4 months, because the area in front of Cat Loi is very shallow and there is not enough water movement and too little oxygen in the summer to culture lobster all the way to market size.
82:6 Codes: [Low quality of lobster fry caught by light]
Reasons for high mortality is one the one side fry caught buy light fishing and then fry that comes

from different Provinces and is weakened by the transport.
82:7 Codes: [Intermediaries control fish sales and informal credits]
He has to buy from middlemen and cannot purchase directly, because the fishermen who catch lobster fry lend money from the middlemen and therefore have to sell their catch to the middlemen.
83:1 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]
Electric fishing is still the biggest problem today.
83:2 Codes: [Illegal fishing/Electric fishing]
On some days 100 people can be seen electric fishing just in front of the village. Most electric fishermen come from the villages in xa Ninh Phu.
83:3 Codes: [Juvenile fish and shrimp catches through (illegal) fishing (electric and drag net)]
According to his knowledge, small fish, egg and larvae is destroyed through electric fishing.
83:4 Codes: [Agriculture]
Most people who do agriculture grow cashew trees.
83:5 Codes: [Crab fishing]
All fishermen use crab traps about 60-70 a day.
84:1
“All boats in Tan Thanh even the biggest never leave the bay for drag net fishing.”
85:1
“When shrimp ponds are prepared, the next day nothing can be caught close to them.”
86:1 Codes: [Mud crab culturing]
Crab fishermen sell small mud crabs to shrimp pond owners, who culture crabs. Up to 1 kg a day, accounting for 25-30 juvenile crabs are soled via middlemen who come to the fishermen houses daily. The fisherman sells throughout the year. That means many pond owners culture crab all year around.
86:2 Codes: [Intermediaries control fish sales and informal credits]
Up to 1 kg a day, accounting for 25-30 juvenile crabs are soled via middlemen who come to the fishermen houses daily.
86:3 Codes: [High entry costs into aquaculture prevent alternative income development]
Especially lack of money does not allow pond owners to invest in shrimp fry.
86:4 Codes: [Crab fishing]
In the crab trap, only swimming crabs are caught.
86:5 Codes: [Market structures/Fish sales]
Small swimming crabs are sold to the middlemen for 6000 VND/kg and probably resoled as lobster feed.
86:6 Codes: [Mud crab culturing]
The juvenile mud crabs used in the pond are caught with the net.
86:7 Codes: [Market structures/Fish sales] [Mud crab fry catching]
Small mud crabs are paid by piece (1000 VND/piece) and big ones by kg (15 crabs make 1 kg/ soled for 25000 VND/kg).
87:1 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
Since 4 years he is unsuccessful.
87:2
“Everybody is one time successful and then again unsuccessful.”
87:3 Codes: [Increasing diseases and financial losses in shrimp culture (since 2000)]
Most people owning shrimp ponds in Tam Ich have depths at the bank.
87:4 Codes: [Polyculture/Crabs and shrimp]
He started shrimp farming in 1985. He cultures mud crabs all year around, with the main season from April-Nov (lunar calendar). In the other months it is difficult to purchase juvenile crabs. At first shrimp and crab are fed together. Later he starts feeding about 2-3 kg/fish per day. He buys continuously crabs for his pond and stocks it throughout the year.
He dries out his pond every 2 years. He wants to provide a good environment for the shrimp. The professional shrimp farmers dry out their ponds once a year.
87:5 Codes: [Shrimp culture]
He dries out his pond every 2 years. He wants to provide a good environment for the shrimp. The

professional shrimp farmers dry out their ponds once a year.
88:1 Codes: [Fishermen] [Fishing as last resort]
He fishes with a head lamp wading in the water and catching crab and shrimp with his hands or with a hand net. There are many fishermen like him in Tam Ich.
88:2 Codes: [Market structures/Fish sales]
He can catch between 5-50 juvenile mud crabs a night and maybe 1,5 kg big crabs.
88:3 Codes: [Intermediaries control fish sales and informal credits]
Sometimes he sells his small crabs to a middleman other times directly to the pond owners.
88:4 Codes: [Market structures/Fish sales]
One small mud crab makes about 500-2500 VND/crab.
88:5 Codes: [Seasonal fishing techniques]
The main season lasts from March to September (lunar calender) but he catches crabs all year around.
88:6 Codes: [Mud crab fry catching]
He makes most of his income through catching and selling small mud crabs.
89:1 Codes: [Women]
Fisherman (woman)
89:2 Codes: [New fish trap]
They go fishing with No. Last year they operated 4 No.
89:3 Codes: [Illegal fishing/Net size]
Since December it is illegal and the village leader ordered to take them away. This order was based on the fact that too small net is used for the construction of the No.
89:4 Codes: [Government fails to keep up with new developments]
Nowadays, they have one left. Little attention is paid to No fishing at the moment by the village leader.
90:1 Codes: [Traditional fish trap]
He fishes with the traditional fish trap (Giang). He operates 2 Giang. There are about 10-12 Giang in the area. They have been around for 50 years.
90:2 Codes: [Fishing history]
They have been around for 50 years.
91:1 Codes: [Fishing history]
The 3-layer net came to Dam Nha Phu about 10 years ago.
91:2 Codes: [Traditional gill net fishing]
Before they used 1-layer nets and caught less.
91:3 Codes: [Fishing history]
The 3-layer net assures that bigger shrimp entangle themselves in the net.
91:4 Codes: [Intermediaries control fish sales and informal credits]
He borrows money from the middleman and has to sell his catch to them. Next year he wants to repay his loan, because he earns more money nowadays by culturing green mussels. If the loan is repayed he can make more money by selling on the market. He has been repaying his loan little by little. On average he earns 40-50000 VND/day from selling to the middleman. He could make about 5-10000 VND more per day, if selling directly.
91:5 Codes: [Green mussel cultivation]
Next year he wants to repay his loan, because he earns more money nowadays by culturing green mussels.
91:6 Codes: [Income]
On average he earns 40-50000 VND/day from selling to the middleman. He could make about 5-10000 VND more per day, if selling directly.
92:1 Codes: [Traditional gill net fishing]
His crab net is 150 m long. The length of a crab net depends on the money of the fisherman. The bigger nets are about 500-700 m long and some reach 1 km.
92:2 Codes: [Increase of aquaculture activities] [New developments brought in by outsiders] [New market opportunities (shrimp, lobster,blood cockle, green mussel, grouper)]
He cultures a shell hau (oyster) since 6 months.
92:3 Codes: [Material and production costs (economics of aquaculture and fishing)]
He buys small ones for 3000 VND/piece and sells them at 6000 VND/piece.

92:4 Codes: [Loans and banking]
He tried to get a 15 million VND credit from the bank but was refused, because of lack of red paper.
92:5 Codes: [Intermediaries control fish sales and informal credits]
He found a partner who supplied the money and material to culture the oysters and they share the profit 50/50.
92:6 Codes: [Environmental pollution as reason for the decline of coastal fishery resources]
He mentions urban pollution as a big problem, especially from the local processing factory. Sometimes when wading in the water doing electric fishing, he develops a skin rash, which he believes is caused by polluted water.
92:7 Codes: [Illegal fishing/Electric fishing]
Electric fisherman
93:1 Codes: [Animal husbandry as alternative income]
Their visions on improving livelihoods:

- Develop agriculture, especially animal husbandry cows and goat at Hon Quai.

93:2 Codes: [Local INRM approaches/Aquaculture development]
Develop aquaculture suitable to the environment in the area
93:3 Codes: [Stakeholders]

So Thuy San	Ministry of Fisheries
Chi cuc Bao ve nguon loi Thuy San	Fisheries Resources Conservation Department
Bien Phong	Border Police
Chimh quyen Thon	Village authority
To bao ve nguon loi Thuy San	Fisheries Resources Protection Group
Hoi phu nu	Women Group
Hoi nong dan	Farmers Group
Chi hoi nghe ca	Fishery Group
Trung tam khuyen ngu	Fishery Promotion Center
Ngan Hanh	Bank
Cong ty che bien Thuy San	Fishery Processing Company
Nguoi trung gian	Middlemen

94:1 Codes: [Extension] [Increasing participation and awareness building between the government and the public]
They do training courses 3 times a year in the UBND in every xa. Especially on shrimp culture, green mussel or advise illegal fishermen to change to another job, e.g. diving for lobster fry.
94:2 Codes: [Extension]
In Tan Dao this concept has been successful when 10 electric fishermen were trained in green mussel culture and 7 abandoned electric fishing and culture green mussels nowadays.
94:3 Codes: [Extension]
Blood cockle and oyster culture would be suitable for Xa Ninh Ha.
94:4 Codes: [High entry costs into aquaculture prevent alternative income development]
The y teach little about culturing crabs but a lot on shrimp and lobster culture.
94:5 Codes: [Government structures and organization]
The fishermen interested in culturing green mussel for example can ask their village leader to invite someone from the Fishery Extension Center.
94:6 Codes: [High entry costs into aquaculture prevent alternative income development] [No participation in decision-making and policy formulation on village level (political disempowerment)]
They had a training course offer in Tan Te but nobody registered (Training on blood cockle).
95:1 Codes: [Community (self-help) organization to initiate natural resource management]
There is a self formed Offshore Fishing Support Group (To ho tro danh bat xa bo).
The fishery group existed years ago but nowadays not any more.
95:2 Codes: [Local INRM approaches/artificial reef construction]
Visions to develop the fishery in Dam Nha Phu:

1. Construct artificial reefs

95:3 Codes: [Local INRM approaches/strictly enforce existing laws]

2. Stop drag net fishing

95:4 Codes: [Illegal fishing techniques as reason for the decline of coastal fishery resources]

The biggest problem are the small drag net boats.
95:5 Codes: [Low entry costs into illegal fishing activities/electric fishing]
They could change to traditional gill net fishing but the investment costs are much higher then for drag net fishing equipment.
95:6 Codes: [Fishing history]
In the past many of the small drag net fishermen were working on the big offshore dragnet fishing vessels but started there own business, i.e. dragnet fishing with small boats copying there employees.
95:7 Codes: [Low entry costs into illegal fishing activities/electric fishing] [Material and production costs (economics of aquaculture and fishing)]
A dragnet for a small boat only costs about 4-5 million VND.
For gill net fishing you need about 22-23 gill nets, which each costs about 600000 VND. So the total investment cost is about 14 million VND. Per year repair cost is about 1,5 million VND.
95:8 Codes: [Loans and banking]
The biggest problem remains the availability of long term credits. Paying back a 10 million VND bank loan can only be done step by step. The gill net fishermen can set aside about 3500 VND daily and can save about 110000 VDN/month. That means about 1,4 million VND per year could be paid back to the bank.
95:9 Codes: [Incentives to engage in illegal fishing (higher income, less labor)]
One more problem is that you need more labor to run the gill net fishing.
Two fishermen are setting the nets and one man drives the boat.
But a single person can carry out drag net fishing.
96:1 Codes: [Stakeholders]

So Thuy San	Ministry of Fishery	8
Ngan hang	Bank	4
Hoi phu nu	Woman group	8
Hoi nong dan	Farmer group	8
Chi hoi nghe ca	Fishery group	8
Chimh quyen Thon	Village authority	7
UBND	People’s Committee	5
Chi cuc bao ve nguon loi Thuy San	Fishery resources conservation dept.	3
Cong ty che bien Thuy San	Fishery processing company	6
Bien Phong	Border police	3
Nguoi Trung gian	Middleman	8
Trung tam khuyen ngu	Fishery Extension Center	9

96:2 Codes: [Extension] [Green mussel cultivation]
Special in Tan Dao is the Fishery Extension Center, which has trained electric fishermen in green mussel farming and from 10 families 7 changed to this new job.
97:1 Codes: [Stakeholders]

So Thuy San	Ministry of Fishery	9
Ngan hang	Bank	10
Hoi phu nu	Woman group	5
Hoi nong dan	Farmer group	8
Chimh quyen Thon	Village authority	10
UBND	People’s Committee	10
Chi cuc bao ve nguon loi Thuy San	Fishery Resources Conservation Dept.	2
Cong ty che bien Thuy San	Fishery processing company	5
Bien Phong	Border police	8
Nguoi Trung gian	Middleman	9
To bao ve nguon loi thuy san	Fishery Resources Protection Group	10

97:2 Codes: [Community (self-help) organization to initiate natural resource management]
Special in Ha Lien is the self formed Fishery Resources Protection Group
97:3 Codes: [Extension]

On the other side the Fishery Extension Center plays no role just as the Fishery Group.

97:4 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]

Interesting is the little influence of the Fishery Resources Conservation Department on the local fishery.

98:1 Codes: [Stakeholders]

So Thuy San	Ministry of Fishery	5
Ngan hang	Bank	8
Hoi phu nu	Woman group	7
Hoi nong dan	Farmer group	7
Chimh quyen Thon	Village authority	4
UBND	People's Committee	10
Chi cuc bao ve nguon loi Thuy San	Fishery Resources Conservation Dept.	10
Cong ty che bien Thuy San	Fishery processing company	9
Bien Phong	Border police	7
Nguoi Trung gian	Middleman	6
Trung tam khuyen ngu	Fishery Extension Center	10
To ho tro danh bat xa bo	Offshore Fishing Boat Support Group	3

98:2 Codes: [Local organization and decision-making]

Special in Van Dang is the Offshore Fishing Boat Support Group. It is a self formed group and not really recognized by the government authorities.

98:3 Codes: [No participation in decision-making and policy formulation on village level (political disempowerment)]

Again the Fishery Group plays no role in the local fishery and does not exist in this village.

98:4 Codes: [Community (self-help) organization to initiate natural resource management]

It is said that several of these groups exists but when questioned how many, nobody knows exactly how many.