Food and Agriculture Organization of the United Nations

FAO FISHERIES AND AQUACULTURE PROCEEDINGS
ISSN 2070-6103
50

Socio-economics of trawl fisheries in Southeast Asia and Papua New Guinea

Proceedings of the Regional Workshop on Trawl Fisheries Socio-economics
26-27 October 2015
Da Nang, Viet Nam
and
Socio-economic Write-shop
25-26 April 2016
Cha Am, Thailand

gef GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

Cover photograph:
Trash fish catch landed by trawler in the Gulf of Thailand. Courtesy of Petri Suuronen, FAO.

FAO
FISHERIES AND
AQUACULTURE
PROCEEDINGS
50

Socio-economics of trawl fisheries in Southeast Asia and Papua New Guinea

Proceedings of the Regional Workshop on Trawl Fisheries Socio-economics
26–27 October 2015
Da Nang, Viet Nam
and
Socio-economic Write-shop
25–26 April 2016
Cha Am, Thailand

Edited by

Susana V. Siar
Fishery Industry Officer
Fishing Operations and Technology Branch
FAO Fisheries and Aquaculture Department

Petri Suuronen
Fishery Industry Officer
Fishing Operations and Technology Branch
FAO Fisheries and Aquaculture Department

Richard Gregory
Project Regional Coordinator
Strategies for Trawl Fisheries Bycatch Management Project

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2017

ISBN 978-92-5-109929-2

Preparation of this document

The Strategies for Trawl Fisheries Bycatch Management Project (REBYC-II CTI; GCP/RAS/269/GFF), funded by the Global Environment Facility and executed by FAO, carried out socio-economic studies in project countries to understand the contribution of trawl fisheries to food security and livelihoods, and determine the potential impacts of management measures on stakeholder groups. The project countries were Indonesia, Papua New Guinea, Philippines, Thailand, and Viet Nam. No study was conducted in Indonesia as a result of the ban on trawl fisheries which began in January 2015. However, a paper based on key informant interviews was prepared and is included in this publication. The plans/initial findings of the studies were presented at the Regional Workshop on Trawl Fisheries Socio-economics held in Da Nang City, Viet Nam on 26–27 October 2015. The Regional Workshop was organized by the Training Department of the Southeast Asian Fisheries Development Center (SEAFDEC/TD) and hosted by the Directorate of Fisheries of Viet Nam. The completed studies were presented and discussed at the Socio-economic Write-shop held on 25–26 April 2016 in Cha Am, Thailand, organized by SEAFDEC/TD. The papers were reviewed by the following: Richard Gregory, REBYC-II CTI Project Regional Coordinator; Susana V. Siar, FAO Fishery Industry Officer; and Petri Suuronen, FAO Fishery Industry Officer and Lead Technical Officer of the project. The papers were further reviewed by Chavakat Muralidharan, Consultant, and Rudolf Hermes, ex-Chief Technical Adviser of the Bay of Bengal Large Marine Ecosystem Project; they are reproduced here as submitted.

Abstract

Socio-economic surveys were carried out in pilot sites in Papua New Guinea (Gulf of Papua Prawn Fishery), the Philippines (Samar Sea), Thailand (Trat and Chumphon) and Viet Nam (Kien Giang) as part of the Strategies for Trawl Fisheries Bycatch Management Project (REBYC-II CTI), funded by the Global Environment Facility (GEF) and executed by FAO. No study was conducted in Indonesia as a result of the ban on trawl fisheries which began in January 2015. However, a paper based on key informant interviews was prepared. The socio-economic studies were undertaken to understand the contribution of trawl fisheries to food security and livelihoods, and determine the potential impacts of management measures on stakeholder groups. The socio-economic information collected included: the demographic structure of vessel owners and crew; fishing practices (boat, gear, season, duration; catch composition, value chain and markets); contribution to livelihoods, food security and nutrition; role of women; costs and income from trawling; catch/income sharing arrangements; links with other sectors; and perceptions (resources, participation, compliance and the future).

A common finding from the surveys in Papua New Guinea, the Philippines and Thailand was the low level of education among fishers. In the Philippines, Thailand and Viet Nam, trawl fisheries are very important for livelihoods, and many fishers depend solely on fishing.

The important findings in Papua New Guinea included: (a) the absence of direct benefit from trawl fisheries to resource owners or to the provinces; (b) bycatch utilization is very low because of a lack of accessibility to trawlers for communities, leading to the discarding of bycatch; (c) weak implementation of management rules by provincial fisheries officers as a result of limited capacity; and (d) provincial and national fisheries management plans do not address women's issues.

In the Philippines, the important findings included: (a) differences of perception between municipal and commercial trawl fishers with respect to the condition of fishery resources; (b) use of income from fishing on children's education and basic needs; (c) willingness of municipal trawl fishers—but not commercial trawl fishers—to shift to other gears; (d) the preference for gillnets should all trawl fishers be required to shift to other gears; (e) catch from trawling contributes to fish for home consumption; and (f) the fishing operations of small- and medium-scale fishing boats are still profitable.

The survey in the pilot site in Thailand showed that the number of fishing boats is still increasing, in spite of the decrease in the number of fishing households. There is a low level of knowledge and awareness of fisheries regulations. Management measures, when enforced, would have a huge impact on livelihoods because many fishers rely solely on fishing for their livelihoods. When considering which management options to implement, the similarities and differences in perceptions among fishers should be taken into account.

In Viet Nam, there is a very close connection between trawl fisheries and aquaculture because trawl fisheries provide the raw materials necessary to the fishmeal industry. There is an increasing demand for raw materials for fishmeal. Fishers practically land and utilize all catch. Low-value fish account for 30–40 percent of trawlers' landing volume. There is a significant loss in quality during the capture stage as a result of the long towing time (7–8 hours per haul) as well as significant post-harvest losses (20–30 percent).

In Indonesia, the implementation of the moratorium for foreign vessels and the new trawling ban enforced in 2015 has made it difficult for many crew members and fish workers to find another job. Companies cannot operate their processing facility at full capacity and find it difficult to maintain trade with buyers abroad. On the other hand, the ban apparently has provided an opportunity for small-scale fishers to supply shrimp to the processing industry in Arafura region.

Siar, S. V. , Suuronen, P and Gregory, R., eds. 2017. *Socio-economics of trawl fisheries in Southeast Asia and Papua New Guinea.* FAO Fisheries and Aquaculture Proceedings No. 50. Rome, FAO.

Contents

Acknowledgements

The members of the organizing committee for the Da Nang workshop were Nguyen Thi Trang Nhung, Deputy Director of the Department of Science Technology and International Cooperation, Directorate of Fisheries of Viet Nam, and the following staff from the Regional Facilitation Unit hosted by the Training Department of the Southeast Asian Development Center (SEAFDEC/TD): Richard Gregory, Project Regional Coordinator; Sayan Promjinda, Project Technical Adviser; and Nathacha Sornvaree, Administrative Officer.

The members of the organizing committee for the Cha Am workshop were: Richard Gregory, Sayan Promjinda, and Nathacha Sornvaree, all from the Regional Facilitation Unit hosted by SEAFDEC/TD.

The socio-economic studies were carried out with technical and logistical support from the following: Joseph Posu of the National Fisheries Authority in Papua New Guinea; Jonathan Dickson (National Technical Officer), Rafael Ramiscal (National Project Coordinator), and members of the National Facilitation Unit hosted by the Bureau of Fisheries and Aquatic Resources, Philippines; Mala Supongpan, Project National Technical Officer, Thailand; Nguyen Thi Trang Nhung (National Project Coordinator) and Pham Viet Anh (National Technical Officer) of the Directorate of Fisheries of Viet Nam.

The socio-economic survey in the Philippines was preceded by the Workshop on Participatory Approaches and Socio-economic and Gender Mainstreaming in REBYC-II CTI held from 12 to 18 November 2014 in Catbalogan City, Samar, Philippines. Technical support for this workshop was provided by the following officers from SEAFDEC/TD: Isara Chanrackij, ex-Project Technical Adviser and currently Head a.i. of the Capture Fishery Technology Division; Panitnard Taladon, Training and Extension Section Head; and Thanyalak Suasi, Socio-Economic Scientist.

The Budget Holder for the project, Liao Chongguang, Field Programme Officer at the FAO Regional Office for Asia and the Pacific in Bangkok, Thailand, provided the necessary operational support.

PAPERS PRESENTED AT THE WORKSHOPS

Overview of the trawl fisheries socio-economic conditions in Indonesia after the second trawl ban

Endroyono
National Project Coordinator
REBYC-II CTI Indonesia

ACKNOWLEDGEMENTS

On behalf of the National Project Coordinator of REBYC-II CTI in Indonesia, we are presenting the socio-economic conditions of shrimp trawl fisheries in Indonesia, especially in industry scale at the Aru-Arafura Sea.

We would like to thank Ms Endang Roesbandi, leader of the Indonesian Shrimp Catching Entrepreneurs Association (HPPI), which has participated actively and supported the activities on information and data capture. We are also grateful for the support of Director of Fishing Vessels and Fishing Gears and her colleagues who have been involved with the REBYC-II CTI project such as Imron Rosyidi, Bagus Oktori Sutrisno and Mas Umamah for collecting and compiling data.

I am also very grateful for the editorial support received from Rick Gregory, Petri Suuronen, Susana Siar and Muralidharan Chavakat.

This paper tries to give a broader picture of the background related to the implementation of the moratorium and the ban on trawl vessels operating in Indonesia, as well as an indication of the impact on the people who operate in the trawl fisheries sector. The paper also attempts to describe the main characteristics of shrimp fishery in the Aru-Arafura Sea.

Last but not the least, we would like to thank all fishermen, crew and members of the association (HPPI) for their time and effort in sharing their understanding of the socio-economic impacts after trawl ban in Indonesia.

ABSTRACT

This paper gives an overview of the socio-economic impact on the communities affected by the implementation of governmental policy on trawl banning in Indonesia. It has been written based on data from the Indonesia Shrimp Catching Enterpreneurs Association (HPPI) and explanations of experts and actors in particular fishers who operate trawl vessels.

It is generally known that bottom trawling operates on and touches the bottom and thereby directly disturbs the seabed habitats and benthos. This has been a serious concern. Indonesia has various types of trawlers from small and medium to large scale. Over the years modifications of different components in the trawl gears were made and different local names for these gears were given.

In Aru and Arafura Sea, trawlers permitted by the government have been largely industrial-scale fish and shrimp trawlers. The license fee paid each year has been calculated based on the size of fishing vessels (GT) multiplied by the potential productivity of fishing gear and multiplied by the benchmark prices of fish and the percentage of business scale. The percentage of business scale is grouped into small-scale fisheries (5 percent), medium scale fisheries (10 percent) and large-scale fisheries (25 percent). Shrimp produced in these fisheries is exported to various countries such as Japan, USA, Australia, the EU, Thailand and Taiwan Province of China. Trawl fishery has contributed greatly to the economy and the state revenue through the export and earning from foreign exchange.

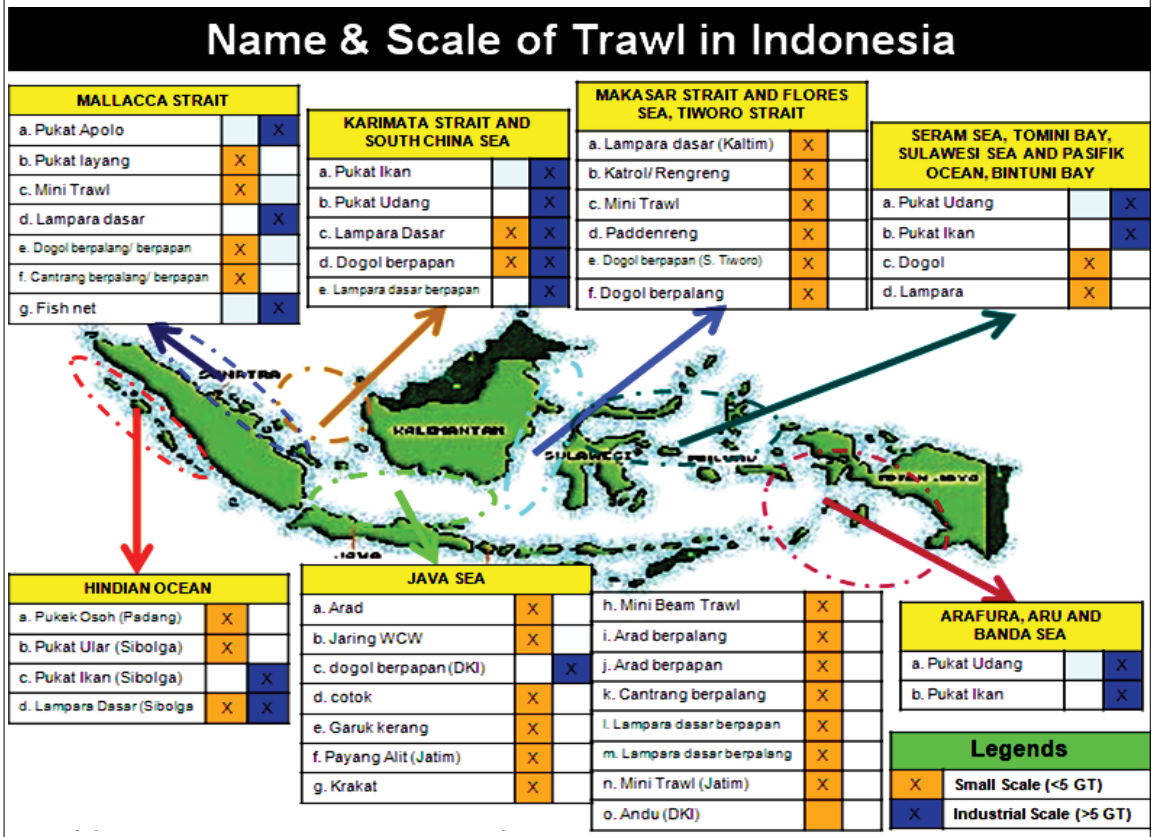
The prohibition of trawling since 9 January 2015 has resulted in a gradual cessation of shrimp trawling in Aru-Arafura Sea. The trawlers have not yet been able to find alternative and adequate shrimp fishing technique. Some alternative fishing gears have been tried but they have not been in tune with the capacity of these high-power ex-trawlers. Nonetheless, in response to the government's policy on trawl ban, the attempt has been to maintain the business continuity. The trawler companies have sought to reduce operating costs by reducing operating days and cutting crew costs. Processing units are experiencing serious idle capacity and currently are largely relying only on supply from the smaller fishing ports located around the region. The production base is very weak but can still maintain limited trade relations with overseas buyers.

A potential positive impact of the trawling ban has been that small-scale fishers are now able to catch fish more easily and the volume of catch per fisher has been increasing. The small-scale fishermen, however, need support in distribution and marketing their catches. Poor infrastructure in the fishing villages has become an obstacle in maintaining the quality of catch, and is also an obstacle for effective fish distribution. Provision of ice and coolbox has become a very important intervention to keep the catch fresh until it reaches a shelter in a cold storage.

1. INTRODUCTION

Trawl fisheries was introduced in Indonesia in the 1960s from Japan. During a symposium under REBYC-I project in August 2005, the variety of local names of trawls in Indonesia was collected, based on the scale of the size of the vessel and its region (Figure 1). The issues in the regulation of fishing activities and enforcement were also looked into. In tackling the various problems caused by the trawling, the government has tried several rules, including banning trawlers.

FIGURE 1
Local names and scale of trawl vessels in Indonesia



Source: Symposium on Present Status of Trawl in Indonesia Waters, Jakarta April 2005

1.1 Trawl Ban Phase I

The prohibition of trawling throughout Indonesia for the first time had been implemented in 1980 through Presidential Decree 39/1980: The implementation phase was ruled by Presidential Instruction INPRES 11/1982. This was as a result of the conflict other fisherman had with the trawler fishing groups as their fishery resources were heavily exploited by trawlers.The execution of the ban was done in stages that can be explained as follows:

1. Presidential Decree 39/1980 (KEPPRES 39/1980)
   a. First stage
      i. 1 May – 1 Oct 1980: ban on trawling in the waters around Java and Bali Islands
      ii. By 11 January 1981: ban on trawling in the waters around Sumatera Island
   b. Second stage
      By 1 Oct 1981: number of trawlers reduced to 1 000 units

2. Presidential Instruction No. 11/1982 for implementation of the Presidential Decree 39/1980. The banning of trawling in the waters of Indonesia came into force 1 January 1983.

Re-opening of the licences for trawl

Over time, the fishing communities began to develop fishing gears to improve its productivity while reducing the bycatch. Finally, the government accommodated the re-use of trawl in certain areas. The government issued regulations to legalize trawl fishing in certain areas as follows:

1. **Shrimp trawl in waters Aru-Arafura**
   Presidential Decree No. 85/1982 allowing use of shrimp trawl in the Aru-Arafura Sea at the east of 130°E until the waters with a depth of 10 m isobaths with the following conditions
   a. The bycatch to be utilized;
   b. Install TED with a bar distance of 3 inches. (Minister of Agriculture number Kep 930/Kpts/Um/12/1982 and SK Director General Capture Fisheries No. IK.010/S4.8075/82 about Installation Turtle Excluder Device (TED) on ShrimpTrawl (Pukat Udang)
   c. Terminology this fishing gear falls in the category Bottom Trawl.

2. **Fish Trawl in the Indian Ocean around west of Sumatra and Aceh island.**
   Minister of Agriculture KEP 770/Kpts/IK120/10/1996 allows Fish Trawl in Exclusive Economic Zone of Indonesia in Indian Ocean at western part of Sumatera and DI. Aceh limited to 4°N & 96°E, with requirements:
   a. Codend> 5 cm (2 inch), not to use a tickle chain and iron sinker
   b. Use fishing vessels above 80 GT, the engine above 350 Horse Power
   c. Based at the Port of PT (Persero) Great Ocean Fisheries and Sibolga National Fishing Port (Decree of the Minister of Agriculture No. 1039.1/Kpts/IK.120/10/1999)
   d. Terminology this fishing gear falls in the category mid-water trawling.

3. **The trawl-like fishing gears for small-scale:**
   a. Lampara Dasar in Aru-Arafura Sea at the eastern of 130°E.
      Minister of Agriculture KEP 769/Kpts/HK210/10/1988 about Net Usage Lampara Dasar requirements:
      i. Not operated with two boats (pair)
      ii. Vessels LOA <12m, Engine power <36 Horse Power
      iii. Owner under a Cooperative
   b. Fishing Gear modified such as: cantrang berpalang, Jaring Arad, Otok (KEP DJPT No. IK.340/DJ.10106/97 about Guidelines Kepmentan 503/Kpts/Um/7/1980) with the following requirements:
      i. Mesh Size > 1 inch
      ii. without otter boards, bobbins, tickle chain
      iii. the vessel size <5 GT, Engine power <15 Horse Power
      iv. Terminology this fishing gear falls in the catagory Seine Net.
      Fishermen are starting to use this fishing gear around the Java Sea.
   c. Trawler in Eastern part of Kalimantan
      Ministry Regulation PERMEN No. 06/MEN/2008 about trawl (Pukat Hela) in Eastern part of Kalimantan with the following requirements:
      i. Fishing zone 1 (1-4 nautical miles from coastline) for vessels<5 GT using trawl with Head Rope max 13.50 Ground Rope max 15m.

ii. Fishing zone 2 (4-12 nautical miles from coastline) for vessels 5 GT-30 GT using trawl with head rope (HR) maximum 22.50 m, Ground Rope maximum 24 m.
iii. Terminology this fishing gear falls in the catagory Trawl.

4. **Fish Trawl (Pukat Ikan) in Excluive Economic Zone of Indonesia (EEZI) in South China Sea, Sulawesi Sea, Pacific Ocean, Arafura Sea, Indian Ocean. Ministerial regulation of PERMEN KP 11/MEN/2009 fish trawl in EEZI requirements:**
   a. Head Rope length<60m, Codend length<10m, Mesh Size>5cm
   b. Fishing vessel made of steel/fiberglass should be greater than 100 GT or
   c. Fishing vessel made of wood should be greater than 60 GT
   d. Use only one (1) Ships (inline with Ministrial Decre 60/Men/2001)
   e. Terminology this fishing gear falls is Not Pair Trawler.

1.2 Trawl Ban Phase II

The new government in Indonesia (2014) started attempts to combat illegal, unreported and unregulated (IUU) fishing in Indonesian waters that often occurs due to rampant illegal fishing vessels entering into the waters of Indonesia, the misuse of the flag as well as human trafficking. The impact is most felt by small-scale fishermen when their catches come down and they have to make a longer fishing trip to locate fishing areas.

The moratorium policy was another step, purposed to fight againt the proliferation of IUU fishing in the Indonesia fisheries management area (WPP-NRI) done by foreign vessels. This was done also to secure and save the fish resources nationwide as "Komnas Kajiskan" have indicated symptoms of overfishing of some fish species. This started in the decree No. 45/2011.

Degradation of fish resources is also caused by the widespread use of trawling and the use of fishing gear that resembles a trawl by small and medium-scale fishermen. Therefore, considerations were given to the need of prohibition use of fishing gear that is less environmentally friendly by ministerial regulation number KP No. 2/ PERMEN-KP/2015 issued on 8 Jan 2015 prohibition the use trawl (Pukat Hela) and Seine Nets (Pukat Tarik) in WPP-NRI.

Circular Paper number 72/MEN-KP/II/2016 on the restriction of use of fishing gear "cantrang" in WPP-NRI issued on 11 February 2016 gradually sets limits on its use through the following requirements:

1. Re-measurement of the size of fishing vessel (GT). If greater than 30 GT they should change fishing gear
2. Only operated in the management area under the province's territory (12 nautical miles).
3. Limitation of selectivity and capacity: minimum mesh size > 2 inches, and head rope longer than 60 meters.

Trawl Ban phase II has had a great impact on the shrimp fishery in the Aru-Arafura Sea. The impact has been significant because the fishing industries generally use vessels constructed abroad. Under the ministerial decree Number 56/2014 about Moratorium, the vessels constructed abroad should be evaluated on valid legal documents and to ensure compliance for carrying out fishing activities in Indonesia. The vessels passing the evaluation process can undertake fishing activities until the end of the business license granted.

Scope of this paper

This paper will describe:

1. Condition of the shrimp fishery in the Aru-Arafura Sea;
2. Conditions of the shrimp fishing industry in Aru-Arafura;
3. Impact of Trawl Ban on the shrimp industry (such as the company, crew, small fisherman, market, tax, foreign exchange); and
4. The future management of the shrimp fishing in the Arafura.

2. OVERVIEW OF FISHERIES IN ARU-ARAFURA SEA

Indonesian waters consist of three major ecosystems, the Sunda Shelf, Sahul Shelf and the deep sea. Sahul Shelf area of 160 000 km^2, covers Aru-Arafuru Sea (143 500 km^2) and other waters (16 500 km^2) (Bailey *et al.*, 1987). Aru-Arafuru Sea is shallow, with depths up to 80 meters. The deeper waters are on the west side (Figure 2).

FIGURE 2
Aru-Arafura Sea

Source: Fisheries Management Area Plan of Aru Sea, Arafura Sea dan Timor Bagian Timor Sea (WPP-RI 718), Directorate General of Capture Fisheries

Arafura Sea is one of the most productive fishing grounds in Indonesia for catching shrimp and demersal fish. The high productivity of Arafura Sea is due to the process of nutrient upwelling and nutrient inputs from the watershed. So the area is indicated as nursery ground and feeding ground. The upwelling in Banda Sea and Arafura is formed due to the influence of the southeast wind season (Wyrtki, 1961). Upwelling improves nutrient (Wetsteyn *et al.*, 1990) and organic carbon (Cadee, 1988), which promotes the growth and biomass of phytoplankton, increased oxygen production (Tijssen *et al.*, 1990) and the abundance of zooplankton (Baars *et al.*, 1990). Meanwhile, the water flowing in the rivers carries nutrients from the dense forests in the interior of Papua to Arafura Sea during the rainy season. Nutrients are also transported to the Arafura Sea from dense mangrove forests along the western coast of Papua (Sadhotomo *et al.*, 2003). The diversity and extensive mangrove forests in the south coast of Papua, which borders the Arafura Sea is among the highest in the world (e.g. Huffard *et al.*, 2012).

Mangrove ecosystem is spread over three provinces: Province of Papua, West Papua and Maluku. Mangrove forests in the Aru Islands and Southeast Maluku (Maluku), respectively reached 833 km^2 and 18 km^2 (Department of Fisheries & Marine Maluku Province, 2005). High primary productivity in the sea southeast of Arafura (especially during the June-August season) is not caused by the flow of the river but a vertical mixing that brings nutrient-rich water from the deeper sea-water layers (Wetsteyn *et al.*, 1990).

2.1 Overview of fisheries legal framework in Indonesia

Some of the information in this section is quoted from the Fishery Management Plan in WPP-NRI 718 as outlined in the Regulation of Ministry of Marine Affairs and Fisheries number 54/Kepmen-KP/2014 regarding the fisheries management plan of fishery management area 718.

Article 33 paragraph 3 of the Act of 1945 mandates that the wealth of the earth and the water contained in it are controlled by the state and utilized for the welfare of the people. Fish resources in Regional Fisheries Management of the Republic of Indonesia (WPP-NRI) 718 are natural resources controlled by the state and utilized for the welfare of the people. The fish resources should be utilized to support the realization of food sovereignty; especially the supply of fish protein which is very helpful for the health of the nation's children. Indonesia must ensure sovereignty and exploit fish resources in the WPP-NRI 718 for the overall prosperity of the people. Sovereignty will also contribute greatly to the potential employment on fishing vessels to reach about 15 000 people, not including labor in fish processing units and other supporting activities on land.

Article 1 paragraph 1 of Law No. 31 of 2004 on Fisheries, as amended by Act No. 45 of 2009, noted that fisheries are all activities related to the management and utilization of fish resources and the environment ranging from preproduction, production, processing to marketing conducted over a fishery business system. Furthermore, Article 1 paragraph 7 states that fisheries management includes all effort, including integrated processes in information gathering, analysis, planning, consultation, decision-making, allocation of fish resources, and the implementation and enforcement of legislation in the field of fisheries, which is done by government or other authorities aimed at achieving viability and productivity of aquatic biological resources and agreed objectives. Based on such understanding, the management of the fishery is a very important aspect to strive for fish resources to be used sustainably.

2.2 Overview of Fisheries in Aru-Arafura Sea

WPP NRI 718 covering the Aru Sea, Arafura Sea and the eastern part of the Timor Sea is one the main fishing ground of shrimp and fish trawlers in Indonesia. Estimation of the potential of fish resources in WPP-NRI 718 reached 13 percent of the potential resource of the national marine fish. The contribution of shrimp and demersal fish to the national marine fisheries production amounted to approximately 45 percent and 20 percent, respectively. Shrimp and demersal fish have long been the main target of fishing activities in WPP-NRI 718 by the fishing fleet. Illegal, Unreported and Unregulated (IUU) Fishing in WPP-NRI 718 has continued long with high intensity, resulting in considerable loss to Indonesia in terms of social, economic and ecosystems aspects, as well as fisheries management.

From the economic aspect, Indonesia has suffered losses due to IUU fishing activities in WPP-NRI 718 equivalent to around Rp. 20 000 billion per year (Stacey *et al.*, 2011). Article 6.2 of the 1995 Code of Conduct for Responsible Fisheries (CCRF), mandates that fisheries management should ensure the quality, diversity and availability of fishery resources in sufficient quantities for now and next generations, in the context of food security, poverty reduction and sustainable development. Given

the high potential of fish resources in WPP-NRI 718, Indonesia should make the best effort to make sure that WPP-NRI 718 is sustainably managed to support the realization of our national goals mentioned above. At the same time, Indonesia also has to make maximum efforts so that the potential of fish resources in WPP-NRI 718 is realized by the Indonesian State and used for the greater prosperity of the community.

In this connection, the Government, local authorities of provincial and district/city concerned shall undertake the management of fish resources in WPP-NRI 718. The government, the provincial government and local government of district/city also should be together with the fisheries stakeholders in WPP-NRI 718 to ensure the realization of our national goals as described above. This is important, because according to article 6.1 of the CCRF, the right to catch fish (for businesses) must be accompanied by an obligation to use in ways that are responsible, to ensure effective implementation of conservation measures and management of fish resources.

The preparation of a fishery management plan should be in line with the Ecosystem Approach to Fisheries Management (EAFM) developed by FAO (2003). The ecosystem approach tries to balance the socio-economic objectives and fisheries management (fishermen's welfare, just utilization of fish resources, etc.) taking into account knowledge and uncertainty about the components of biotic, abiotic, and human interaction in the aquatic ecosystem through fisheries management and sustainability.

2.3 Fisheries Management Area

The Regulation of Ministry of Marine Affair and Fisheries No.18/PERMEN-KP/2014 on Fisheries Management Area of the Republic of Indonesia, WPP-NRI 718 includes Aru Sea region, Arafura Sea and the East Timor Sea. The area is part of Sahul Shelf and geographically bordered by the mainland of Papua and Banda Sea in the north, as well as directly adjacent to the 3 (three) countries, namely Australia in the South, East Timor in the west and Papua New Guinea in the east (Figure 3).

Administratively, the local government has the authority and responsibility for the management of fish resources in WPP-NRI 718 consisting of the three (3) provincial governments of Papua, West Papua and Maluku, and 8 (eight) district /city governments, including West Southeast Maluku District, Southeast Maluku regency, Southwest Maluku district, Merauke, Mappi, Asmat, Mimika Regency and Regency of Aru Islands.

FIGURE 3
Geographical Location of WPP-NRI 718

Source: Ministerial Regulation No. PER.01/MEN/2009, Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia

2.4 Fish Resources in WPP-NRI 718

Fish resources in waters of WPP-NRI 718 can be classified under 7 (seven) main groups, namely:

1. The large pelagic fish;
2. Small pelagic fish;
3. Demersal fish;
4. Penaeid shrimp;
5. Coral fish;
6. Lobster; and
7. Squid.

The estimation potential of fish resources based on the Decree of the Ministry of Marine Affairs and Fisheries number No. KEP.45/MEN/2011 on the potential catch (MSY) of Fish Resources in Fisheries Management Area of the Republic of Indonesia, in WPP-NRI 718 is shown in Table 1.

Table 1 showed that five (5) fish resource groups that dominate the waters WPP-NRI 718 are small pelagic fish, demersal fish, large pelagic fish, penaeid shrimp and squid. The potential of fish resources (maximum sustainable yield, MSY) is highest for small pelagic fish amounting to 468 700 tonnes/year, followed by demersal fish amounting to 284 700 tonnes/year, large pelagic fish amounting to 50 900 tonnes/year. Penaeid shrimp amounted to 44 700 tonnes/year, squid only 3 400 tonnes/year. The total potential of the five groups of fish resources have reached 99 percent of the potential of all the water biota in WPP-NRI 718.

TABLE 1
Estimation of potential fisheries resources in WPP-NRI 718

No.	Fish resources	Maximum sustainable yield (thousand tonnes/year)
1	Large Pelagic Fish	50.9
2	Small Pelagic Fish	468.7
3	Demersal Fish	284.7
4	Penaieid Shrimp	44.7
5	Coral Fish	3.1
6	Lobster	0.1
7	Squid	3.4

Source: Decree of the Minister of Marine Affairs and Fisheries No.KEP.45/MEN/2011.

Capture fisheries production in WPP-NRI 718 based on statistical data of fisheries in 2016 is shown in Table 2.

TABLE 2
Fish landings in WPP-NRI 718 (year 2007-2014)

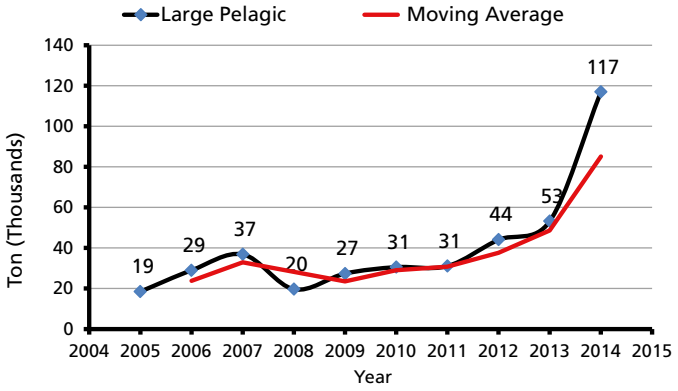
Fish landings	Year (tonnes)							
	2007	2008	2009	2010	2011	2012	2013	2014
Large pelagic	36 860	19 677	27 390	30 563	31 072	44 078	53 217	117 039
Small pelagic	107 067	78 957	79 165	162 064	123 462	130 604	94 718	66 356
Demersal fish	210 449	179 286	178 796	296 883	246 255	221 103	224 974	194 498
Coral reeffish	8 616	8 115	9 871	12 739	13 636	17 301	17 493	8 378
Shrimp	35 997	6 840	9 744	11 476	12 206	15 354	12 892	15 247
Crabs	1 247	1 146	9 813	9 261	9 927	3 457	3 223	3 563
Squit	6 786	2 996	3 820	8 555	5 881	6 727	3 934	3 082
Other	3 321	1 519	5 967	6 423	6 747	6 626	4 914	4 955
Total	**410 343**	**298 535**	**324 566**	**537 964**	**449 186**	**445 250**	**415 365**	**413 118**

Source: Directorate of resources – DGCF, 2016.

Large Pelagic Fish

Large pelagic fish caught in WPP RI 718 include shark (*Hemigalidae*), mackerel (*Scomberomorus commersoni*), tuna (*Euthynnus sp.*), skipjack (*Katsuwonuspelamis*), yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*). Many sharks are caught in these waters for their economically valuable fins. Large pelagic fishing areas are Arafura Sea waters around the Aru Islands to the southern part of the Arafura Sea waters directly adjacent to Australian waters.

FIGURE 4
Catch of large pelagic fish in Aru-Arafura Sea (2006-2014)



Source: Directorate of Resources – DGCF, 2016.

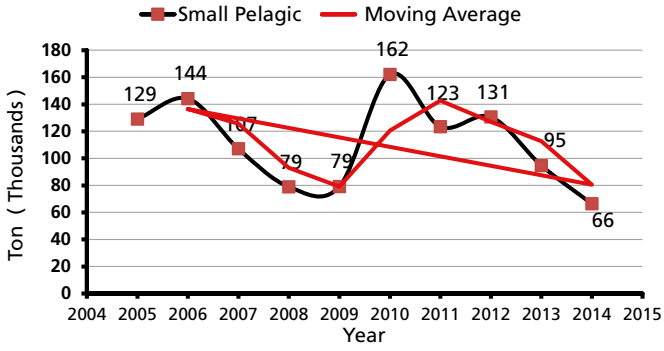
Figure 4 shows the annual landings of large pelagic fish in WPP-NRI 718 during the period 2006-2011. Landings decreased sharply in 2008, and increased again in the following year until the year 2014.

Small Pelagic Fish

Small pelagic fish caught in WPP RI 718 include *Caranx spp., Decapterus ruselli, Megalaspis cordyla, Formio niger, Cypselurus spp, Hemirhampus spp., mackerel (Rastrelliger spp.), Rastrelliger kanagurta, Sardinella fimbriata and Upeneus vittatus*. The small pelagic fish catch during the period 2007-2011 is shown in Figure 5.

Figure 5 shows the small pelagic fish annual landings in WPP-NRI 718 during the period 2006-2011. Landings decreased in 2000, and increased again in the following year until the year 2010. Since 2011 the landings have decreased again.

FIGURE 5
Catch of small pelagic fish in Aru-Arafura Sea (2006-2014)

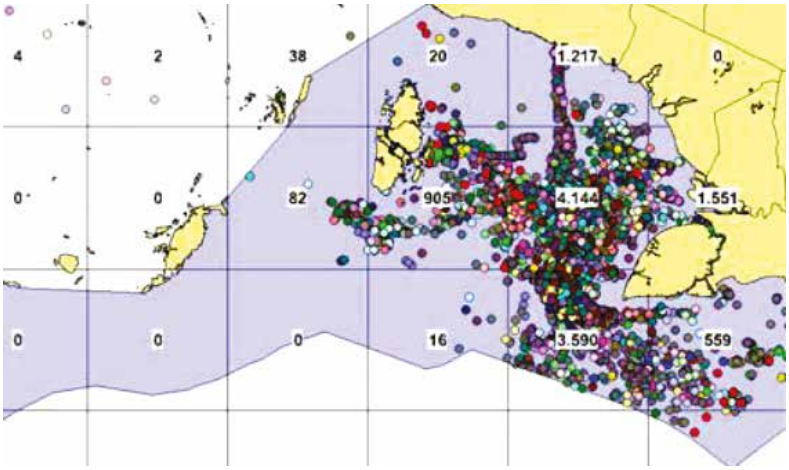


Source: Directorate of Resources – DGCF, 2016.

Demersal Fish

Demersal fish caught in WPP RI 718 include *Arius spp., Psettodes erumei, Caranx sexfasciatus, Caesio caerulaurea, Pampus argentus, barramundi (Lates carcarifer), Lethrinus spp., Upeneus sulphureus, red snapper (Lutjanus sp.), and Trichiurus spp.* Fishing ground of demersal fish in WPP-NRI 718 is shown in Figure 6.

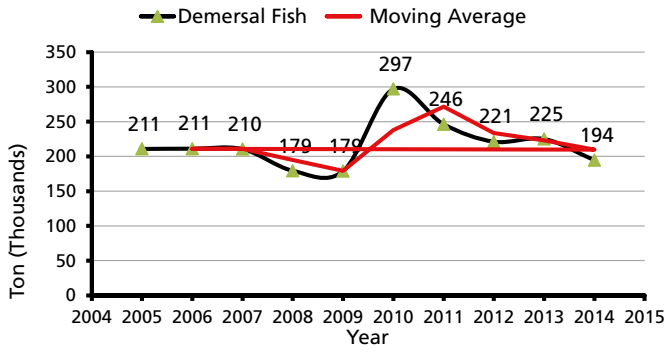
FIGURE 6
Demersal fish fishing grounds in Aru-Arafura Sea (2012)



Source: Suryanto & Widodo, 2012.

Figure 7 shows that the demersal fish catches in the waters of WPP-NRI 718 in the period 2005-2014 ranged between 170 000 – 290 000 tonnes per year. The average yearly catch was much lower than the estimated maximum sustainable catch, which is estimated at 539 100 tonnes per year. The rapid growth of catches in the period 2009-2010 maybe an indication of an increasing fishing pressure on demersal fish. The figure also suggests that there was no drastic decrease of catch during the observed period although during the last five years the trend is downwards.

FIGURE 7
Catch of demersal fish in Aru-Arafura Sea (2006-2014)



Source: Directorate of Resources – DGCF, 2016.

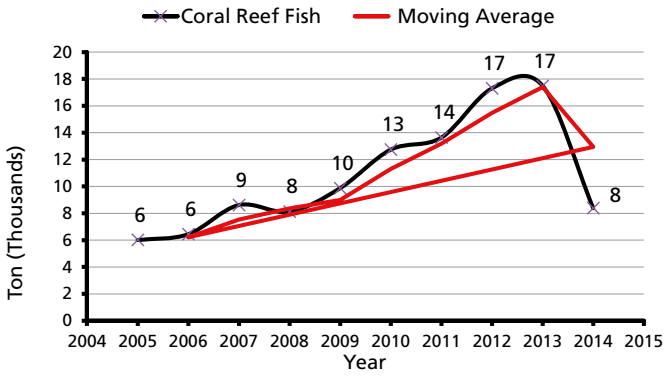
Coral Reef Associated Fish

Coral fish caught in the waters of WPP RI 718 include the yellow tail fish (*Caesio cuning*), Napoleon (*Cheilinus undulatus*), grouper (*Epinephelus spp.*) and *Siganus spp.* The coral fish catch during the period 2005-2014 is shown in Figure 8.

Coral reef fish catches during the period 2007-2011 ranged between 8 000 and 12 000 tonnes per year. The catch was relatively small and apparently the biomass of

the stocks was still good although there was a significant drop in catches after 2013. At that time reef fish stocks were not prioritized as a commodity that was taken into account in fisheries management in WPP-NRI 718.

FIGURE 8
Catch of coral reef fish in Aru-Arafura Sea (2006-2014)



Source: Directorate of Resources – DGCF, 2016.

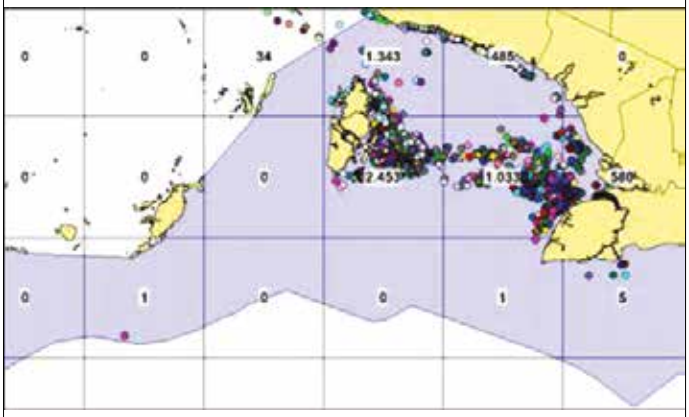
Shrimp

Crustaceans that have been caught in WPP-NRI 718 include penaeid shrimp, tropical rock lobster (*Panulirus ornatus*), crab (Scylla serrata) and crab (*Portunus pelagicus*). Penaeid shrimp are the main target of commercial fishing because these shrimp species are a major export commodity with high value.

Landings of shrimp in WPP-NRI 718 in 2011 were ranked sixth in terms of volume in the whole WPP-NRI. The main catches in 718 WPP-NRI include banana shrimp (*Penaeus merguiensis*) and tiger shrimp (*P. monodon*). Banana prawn are found in waters adjacent to mangrove forests, while the black tiger shrimp is more common in the waters covered with seagrass. Fishing ground of shrimp in WPP-NRI 718 is shown in Figure 9.

Shrimp landings in WPP-NRI 718 for the period 2007-2011 ranged between 7 000 – 38 000 tonnes per year. A drastic reduction of the catch of shrimp in 2007-2008 was probably due to increasing poaching by shrimp trawlers that fish without permission; their catches are not accounted for in the Fisheries Statistics in Indonesia. Purwanto (2013) estimated that in 2011 there were 731 similar units of GT 130 shrimp trawlers operating in WPP-NRI 718 with catches reaching 48 370 tonnes.

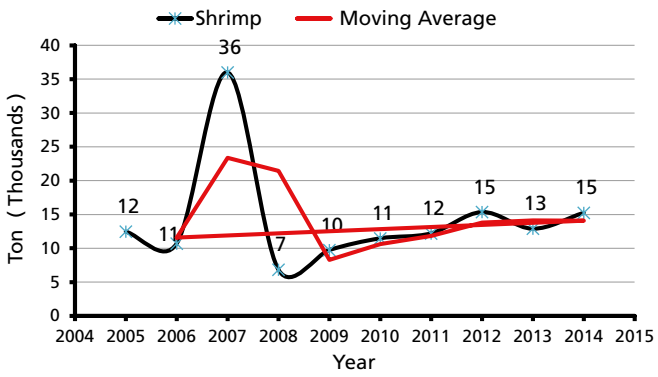
FIGURE 9
Shrimp fishing grounds in Aru-Arafura Sea (2012)



Source: Suryanto & Widodo, 2011.

The number of vessels fishing for shrimp consisted of 267 licensed vessels (SIPI) and 464 vessels without license (No-SIPI). Shrimp catches of vessels which had a license were 17 678 tonnes and that of unlicensed vessels was 30 672 tonnes.

FIGURE 10
Catch of shrimp in Aru-Arafura Sea (2006-2014)



Source: Directorate of Resources – DGCF, 2016.

Purwanto (2013) estimates that the potential for sustainable shrimp fishery in WPP-NRI 718 is 49 500 tonnes per year with the optimum fishing effort 635 units of assuming size shrimp trawlers as 130 GT. Most of the shrimp are caught by shrimp trawlers of size 130 GT and fish trawl of size 180 GT. Maximum sustainable yield is 77.9 tonnes per shrimp trawl with of size 130 GT. In 2011 the excessive production of shrimp fishing works out to only 66.2 tonnes per vessel. If there were no shrimp trawlers without licenses in 2011, the 267 licensed shrimp trawlers will produce a catch of 123 tonnes per vessel.

Officially, the status of utilization of fish resources in the WPP-NRI, including WPP 718 still refers to the Decree of the Minister of Marine and Fisheries No. KEP.45/MEN/2011 on Potential Estimation of Fish Resources in Regional Fisheries Management of the Republic of Indonesia are shown in Table 3.

Table 3 shows that most of the fisheries resources in WPP-NRI 718 are over-exploited, except for shrimp (fully-exploited) and small pelagic fish (moderate-exploited). For demersal fish, which is over-exploited, a reduction in fishing activity is required in order to restore the sustainability of fish resources and the environment. Potential of small pelagic can be increased.

TABLE 3
Status for exploitation of fisheries resources in WPP-NRI 718

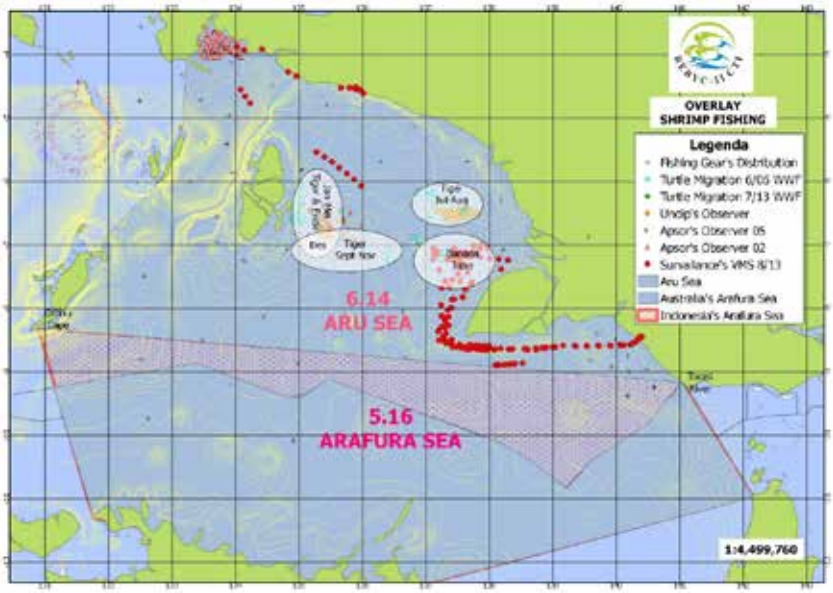
No.	Fish Resources	Status	Remark
	Shrimp	F	Fully – Exploited
	Demersal fish	O	Over – Exploited
	Arius spp	O	Over – Exploited
	Nemipteridae	O	Over – Exploited
	Upeneus sulphureus	O	Over – Exploited
	Swanggi	O	Over – Exploited
	Saurida spp	O	Over – Exploited
	Scianidae	O	Over – Exploited
	Lutjanidae	O	Over – Exploited
	Cynoglosus	F	Fully – Exploited
	Small Pelagic Fish	M	Moderate – Exploited

Source: Decree of the Minister of Marine Affair and Fisheries No.KEP.45/MEN/2011.

2.5 Fishing Ground of Trawl Vessels

There are four major trawl fishing areas as shown in Figure 9. The results of data collection activities from the vessel monitoring system in the Arafura Sea trawl vessels for 2014-2015 were presented during the National Working Group discussion in late 2015. Trawl fishing areas are concentrated around Aru and in the area of Dolak.

FIGURE 11
Map of fishing ground of trawlers in Aru-Arafura Sea



Source: National Working Group – REBYC II – CTI Indonesia, 2015

2.6 Fishing Method

Decree of the Minister of Marine and Fisheries of the Republic of Indonesia Number KEP.06/MEN/2010 on Fishing Equipment in Fisheries Management Area of the Republic of Indonesia categorized fishing gears into 10 (ten) groups. Tables 4 and 5 show the WPP-NRI 718 recorded the number of vessels that obtained a license to fish in WPP-NRI 718 waters until the end of 2014.

TABLE 4
Number of licenses (vessels >30 GT) in WPP-NRI 718

No.	Fishing gears	Name in license	Units	Gross tonage
1	Fish trawl	Pukat Ikan	440	115 932
2	Shrimp trawl	Pukat Udang	129	19 760
3	Gill net oceanic	Jaring Insang Hanyut Oseanik	118	23 360
4	Bottom long line	Pancing Rawai Dasar	107	6 354
5	Squid jigging	Pancing Cumi	99	13 084
6	Drift gill net	Jaring Insang Hanyut Pantai	55	3 995
7	Lift net	Bauke Ami	15	2 029
8	Hand line	Hand Line	14	1 834
9	Pole and line	Huhate	8	529
10	Purse seine (small pelagic)	Purse Seine Pelagis Kecil	2	147
Total			**980**	**184 024**

Source: DGCF – Directorat PUP (2011).

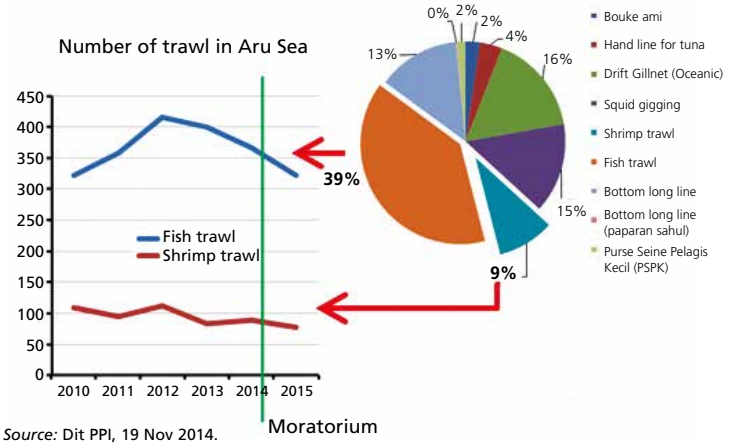
TABLE 5
Distribution size of fishing vessels in WWPP-NRI 718

No.	Fishing gears	GT				Total
		30-60	>60-100	>100-200	>200	
1	Fish trawl	0	2	141	297	440
2	Shrimp trawl	1	51	75	2	129
3	Gill net oceanic	13	14	31	60	118
4	Bottom long line	93	11	2	1	107
5	Squid jigging	1	28	66	4	99
6	Drift gill net	20	27	7	1	55
7	Lift net	10	4	1	0	15
8	Hand line	0	14	0	0	14
9	Pole and line	3	5	0	0	8
10	Purse seine (small pelagic)	1	0	1	0	2
Total		**142**	**156**	**324**	**365**	**980**

Source: DGCF – Directorat PUP (2011).

Figure 12 shows the composition of fishing gears in Aru-Arafura waters (WPP-NRI 718), based on the licenses from the central government in 2014. Trawl nets are dominant gear, with 9 percent shrimp trawl and 39 percent fish trawl.

FIGURE 12
Composition of fishing gear in Aru-Arafura



Source: Dit PPI, 19 Nov 2014.

TABLE 6
Base port of trawlers operated in WPP-NRI 718

No	Fishing port	Fish trawls	Shrimp trawls	Grand total
1	PP. Ambon	102	24	126
2	PP. Benjina	88	-	88
3	PP Bitung	4	-	4
4	PP. Merauke	2	-	2
5	PP. Timika	2	-	2
6	PP. Tual	55	-	55
7	PU.Avona (Papua)	6	30	36
8	PU.Benoa	3	-	3
9	PU.Dobo	7	6	13
10	PU.Kaimana	3	-	3
11	PU.Merauke	10	9	19
12	PU.Mimika	26	-	26
13	PU.Timika	52	-	52
14	PU.Wanam	93	-	93
15	PP. Sorong	-	27	27
16	PP. Lainnya	2	1	3
Grand total		**453**	**97**	**552**

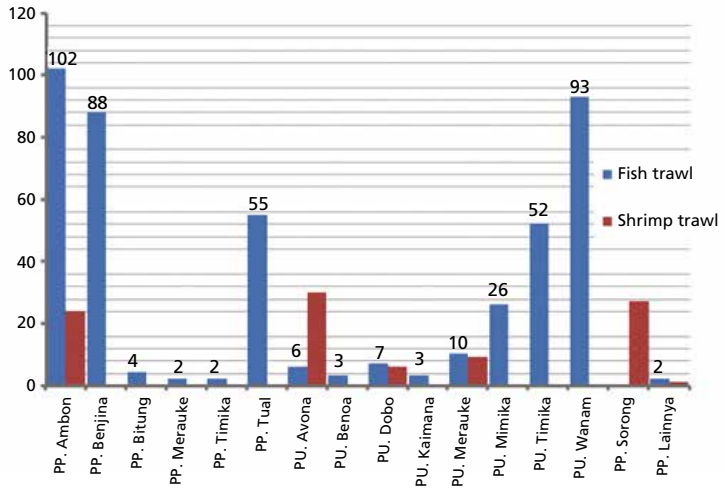
Source: Dit PPI, 19 Nov 2014.

The number of fish trawlers decreased during 2011 to 2014, while the numbers of shrimp trawlers were relatively stable. No new shrimp trawlers are added, whether or not there is a new company in Aru-Arafura Sea.

The number of trawlers (fish trawl and shrimp trawl) operating in WPP-NRI 718, or Aru-Arafura Sea are scattered in various base ports, as shown in Table 6 and Figure 13.

Based on the dominance of shrimp trawl in Sorong and of fish trawl in Ambon, Local Consultative Groups were formed in these two areas.

FIGURE 13
Number of trawlers operated in WPP-NRI 718 (Based on Port)



Source: Directorate PUP - DGCF, 19 Nov 2014.

2.7 Social

Fisheries Management Area (WPP-NRI 718) includes Aru Sea, Arafura Sea and the Sea of Eastern Timor. WP-NRI 718 covers territorial waters of 3 provinces of Maluku, Papua and West Papua Province. In addition, some districts located 4 miles from the baselines of the WPP-NRI 718 are also entitled to fisheries in the area, namely District Southeast Maluku, District West Southeast Maluku, District Southwest Maluku, District Aru Islands, District Merauke, District Mappi, District Asmat, and District Mimika.

Maluku province is an island province with an area of about 581 376 km^2, consisting of 527 191 km^2 the territorial waters and 54 185 km^2 land area. Maluku Province is an archipelago with 559 large and small islands. There are 4 large islands namely Seram Island (18 625 km^2), Buru Island (9 000 km^2), Yamdena island (5 085 km^2) and Wetar Island (3 624 km^2). Maluku province includes two cities and nine districts, associated with WPP-NRI 718, which are Southeast Maluku District, West Southeast Maluku District, Southwest Maluku District and Aru Islands.

West Papua province lies between 0-4 degrees south latitude and 124-132 degrees east longitude, which is located below the equator. The level of land ranges in altitude of 0-100 meters above sea level. At least 14 rivers are used as a means of transport or conecting between districts.

Fish resources in the WPP-NRI 718 are used by communities and private companies, including national fishing companies and foreign fishing companies that acquired the license to operate in these waters. Stakeholders involved in the utilization of fish resources in the WPP-NRI 718 has social and economic characteristics of different cultures. They are different among the local communities and immigrant communities

recruited by the companies. The detail of the social and economic conditions in the area around Aru-Arafura waters were obtained from several sources, among others Norimarna (2012) and Maanema *et al.* (2006).

Kinship, customs and culture should be encouraged in order to create synergies that can be relied upon as an attempt of community building in Maluku in the future. Maluku has hundreds of sub-tribe, with about 130 languages known to have existed, and 117 languages are still actively used today.

West Southeast Maluku District is a district in the province of Maluku, with the capital city of Saumlaki. The area of West Southeast Maluku District is 52 996 km^2, consisting land area of 10 103 km^2 and sea area of 42 892 km^2. This area is an archipelago consisting of large and small islands with the total number of islands reaching 85, of which 57 are inhabited and 28 are uninhabited.

Aru Islands district with capital Dobo, is a new district split from Southeast Maluku District. Aru Islands consist of 187 islands, and only 89 islands are inhabited. Aru district has land and coastal ecosystems dominated by mangrove forests, seagrass beds and coral reefs. Various types of marine resources are found in this region; among those are snail pearl, in addition to crocodiles, turtles and marine mammals. The main activity is shrimp trawling. This activity may conflict with the cultivation of pearls and traditional fishing. Benjina is one of the bases of fishing activities.

One of the fishing companies located in Aru is equipped with port and fish processing plant. Cultural communities and especially the indigenous communities of Kei Islands influence the culture of Aru Islands. Residents in the region of Central Aru (Benjina) are mostly migrants coming from Central Java and Java Timur. The community is divided into two groups, with the first group having fishing as their occupation in their places of origin, and have managed to become the owners of gillnets for catching mackerel and shark fin. The second group did not have fishing as their occupation in their places of origin and, have become crew of privately-owned fishing vessels. Javanese culture is more prominent in the region. Ties to the customs and values in the local community in the Aru Islands is still very strong binding Aru public life, shown by the results of the study by PKSPL IPB (2011).

Local Wisdom

The local wisdom in the Aru Islands which is part of the traditional culture still practiced by people is known as "PELA" and "SASI" culture. In general, the villages in the Aru Islands have customary ties between the villages called "Pela". Pela is the bond of brotherhood that exists between one village to another and is equated to relationship between siblings (brothers) from one village to another or even with an oath as brothers by the ancestors of the villagers long back. Pela who have a very strong bond is usually known as "Pela Tumpa Darah". Pela can bind two or more villages.

One example of this practice is the relationship of village of Koba (with Muslims and Christians) that has a pela relationship with the people of the village Ujir (100 percent Muslim). Pela relationship between these two villages (called Pela Padi), is motivated by traditional rice harvest done in Koba; this requires providing parts of the harvest to people of the village Ujir. Pela customary form has been the bond that strengthens inter-religious relations in the Aru Islands, because these are villages interwoven in the pela alliance in spite of having different beliefs.

In addition to their traditional values as cultural ties, their ethics and culture are also associated with human attitude and relationship to nature and the environment. For Aru and Maluku in general, human existence is an inseparable part from other environmental elements of the ecosystem. Humans are viewed as part of a holistic system of nature, which can be seen and felt on the wisdom of local culture. This is unlike the anthropocentric view, which put people at the center. Aru community from

both the indigenous tribes in the Aru Islands or immigrant tribes had a cultural wisdom that humans and nature have a law of space and time that are so interdependent. One of this local wisdom is called "SASI".

Sasi is a special prohibition rule controlling exploitation of the natural resources as commonly agreed, and is usually applied to the forests, cultivated fields and seafood. Sasi is applied time or location limit though sometimes the timing is not explicitly defined as regard to validity period, due to the flexibile nature of time until sufficient resources are optimally utilized/managed.

TABLE 7
Population of each District in Papua Island for 2013-2014

District / City	2013		2014			
	Total	Sex ratio	Male	Female	Total	Sex ratio
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Merauke	209 980	110.84	110 787	102 697	213 484	107.88
2. Jayawijaya	203 085	102.73	103 482	100 630	204 112	102.83
3. Jayapura	118 789	112.12	62 796	56 587	119 383	110.97
4. Nabire	137 283	113.80	73 185	64 591	137 776	113.31
5. Kepulauan Yapen	88 187	106.06	46 104	43 890	89 994	105.04
6. Biak Numfor	135 080	106.24	69 608	66 223	135 831	105.11
7. Paniai	161 324	107.57	84 315	78 174	162 489	107.86
8. Puncak Jaya	112 010	119.94	61 406	51 874	113 280	118.38
9. Mimika	196 401	129.50	111 618	87 693	199 311	127.28
10. Boven Digoel	60 403	118.02	33 225	28 058	61 283	118.42
11. Mappi	88 006	108.42	46 406	43 384	89 790	106.97
12. Asmat	85 000	108.79	44 674	41 940	86 614	106.52
13. Yahukimo	175 086	110.77	92 992	85 201	178 193	109.14
14. Pegunungan Bintang	69 304	115.75	37 607	33 090	70 697	113.65
15. Tolikara	125 326	120.18	69 297	58 229	127 526	119.01
16. Sarmi	35 508	120.59	19 416	16 371	35 787	118.60
17. Keerom	51 772	119.50	28 827	24 175	53 002	119.24
18. Waropen	26 905	111.90	14 597	13 126	27 723	111.21
19. Supiori	16 976	109.55	9 120	8 168	17 288	111.66
20. Mamberamo Raya	19 776	110.63	10 617	9 897	20 514	107.27
21. Nduga	85 894	118.99	52 184	40 346	92 530	129.34
22. Lanny Jaya	161 077	115.19	93 394	77 195	170 589	120.98
23. Mamberano Tengah	42 687	115.78	24 979	20 419	45 398	122.33
24. Yalimo	54 911	112.51	31 096	26 489	57 585	117.39
25. Puncak	99 926	109.04	52 984	48 531	101 515	109.18
26. Dogiyai	89 327	101.12	45 502	45 320	90 822	100.40
27. Intan Jaya	43 405	102.88	22 610	22 202	44 812	101.84
28. Deiyai	66 516	106.52	35 008	33 017	68 025	106.03
29. Kota Jayapura	272 544	111.77	144 440	131 254	275 694	110.05
Papua	**3 032 488**	**112.16**	**1 632 276**	**1 458 771**	**3 091 047**	**111.89**

Source: Website BPS Papua, http://papua.bps.go.id/linkTabelStatis/view/id/37.

Aru Islands follow "sasi" in an effort to appreciate the natural resources. In the past, sasi was heavily implemented throughout the Molluca region. For example "Sasi Teripang", is a practice whereby when the head of the village and the local indigenous stakeholders see that the sea cucumber resources has begun to decrease, then the head of the village take the initiative to run "sasi". The village head convince the traditional leaders, to agree on "sasi" for sea cucumbers, and then the traditional procession performed, followed by a prayer in a church or a mosque.

The population in Papua based on published data by BPS Papua through the web site can be seen in Table 7. The total population in the year 2014 was 3 091 047 with a male to female ratio almost 112 percent.

In 1990, there were 385 509 people in the province of West Papua, while in 2000 it was 571 107. In 2007 the population had reached 722 981. Merauke District has an area of 119 749 km^2, consisting of coastal, land, forest and swamp. Total population was 336 362 in 2003, of which 2.65 percent were fishermen and fish farmers. Table 8 shows the number of fishermen in WPP-NRI 718.

Fishermen generally are migrants from South Sulawesi. Natives generally will be crew members of the hand line and generally do fishing without use of an engine. The type of fishing gear used varies and is generally kind of drifting gillnets and trawl. Fish produce is marketed locally, inter-island and for export.

TABLE 8
Number of Fishermen in WPP-NRI 718

No	Years	Number of fishermen
1.	2007	256 000
2.	2008	271 000
3.	2009	243 000
4.	2010	265 000
5.	2011	257 000
6.	2012	273 000

2.8 Economy

Aru-Arafura Sea fisheries is complex and challenging partly due to the large size of trawlers which catch large amunt of demersal fish and shrimp, and cause habitat destruction at least locally (Dudley & Ghofar, 2006). Nevertheless, fishery resources in the Aru-Arafura Sea have contributed to the income of fishers, and the national fisheries industry as well as the foreign investment companies (ATSEA, 2011).

The large volume of fish catch per fisherman is considered to indicate excessive utilization of fisheries resources (over-exploited) in Arafura Sea, and in particular that of shrimp resources (Stacey *et al.*, 2011; Purwanto, 2010). This has resulted in the reduction of shrimp stocks and thereby the production is lower than the optimum level (Purwanto, 2010). Such conditions ultimately has led to the situation where the benefits from fishing businesses have become lower than the optimum level. Some businesses have suffered significant losses (Purwanto, 2011). Conditions were similar although not identical where species of shark or rays are over-exploited (Dulvy *et al.*, 2008; Camhi *et al.,* 2009), and the catch of small and medium-size demersal species showed an increase in production (ATSEA, 2011).

Based on the 2010 National Census, the total population recorded in 8 districts (West Southeast Maluku, Maluku Tenggara, Maluku Barat Daya, Aru Islands, Merauke, Mappi, Asmat, Mimika) were 2.8 million, with nearly 34 000 households belonging to fishermen (employed full or part time). Fishermen's livelihood is dependent on marine resources. Marine resources and marine transportation are drivers of economic activity in Aru-Arafura. Activities such as loading and unloading of goods in the main port in Ambon, Bintuni, Merauke, and the number of available infrastructure and transport in the region are still limited/lacking.

Based on informal information available, the minimum wage of Indonesian fishermen (in 2013) working in shrimp trawlers and fish trawlers in WPP-NRI 718 was within the range of Rp 900 000 to Rp 1 100 000 (equivalent USD 70-85) per month per crew with experiance less than one year). When the minimum wage level is compared

to the Regional Minimum Wage (RMW) applicable in 3 provinces as mentioned in Table 9, it appears that the minimum wage of Indonesian crew members are still below the RMW.

TABLE 9
Regional Minimum Wage (RMW) in Province of Maluku, Papua, and West Papua

No	Province	RMW 2012 (Rp)	RMW 2013 (Rp)	Based on	Date
1	Maluku	975 000	1 275 000	Governor Agree No. 173 Tahun 2012	17-Dec-12
2	Papua	1 515 000	1 710 000	Governor Agree No. 162 Tahun 2012	10-Oct-12
3	West Papua	1 450 000	1 720 000	Governor Agree No. 561/246/12/2/2012	5-Dec-12

The dominance of foreign crew in fish trawlers became one of the issues in the management of fisheries in the Arafura Sea. Based on data of permits issued by the central government for fish trawlers that operate in the area WPP-NRI 718 in 2013, there were as many as 480 units. With the fact that the Indonesian citizen crews were a maximum of 3 persons from a total number of 30 crews, it is estimated that the foreign crews reached almost 13 000 people in 2013.

Information about the investment cost is quite difficult to obtain, especially from companies that operate ex foreign flag trawl fishing vessels with the number 6 and 5 vessels unit. The cost of second-hand fish trawlers with size <200 GT) purchased in 1999 ranged between Rp 200 million to Rp 225 million. The ship is made of steel and equipped with trawl winch.

The operational costs of fish trawler include the cost of diesel, oil, food, levies, unloading costs, mooring fees and other expenses. The operating costs per trip can be described in two categories: for size <200 GT and >200 GT. The operating costs of fish trawler with a size <200 GT is approximately Rp 1 172 million per year. The operating costs for fish trawlers with size >200 GT are approximately Rp 2 021 million to Rp 5 482 million per year. Trawler with a size <200 GT go approximately for 10 trips per year, with each trip of about 30 days, and the number of crew of 11 people. Fish trawler of size >200 GT go approximately for 6 trips per year, and each trip takes about 45 days (Manggabarani, 2006).

Based on the sample studied, there are several boats that suffered operating losses. Feasibility of shrimp trawling that is calculated based on a representative sample size study of 100-150 GT, 151-200 GT, 201-300 GT and >300 GT trawlers, shows that the investment cost for trawlers is difficult to be used as a reference, because most ships are old and second hand. In 1988, a trawler of 200-300 GT was approximately Rp 4 600 million.

Second-hand vessels with size of 100-150 GT were purchased at a price of Rp 1 027 million (built in 2002). Number of shrimp trawlers trip averaged about 4-6 trips per year, with operating days of 45-60 days per trip, and the number of crew members at 15-23 people. Operating costs per year ranged between Rp 591 million to Rp 1 928 million (Manggabarani, 2006).

Catches of shrimp trawl ranged from 45.318 tonnes to 64.448 tonnes per year. The value of landings ranged between Rp 2 406 million to Rp 2 481 million. Calculation of feasibility for shrimp trawlers with size >300 GT shows that it suffered losses of about Rp 254 million per year, with the value of B/C at 0.92. Fish trawler with a size <300 GT gained about Rp 230 million to Rp 1 114 million, with a value of B/C at 1.17 to 3.52. A shrimp trawler with a size of 100-150 GT has excellent feasibility.

Fishing vessels operating in WPP RI 718 are based in six major ports, namely Ambon national fishing port, Tual national fishing port, Kendari ocean fishing port, Kupang coastal fishing port, Sorong coastal fishing port and Merauke Public Ports and several fishing ports managed by the private sector, such as ports PT. Maritim Timur

Jaya in Tual (Maluku Tenggara), port PT. Benjina Resources in Benjina (Maluku Tenggara), port Avona, Kaimana (West Papua), and port Kimaam in Merauke (Papua).

Table 10 illustrates the existing market distribution, i.e. local, regional and export. For local market, the fish catch is marketed to the traditional markets in the island of Ambon; for the regional (inter-island/area) market, fish is marketed to Benoa, Surabaya and Jakarta; and for the export market to Japan and China, Hong Kong SAR for frozen shrimp; and the frozen fish mixture is marketed to Thailand, Singapore, and South Korea.

At WPP-NRI718 IUU fishing practices result in losses for Indonesia to a tune of around Rp 20 trillion, equivalent to USD 2 billion each year (Stacey *et al.*, 2011). In order to prevent and combat IUU fishing in Indonesian waters, the Ministry of Maritime Affairs and Fisheries issued a decree No. 50/KEPMEN/2012 on the National Action Plan for Prevention and Control of Illegal, Unreported, and Unregulated Fishing years 2012-2016.

TABLE 10
Market distribution in Ambon Fishing Port (2008-2012)

Years	Volume (Kg)			Total (Kg)
	Local	Regional	Export	
2008	3 423 759	24 546	2 756 808	6 207 121
2009	334 175	4 070 202	8 507 532	12 913 918
2010	338 638	3 576 175	54 615 028	58 531 851
2011	518 149	2 349 998	69 626 818	72 496 976
2012	223 148	2 450 300	71 589 717	74 265 177
Total	**4 837 869**	**12 471 221**	**207 095 903**	**224 404 993**

Source: Ambon National Fishing Port, 2013.

Analysis of the fish species composition was done based on the quantity of fish caught by the dominant three (3) types of gear, i.e. shrimp trawl, fish trawl and bottom longline**.**

2.8.1 Shrimp trawl

The composition of the shrimp trawl catches consisted of white shrimp, tiger shrimp and other shrimp, and the bycatch consisted of Leaftail croaker (gulamah),

TABLE 11
Catch composition of shrimp trawl

No	Local name	Scientific name	Catch composition
	Udang putih	*Penaeus merguiensis*	40.0
	Udang windu	*Penaeus monodon*	28.0
	Udang lainya	-	32.0
Total			**100.0**
	Gulamah	*Scianidae*	33.7
	Petek	*Leognathidae*	18.2
	Kurisi	*Nemipteridae*	7.5
	Kerong-kerong	*Therapon spp*	6.9
	Gerot-gerot	*Pomadasys spp*	6.8
	Beloso	*Saurida spp*	6.0
	Layur	*Trichiurus spp*	2.2
	Kakap	*Lutjanidae*	1.7
	Bawal putih	*Pampus argentus*	0.9
	Bawal hitam	*Formio niger*	0.6
	Kuwe	*Caranx sexfasciatus*	0.3
	Lainnya	-	15.2
Total			**100.0**

Source: 61/KEPMEN-KP/2014 on Productivity of Fishing Vessels.

Leognathidae (petek), and Nemipteridae (kurisi). The composition of each type of shrimp and bycatch are specified in Table 11.

2.8.2 Fish Trawl

The composition of fish trawl catches consisted of kurisi, gulamah, layur and other species, with the bycatch including white shrimp and other shrimp species. The composition of each type of fish and bycatch are specified in Table 12.

TABLE 12
Catch composition of fish trawls

No	Local name	Scientific name	Catch composition
	Udang putih	*Penaeus merguiensis*	80.0
	Udang lainya	-	20.0
Total			**100.0**
	Kurisi	*Nemipteridae*	12.0
	Gulamah	*Scianidae*	10.0
	Layur	*Trichiurus spp*	5.0
	Pari	*Rhinobatidae*	2.3
	Manyung	*Arius spp*	8.0
	Kuwe	*Caranx sexfasciatus*	7.0
	Beloso	*Saurida spp*	5.4
	Kakap	*Lutjanidae*	5.0
	Kembung	*Rastrelliger spp*	5.0
	Sardine	*Clupeidae*	3.9
	Hiu/cucut	*Hemigalidae*	3.0
	Biji nangka	*Mullidae*	9.9
	Pisang-pisang	*Casio spp*	2.8
	Petek	*Leognathidae*	9.5
	Golok-golok	*Chirocentrus dorab*	1.1
	Cumi	*Loligo spp*	0.6
	Gerot-gerot	*Pomadasys spp*	0.6
	Kacangan	*Sphyraena spp*	0.5
	Kerapu	*Epinephelus spp*	0.5
	Bawal hitam	*Formio niger*	0.3
	Lidah/sebelah	*Cynoglosus*	0.3
	Bawal putih	*Pampus argentus*	0.1
	Senangin	*Eletheronemo tetradactylum*	0.1
	Lainnya	-	6.6
Total			**100.0**

Source: 61/KEPMEN-KP/2014 on Productivity of fishing vessels.

3. TRAWL BAN PHASE II

The issuance of Ministerial Decree No. 2/PERMEN-KP/2015 on Prohibition of the use of Trawls and Seine Nets (trawl ban) dated 9 January 2015 has gradually stopped trawl fishing (Figure 14). According to this decree, the licenses for trawl and seine net gears that had been issued before the decree, were still valid until the license expires. The main goal of this decree is to reduce the use and practices of destructive fishing gears in Indonesian waters. At present, the trawl and seine net fishing ban has completely taken place because the last 1 (one) year period of fishing license had expired on 9 January 2016. It is strongly believed that the (shrimp) resources have started to recover.

Furthermore, based on Ministerial Decree No. 56/PERMEN-KP/2014 of 3 November 2014 on Moratorium for Fishing Vessels Built Overseas up until 30 April 2015, which was prolonged up until 31 October 2015 under Ministerial Decree No. 10/2015, less vessels are fishing in Indonesia waters. These two consecutive decrees complete a 1 year cycle of licenses system in Indonesia. Thus, there is no built-overseas vessel operated in Indonesia waters.

The IUU fishing activities that have been carried out by fishing vessels built overseas (called ex-foreign) triggered Permen No. 56/2014. However, not all ex-foreign vessels conduct IUU fishing, such as shrimp trawlers under the HPPI that catch shrimp in the Arafura Sea. Shrimp trawlers were operated by the company originally partnered with Japanese companies in the 1970s; the partnership ended in the 1990s and HPPI has become a national company.

FIGURE 14
Trawl Ban Scheme Policy of Moratorium

Offenses often committed by ex-foreign fishing boats are violation of the provisions of the regulations in the decree 30/2012 on fishery business that has been updated by decree 26/2013, namely:

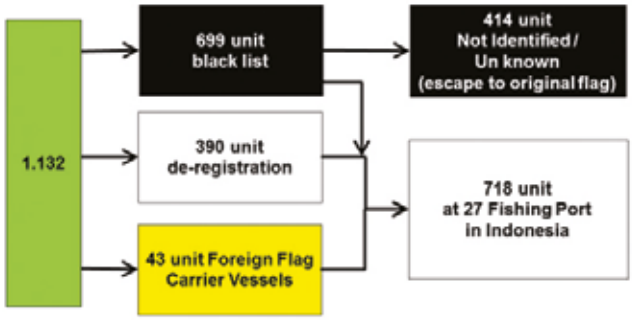
1. The catch of the vessels is not landed in Indonesia, but was taken directly to the home country of the vessel;
2. Catch of the vessels are directly moved to the transport vessel at sea without reporting to be taken abroad (do transhipment, secretly or illegally);
3. The use of foreign crew conflicts with Law No. 45/2009 on the Amendment of Act No. 31 of 2004 on Fisheries, Article 35A.

It is difficult for inspectors from Directorate General of Surveillance and Indonesian Navy to identify illegal and legal foreign fishing vessels using the Indonesian flag in Indonesian waters. This has encouraged foreign fishing vessels to fish without a permit (SIPI). This is compounded by changing the ship's name to an Indonesian name. This is so called double-flag practices in Indonesia waters.

Implementation of the moratorium on 3 November 2014 has successfully identified foreign-made ships numbering 1 132 units consisting of various fishing gear and operating throughout Indonesia. Trawl was the dominant fishing gear (54 percent), with 8 percent shrimp trawl and 46 percent fish trawl (Figure 15).

Trawlers (ex-foreign) authorized to fish in certain waters such as the Strait of Malacca, the South China Sea and Aru-Arafura Sea were up to 616 units. Trawl dominated fishing vessels operating in the Arafura sea-Aru at total 84 percent, with 9 percent of shrimp trawler and 75 percent fish trawler.

FIGURE 15
Status of Ex-Foreign Fishing Vessels under evaluation



Source: Task Force IUU fishing (Press Release).

Results of the evaluation of 1 132 ex-foreign ships carried out by the Task Force on IUU fishing revealed (Figure 15):

1. 699 ships are black-listed because of serious violation;
2. 390 Indonesian-flagged vessels can be de-listed (de-registration) if they pay the appropriate amount of tax liability and get cleared by the Directorate General of Taxes, and secure clearance from the Directorate of Sea, otherwise the vessel will be destroyed;
3. 43 unit carrier vessels with foreign flag can not operation and should be out from Indonesia.

During the evaluation process it turned out that 414 units were unaccounted for and believed to have escaped and returned to their home country. The remaining 718 units were still in 27 ports in Indonesia.

The statement by honorable Susi Pudjiastuti, Minister of Maritime Affairs and Fisheries given in the "Press release" (Figure 16) on September 17, 2015 referring to the results of monitoring and evaluation team, recommends an assessment to measure the compliance of companies and fishing boats, based on 9 criteria, which are as follows:

1. The legality of ownership of the vessel (including original ship registered; vessels have other Indonesia flag; deletion certificate can not be authenticated; and the validity of the provision of the ship can not be proven);
2. The presence of the skipper and crew (crew) foreigners;
3. Vessel Monitoring System active transmits (there are evidence that the ships do not ever turn on the transmitter during a license period SIPI/SIKPI applicable);
4. Transshipment illegally;
5. Violations of fishing area boundaries;
6. Compliance with the fishing vessels permit in SIPI (such as the size mark down the ship and the use of fishing gear that is not in accordance with SIPI that is based on the findings of field verification);
7. Indications in crime (including the practice of forced labor and human trafficking);
8. Do not fulfill the obligation to build or partner with a processing unit (UPI); and
9. Does not fulfill the obligation of landing at the port designated in accordance with valid licence (SIPI/SIKPI)

Evaluation of the ex-foreign vessels indicate several types of violations, among others:

1. Use of counterfeit documents covering up or altering the vessel deletion Certificate (from flag state), import documents, letters measuring vessel (GT).

2. The vessel use double flags, for easy movement between states,
3. Deactivation of VMS
4. Not paying import tax on the purchase of a ship from foreign company
5. Inaccurate reporting of catch because fish exports are mostly done via transhipment at sea
6. Abuse of foreign crew and activities of human trafficking and labor force. This includes recruiting of child labor, putting crew in remote areas, which result in loss of communication and not paying salaries and social insurance.
7. Some companies just functioning as agents or facilitators for foreign vessels operating in Indonesia, and thereby not doing real business, so it does not create multiplier effect.

FIGURE 16
Result of Analysis and Evaluation Ex-Foreign

***Press Release from Ministry of Marine Affair* & Fisheries**
Result of Analysis and Evaluation Ex-Foreign Vessels (17 Sept 2015)

ANEV Phase I 22 June 2015	ANEV Phase II 1 July 2015	ANEV Phase III 5 August 2015	ANEV Phase IV 22 Jun 2015
Revocation of licenses: SIUP : 8 Company SIPI : 146 Fishing Vessels SIKPI : 11 Carrier	Revocation of licenses: SIUP : 4 Company SIPI : Fishing Vessels SIKPI : 9 Carrier Freezing of licenses: SIPI : 1 Fishing Vessels SIKPI : 3 Carrier	Revocation of licenses: SIUP : Company SIPI : 13 Fishing Vessels SIKPI : 6 Carrier Freezing of licenses: SIPI : 12 Fishing Vessels SIKPI : 23 Carrier Remarks 31 Vessels Can not extended licenses 96 Vessel Can Propose New Licenses	718 vessels still in Indonesia Remarks 126 Company evaluation completed 367 vessels evaluation completed

Result of Evaluation	SIPI	SIKPI
Revocation of licenses:	8	1
Freezing of licenses:	14	
Notice of Freezing	6	
Notice of warning	35	1
Licensing of fishing vessels are not renewed and may not apply for a new permit	171	22
Licensing of fishing boats can apply for a new permit	95	13

4. IMPACT TRAWL BAN PHASE II

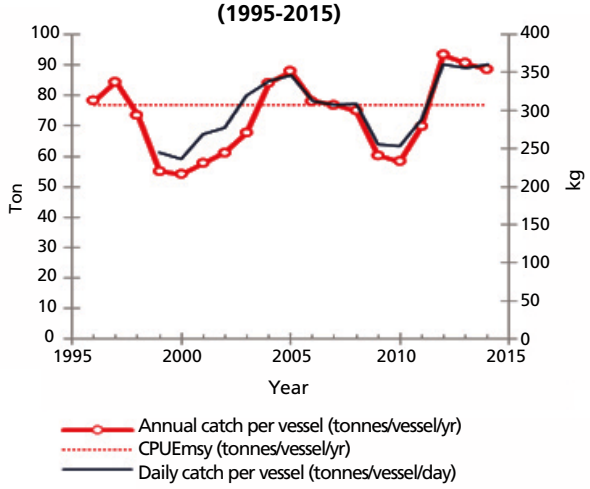
4.1 Shrimp fishery in the Arafura

Data collected by the association HPPI since 1995 shows that there are fluctuations in catch per unit effort (CPUE) in line with the policy of trawlers in Indonesia (Figure 17). The annual catch of trawler in year 2014 for shrimp (Tiger shrimp and Banana prawn) reached more than 90 tonnes/vessel/year. The chart also showed that total shrimp catch on a daily basis was more than 350 kg/vessel/days.

The moratorium of ex-foreign vessels and trawl banning give impact for decreasing fishing pressure in Aru-Arafura, because most of trawlers are not operated. Based on data from 55 unit vessels that are still operating under the HPPI association, in 2014 there were 55 shrimp trawlers from HPPI members producing 4 325 tonnes, which operates a total of 12 385 days. If calculated, the average catch of each vessel would be 78 629 kg/month or equivalent to 349 kg/vessel/day operation.

In 2015 the catch of banana prawns (Jan-Jun 2015) amounted to 633 kg/vessel/day, an increase of 149 percent compared to 2014. The catch of Tiger Shrimp (Aug-Sept 2015) amounted to 435 kg/vessel/day, an increase of 160 percent compared with 2014.

FIGURE 17
Trend of Catch Per Unit Effort for Shrimp in Aru-Arafura Sea (1995-2015)



Source: HPPI, 2016.

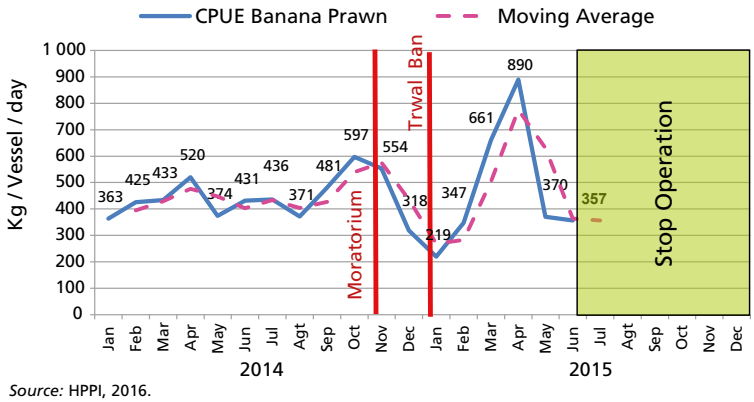
Banana Prawn (Catch Per Unit Effort)

Shrimp trawlers who operated for banana prawn catch during the years 2014-2015, showed that after the moratorium was applied on 3 November 2014, better capture resulted (Figures 18 and 19).

Figure 19 shows similar seasonality for tiger shrimp and banana prawns, which generally occur in September to February.

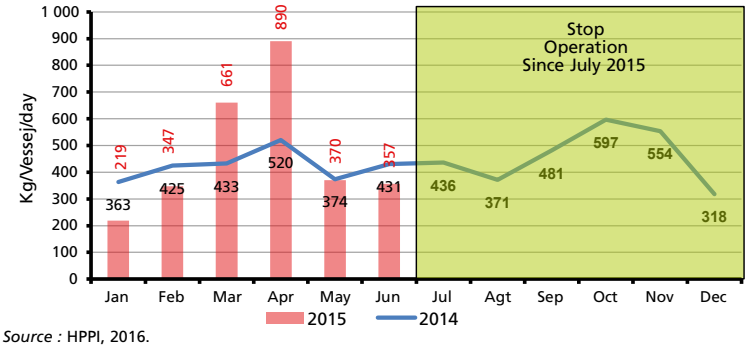
During the ban some trawlers with unexpired licences were still in operation. Based on the data from 5 unit trawlers that were still in operation, it was evident that the catch rate of these trawlers increased in the short term suggesting potential positive impact of the ban. In Figure 19, production of a vessel, which targeted banana shrimp in 2015, was 890 kg/vessel/day, and declined in May-June. In year 2014 catch of banana shrimp was 520 kg/vessel/day.

FIGURE 18
Catch per Unit Effort for Banana Prawn (base on 5 vessels)



Source: HPPI, 2016.

FIGURE 19
Trend Catch Per Unit Effort for Banana Shrimp (5 vessels)



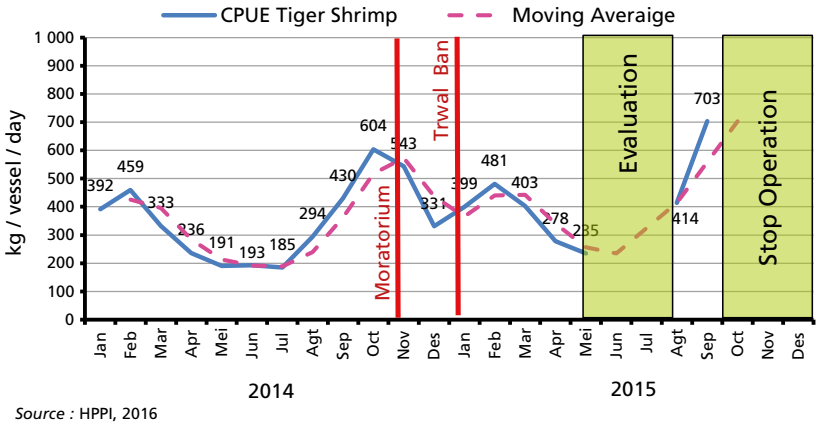
Source : HPPI, 2016.

Tiger Shrimp (Catch Per Unit Effort)

Shrimp trawlers who operated for tiger shrimp catch during the years 2014-2015, showed that after the moratorium was applied on 3 November 2014, comparison of the catch in the same month (August-September) showed better capture results (Figures 20 and 21).

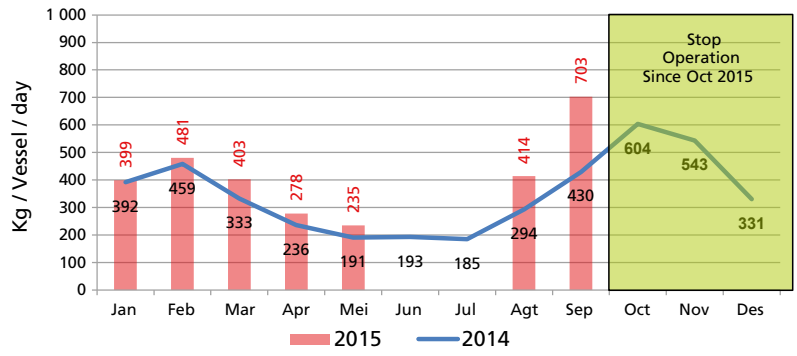
Based on results from 11 vessels that are still operating, it was evidant that total catch amounted to 481 kg/vessel/day with tiger shrimp as target. Data from one company that was still operating during May-August 2015 showed that there were very high catch rates, amounting to 414 kg/vessels/day in August and increased to 703 kg/vessel/day in October 2015. Unfortunately, the license expired in October 2015 and could not be extended (Figure 21).

FIGURE 20
Trend Catch Per Unit Effort for Tiger Shrimp (11 vessels)



Source : HPPI, 2016

FIGURE 21
Trend Catch Per Unit Effort for Tiger Shrimp (base on 11 vessels)



Source: HPPI, 2016.

The potentially positive impact for small-scale fisheries that has resulted from trawl ban phase II is based on some claims from small-scale fishers that they are now able to fish in nearer distance than in the past. The fishers also feel they nowdays can catch more in the same fishing ground with short time fishing operation. There is no scientific data yet to show this effect.

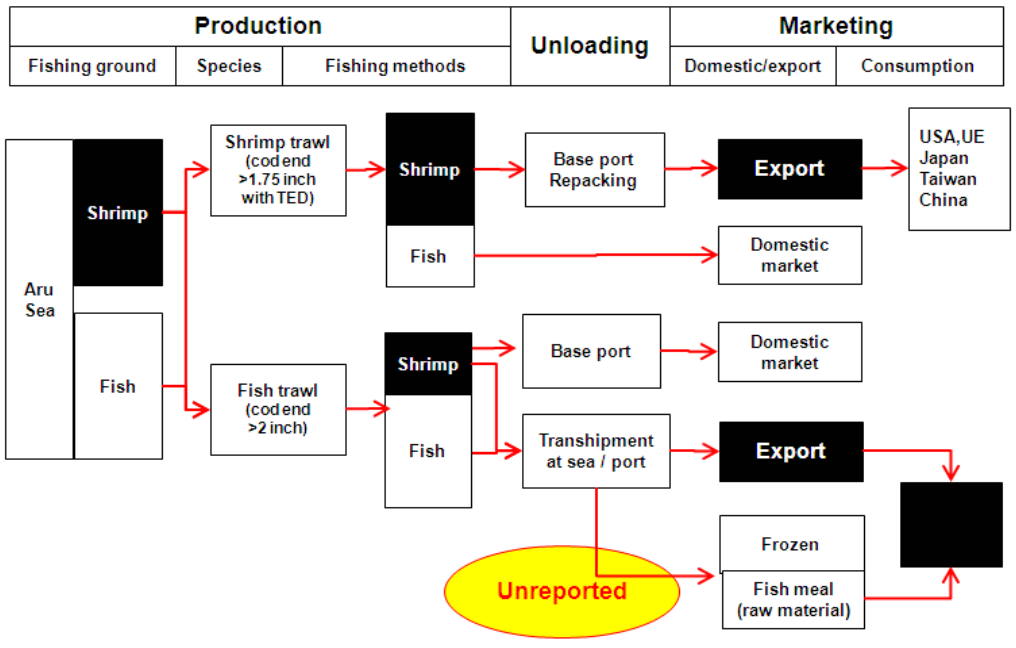
4.2 The Value Chain of Trawl fishing activities in Aru-Arafura

The value chain of the trawl fishery activities in Aru-Arafura is illustrated in Figure 22.

There are two types of commercial trawlers operating in the Aru Sea i.e. fish trawl and shrimp trawl:

a. Shrimp trawlers are incorporated in HPPI. Fish (bycatch) are brought to the port when there is remaining space in the cold storage. Otherwise the bycatch is discarded at sea. Catch of shrimp is landed in the company's private port, and packaging is done prior to export by carrier ship. Most of the landed fish is marketed for local consumption around the harbour bases or to the island of Java.

FIGURE 22
Diagram of Value Chain Trawl Fisheries in Aru-Arafura Sea



b. Fish Trawlers are incorporated with another association. All catches are retained and there are no discards at sea. Transhipment is done on the fishing grounds and at the port, to carrier vessels, so much of the data go unreported. Only a small portion of fish is marketed in the local market.

Companies, who are part of the association HPPI, operate 55 shrimp trawlers in Aru-Arafura Sea, with total operating days between 226-244 days per vessel per year. Shrimp production is sold and marketed locally in Indonesia and exported to Japan, China, Australia and several other countries. The Japanese market is a market with huge potential. Details are shown in Table 13 and Table 14.

TABLE 13
Market Distribution of Shrimp (tonnes)

Years	No of Vessel	Day operation /vessel/year	Market (tonnes)					
			Japan	RRC	Australia	Others Country	Local	Total
2012	57	244	2 281	338	-	1 378	98	**4 095**
2013	55	227	2 057	952	-	1 407	107	**4 523**
2014	55	226	2 157	806	7	1 319	21	**4 310**

Source: HPPI (Assosiation Company for Shrimp Trawl in Indonesia).

TABLE 14
Market Distribution of Shrimp (USD)

Years	No of Vessel	Day operation/ vessel/year	Market (Value – USD)					
			Japan	RRC	Australia	Others Country	Local	Total
2012	57	222	25 195 321	5 351 769	-	18 790 848	1 518 024	50 855 962
2013	55	226	20 623 373	11 898 107	-	15 465 626	1 191 514	49 178 620
2014	55	225	22 600 911	11 294 410	73 936	14 661 694	134 739	48 765 690

Source: HPPI (Assosiation Company for Shrimp Trawl in Indonesia).

The shrimp trawl catches is dominated by Tiger Shrimp *(Penaeus monodon)* 44.4 percent, followed by Banana shrimp *(Penaeus merguensis)* 21.9 percent, and Ende *(Endevour sp.)* 16.4 percent, based on the data of HPPI (year 2014) (Table 15).

TABLE 15
Composition of Shrimp Production

Years	No of Vessel	Day operation / vessel/year	No of hauling / vessel/year	Total catch (kgs)	Compotition (%)			
					P. monodon	P. merguensis	Endevour sp	Others
2012	57	222	1 967	4 497 662	41.7	27.0	15.8	15.5
2013	55	226	1 978	4 389 010	43.1	23.0	16.8	17.1
2014	55	225	1 969	4 324 613	44.4	21.9	16.4	17.3

Source: HPPI (Assosiation Company for Shrimp Trawl in Indonesia).

Trawl vessels are generally operated by a crew of 20-25, bringing the estimated total number of crews as 13 800 persons. Each company is supported by a processing unit with a capacity of 1 000 tonnes of cold storage, which employs a staff of 250 persons. In Aru-Arafura Sea, there are 7 companies belonging to the Indonesian Shrimp Catching Entrepreneurs Association (HPPI) and there are 35 companies belonging to other associations. The estimated total number of processing staff employed by the 42 companies is 10 500 persons. This gives an indication of the socio-economic impact to be addressed.

4.3 Impact

Indonesian fisheries experts have explained the impact that could occur from implementing a fish-licensing moratorium in WPP-NRI, and can be broadly grouped into environmental and economic aspects.

The environmental impacts that may occur from these policies generally have a positive impact on the main fish resources and the environment, which is as follows:

1. If within six months half the number of ex-foreign fishing vessels in question is not in operation (estimated between 200-400 boats), then the fishing pressure on fish resources will be reduced, so that the impact in terms of biology such as the number of fish which will spawn will be more than usual. This condition is expected in the number of juveniles (recruitment success) which will increase, especially for fish whose life cycle is short, such as: shrimp (4-6 months), kurisi, etc.
2. If the period of the moratorium is extended for 2-3 years, the biological impact will be more significant, with a high likelihood of increasing trend of CPUE (catch per unit of fishing effort) of fishing vessels operation.
3. Reduced damage in ecosystems and fish resources. With a reduced number of ex-foreign vessels fishing, which generally use destructive fishing gear, such as shrimp trawl and fish trawl, the estimated damage to ecosystems and fish resources will be reduced. The resources will have the chance to recover, because the marine aquatic ecosystem and fishery resources are renewable.

Meanwhile, the economic impact that may occur as a result of this policy can be positive and negative. The positive economic impacts are as follows:

1. Reduced fishing pressure by ex-foreign fishing vessels, will certainly benefit fishing vessels nationwide, as expected catch will rise, which in turn will contribute to the welfare of the Indonesian fishermen, either directly or indirectly.
2. Reduce the state losses due to IUU fishing practices conducted by ex-foreign vessels which is estimated at more than Rp 7.5 trillion (information based on Tempo News, June 29, 2014). Moratorium within a period of 6 months is expected to reduce IUU fishing of as much as 200-400 units ex-foreign fishing vessels. Generally IUU fishing operates in the Natuna Sea and Arafura Sea.
3. Improving the system of fisheries management and licensing of national fishery business, which then is expected to optimize the economic benefits for the country of Indonesia, through tax revenues and non-tax revenues (PNBP). The period of moratorium is an opportunity to conduct the review and evaluate the fishery management plans and fishing licensing system. This is also an opportunity to review the regulations related to fisheries management (capture) based on the precautionary approach and the the ecosystem approach to fisheries (EAF). Also, it should review or strengthen licensing system and make documentation foolproof specially for the ex-foreign fishing vessels, so the opportunity to manipulate the documents can be removed.
4. This is an opportunity to conduct the review of policy on the use of fish resources by the ex-foreign fishing vessels. The study of state losses due to illegal fishing has been done, both in the official report and the investigation report in the mass media, and show the value of the loss was very high. The period of the moratorium can certainly be used to carry out a policy review of the utilization of the fish that has opened up licensing for fishing by ex-foreign vessels.

The negative economic impacts can be explained as follows:

1. Decreased PHP (Fishery Products Fee). The moratorium will cause a reduction in PHP. However, the declining value of PHP is not comparable with the losses caused by IUU fishing by ex-foreign fishing vessels resulting in damage to fish resources and ecosystems.
2. Reduced employment opportunities for Indonesian crew on ex-foreign fishing vessels. Losses due to reduced employment opportunities for Indonesian crew as a result of the moratorium would be considerable though the actually affected Indonesians are to be assessed, because many ex-foreign fishing vessels need not necessary employ Indonesian crew.
3. It is estimated that there would be a decline in the supply of fish for fish processing units (UPI). It remains to be clarified and studied in greater depth, because the condition before the moratorium also showed that a large number of fish transferred via transshipment were taken directly out of the country.

5. CONCLUSIONS AND RECOMMENDATIONS

The conclusion of the implementation of the moratorium and the ban on trawling for the environmental aspects of fishing activities, are as follows:

1. Provides rest period for exploitation and improves the condition of the aquatic environment
2. Reduced IUU-fishing
3. Reduced human trafficking
4. Small-scale fishermen's role in the economy restored.

Recommendation that can be submitted to improve the management of shrimp in Aru-Arafura are as follows:

1. Shrimp fishing areas have been identified and can be managed well by making clear boundaries for the fishing areas, and in particular, set the fishing season, and the minimum size of shrimp allowed to be caught. At the time if the composition of shrimp caught are more below the allowable size, then the management can be applied by closing fishing season;
2. Restrictions on the number of trawl vessels that should be allowed to operate in order to maintain optimum productivity of each trawl vessel so as to provide profits for the fishing companies.
3. Re-examine appropriate fishing gear to catch shrimp and maintaining the quality of the shrimp.
4. Small-scale fishermen are using gillnets, trammel net and traps to catch shrimp. But shrimp production from these gears often result in some physical damage on shrimp.There is a need of skill upgradation to improve shrimp quality and appearance of shrimp caught according to the demands of export markets.
5. Increased adherence to the application of regulations consistently and continuously. This will support transparency and licenced utilization of fish resources such as vessel size, the company obtaining necessary license, publicizing violation by any, the use of vessel monitoring system, maintaining export documents and complying with tax and evaluation.
6. Application of Fishing Work Agreement (FWA) and social security for the crew can improve protection in preventing human trafficking and forced labor.
7. To keep the economy through export shrimp fishery, there is need for strengthening the cooperation pattern of fishing communities in the model of "INTI-PLASMA", as follows:
    a) "INTI-PLASMA" is a model of partnership between large-scale enterprises with a group of small-scale fisheries. This pattern has developed and grown in some areas for certain commodities such as seaweed and live fish.

b) Existing shrimp fishing industry can act as an "INTI" (core). Company has port facilities, cold storage, network marketing, etc. and utilize the ex-trawler vessels for collecting and transporting shrimp from all fishing village;
c) Developing the fishing vessels that are given to small-scale fishermen who act as "PLASMA" to supply shrimp to the processing unit owned by INTI. Plasma can involve small-scale fishing communities locally or from outside the Arafura region.
d) To provide proper storage for shrimp as simple as a cool box that can store the shrimp a few days to maintain the quality of the shrimp, while awaiting shipment through the carrier ship.

REFERENCES

Camhi, M.D., Valenti, S.V., Fordham, S.V., Fowler, S.L. and Gibson, C. 2009. *The conservation status of pelagic sharks and rays: report of the IUCN shark specialist group pelagic shark red list workshop.* IUCN Species Survival Commission Shark Specialist Group. Newbury, UK. 78p.

Decree of the Minister of Marine and Fisheries of the Republic of Indonesia. Number KEP.06/MEN/2010 regarding Fishing Equipment in Fisheries Management Area of the Republic of Indonesia.

Decree of the Minister of Marine and Fisheries of the Republic of Indonesia. Number 61/KEPMEN-KP/2014 regarding Productivity of Fishing Vessels.

Decree of the Minister of Marine and Fisheries of the Republic of Indonesia. Number KEP.45/MEN/2011 regarding potential estimation of fisheries Resources in Fisheries Management Area of the Republic of Indonesia.

Decree of the Minister of Marine and Fisheries of the Republic of Indonesia. Number 54/KEPMEN-KP/2014 regarding the fisheries management plan for fishery management area 718.

Directorate General of Capture Fisheries. 2014. *Document of Plan Fishery Management Area Laut Aru, Laut Arafura dan Laut Timor Bagian Timor* (WPP-RI 718). Directorate General of Capture Fisheries. Ministry of Marine Affairs and Fisheries, Jakarta.

Directorate General of Capture Fisheries. 2016. *Statistics of Marine Capture Fisheries* by Fisheries Management Area (FMA), 2005-2014. Directorate General of Capture Fisheries, Ministry of Marine Affairs and Fisheries,Jakarta.

Directorate of Fishing Vessel and Fishing Gear. 2006. *Report of symphosium on Present Status of Trawl in Indonesia Water.,Jakarta.*

Dudley, R.G. and Ghofar, A. 2006. *Marine and Fisheries Sector Strategy Study: Sub Sector Strategy Review: Marine and Coastal Resources Management.* Uniconsult International Limited, Dhaka.

Dulvy, N.K., Baum, J.K., Clarke, S., Compagno, L.J., Cortés, E., Domingo, A., Fordham, S., Fowler, S., Francis, M.P., Gibson, C. and Martínez, J. 2008. *You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays.* Aquatic Conservation: Marine and Freshwater Ecosystems, 18(5), pp.459-482.

Indonesia Central Bureau of Statistics. 2016. *Population of Papua Island 2013-2014.* http://papua.bps.go.id/linkTabelStatis/view/id/37

Indonesian Shrimp Catching Entrepreneurs Association. 2016. *Shrimp fishery in Arafura and Aru Sea* presented in Workshop to Evaluate the Available Data (Fishing Pattern Based on VMS Record, Including Socio-Economic Consideration), Bogor.

Manggabarani H. 2006. *Kajian usaha perikanan demersal di laut arafura.* Dalam Monintja DR, Sularso A, Sondita MFA, Purbayanto A. 2006. *Perspektif Pengelolaan Sumberdaya Perikanan, FPIK-IPB.*

Regulation of Ministry of Marine Affairs and Fisheries number 54/Kepmen-KP/2014 regarding the Fisheries Management Plan Fishery Management Area 718.

Stacey, N. (editor), S. Nurhakim, D. Nugroho, H. Soselisa, B. Resosudarmo, O. Kalis, J. Monteiro, J. Prescott, J. Martin, & J. Karam. 2011. *Socio-economic Profile of the Arafura and Timor Seas.* Report prepared for the Transboundary Diagnostic component of the Arafura Timor Seas Ecosystem Action Program, ATSEA Program, Jakarta, 135 p.

Socio-economic survey report of the Gulf of Papua Prawn Fishery

Raymond Unasi
Consultant
Port Moresby, Papua New Guinea

ABSTRACT

Gulf of Papua Prawn Fisheries (GoPPF) has come a long way since its development in the early years preceding Papua New Guinea's independence from Australia. It started in 1969 and became PNG's largest export fisheries apart from tuna. Prawn alone contributes significantly to the economy annually, earning between K2.5 million to K28 million or US$ 1.5 to US$11.5 million per annum. In fact, PNG's prawn industry is very small compared to other countries in Asia. This is due to management regimes that limit all trawlers operating each season at 15 for the Gulf of Papua region (GoP).

Over the course of the years, there is concern for ecological well-being of the GoP marine ecosystem including other similar ecosystems within the Asia-Pacific region. This ecosystem is pristine with kilometers of estuary, mangroves with nipa palm and associated wetland forest. The pristine ecosystem provides perfect spawning environment for shrimp and brackish water fish species such as barramundi, black bass and mudcrabs amongst others. Given this background GoPPF management plan (first drafted in 1998) determines sustainable use of the shrimp resource within the region. However, over time certain management measures have not taken into consideration current technological changes in fishing methods, gear and other thematic threats that compromise the marine ecosystem.

The Strategies for trawl fisheries bycatch management project (REBYC-II CTI) has provided the avenue to re-look at the way GoPPF has been operating in consultation with relevant government, local authority and community interest groups. Within the facets of this program fundamental areas of assessment within the marine ecosystem of GoP needed extensive social, economic and cultural study. The outcomes of the enquiry will guide specific policy changes, if need be.

A survey team was mobilized in October 2015 and again in November-December 2015 to carry out the survey into coastal communities of the GoP, specifically enquiring with local stakeholders on social and economic profiles of the GoPPF industry. Findings of the survey contained herein determined aspects of the community's social and economic outlook specifically targeting:

- income level from bycatch utilization amongst other income sources;
- views on prawn trawling and its associated activities as a whole;
- involvement of women in the fishery sector within the GoP;
- baseline household and biodata information;
- involvement with government and other state players;
- opinion on level of assistance forthcoming from relevant authorities including NFA (National Fisheries Authority) and provincial officers amongst others.

Twenty-one communities from three Local Level Government (LLG) areas of Kerema district were covered in this survey. A total of 300 community consultation guide (interview schedule) with another 50 questionnaires each for trawler crew and local government staff were used to collect information contained in this report. A turnover of 281 response (94 percent) or feedback was completed by 14 enumerators over the duration of this study. Prawn trawler crew returned 18 completed questionnaires while 24 government and fishery officers filled questionnaires targeting technical officers' views.

Given the results presented in this report, it can be summarized that benefits from GoPPF does not trickle down to the coastal communities despite the communities owning much of the resource. Furthermore, the ability of government agency and local initiatives to assist locals to tap into the resource is significantly lacking. Seventy-two percent (72 percent) of respondents recognize the fact that they are observers in the prawn industry while 35 percent of total respondents were women folks who are either directly involved in bycatch utilization and/or artisanal fishing within the waters of GoP. Impediments in education, infrastructure and services are noted as findings of this enquiry.

Generally, significant percentage of marine biota is recorded as bycatch/discards (80 percent-95 percent) amongst the target prawn species. This bycatch constitutes a good portion of coastal populace protein source and income source while a massive fraction of it is discarded as waste into the sea.

ACKNOWLEDGEMENTS

I am greatly indebted to Food and Agriculture Organization of the United Nations (FAO) and the Papua New Guinea National Fisheries Authority (NFA), specifically the Prawns and Lobster Management section for giving me the opportunity to work in this Project. Officers of National Fisheries Authority in Port Moresby have provided invaluable insight and guidance in executing this Project along with logistical support from FAO PNG country office.

I am additionally indebted to numerous people who contributed to conducting the survey and provided valuable information and contribution that enabled me to compile this Report. Firstly I want to acknowledge the contributions from the team members who were involved in phase 1 and 2 of the survey (Gulf Province fishery staff), Mr. Biatus Bito and Mr. Mezin Eseme for data collection, data entry and literature reviews critique. Finally, a big thank you to the REBYC-II CTI project management team from SEAFDEC, FAO and NFA for your patience and understanding.

ACRONYMS

ALC	automatic location communicator
BRD	bycatch reduction devices
CPUE	catch per unit effort
CSIRO	Commonwealth Scientific and Industrial Research Organization
CTI	Coral Triangle Initiative
DoW	Department of Works
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
FIA	Fishing Industry Association
FPIC	Free Prior and Informed Consent
GEF	Global Environment Facility
GoP	Gulf of Papua
GOPPF	Gulf of Papua Prawn Fishery
GoPNG	Government of Papua New Guinea
GPFDP	Gulf Province Fisheries Development Plan
LLG	local level government
MEY	maximum economic yield
MSY	maximum sustainable yield
NFA	National Fisheries Authority
NFB	National Fisheries Board
PNG	Papua New Guinea
REBYC	Bycatch Reduction Technologies and Change of Management
SME	small and medium enterprise
TED	turtle excluder device
ToR	terms of reference
UN	United Nations
VMS	Vessel Monitoring System

1. INTRODUCTION

REBYC-II CTI ("Strategies for trawl fisheries bycatch management") is an intervention designed to minimize impacts of fishing on marine ecosystems. The general project initiative is designed to contribute towards more sustainable use of fisheries resources and healthier marine ecosystems in the Coral Triangle and Southeast Asia waters by reducing bycatch, discards and fishing impact by trawl fisheries.[1]

This project is modeled on the concept of ecosystem-based management of marine resource utilization amongst coastal communities to maximize economic gain and help improve livelihoods at the same time minimize impacts on marine ecosystem from over-exploitation.

Papua New Guinea's (PNG) component of the four-year REBYC-II CTI project started in 2013 and is ongoing at the time of the survey. PNG's component of this project is implemented by the lead agency, National Fisheries Authority (NFA) with operational support from the Food and Agriculture organization of the United Nations (FAO). Given the delays in fully implementing this project within the country, NFA, FAO and the REBYC-II CTI team had gone forward with recommendations from mid-term reviews in January 2015 to get important aspects of the project started. These aspects include a comprehensive socio-economic study of the Gulf of Papua Prawn Fishery and its associated impacts on coastal communities that rely on bycatch as a source of protein and income. As such this study aims to determine:

1. Level of dependence on bycatch by local community;
2. Synergy between different stakeholders within the GoP prawn industry; and
3. Weaknesses and strengths of the current management regime within the GoPPF.

Gulf of Papua Prawn Fishery overview

The Gulf of Papua Prawn Fishery (GoPPF) started almost 45 years ago in 1969 when interest in the shrimp industry escalated. In the late 1960s joint-venture projects were formed and was operated by various operators (Gwyther, 1980 cited in Matsuoka, 1995). According to Matsuoka (1995) only three companies were involved initially.

Between 1988 and 1994, the GoPPF was operating under an interim management plan, which was set-up in 1988. The plan was based on the result of a number of projects and investigations, on catch and effort data since 1977, and on the operations of the 3 main companies (Evans *et al.,* 1995). On average, the individual vessels of the core companies were catching an average of 80 tonnes per vessel per year. Thus, an allowable catch of 80 tonnes per vessel was set, and as a result, the number of vessels was set at 15, based on the estimated yield of 1200 tonnes (Evans *et al.,* 1995).

By 1995, about 14 of the 15 GT-type trawlers were licensed for operation year round and they produced on board-frozen prawns for export. Currently, the fishery is limited to 15 licenses with no foreign registered fleet involvement, except on joint venture arrangements. As a result industrial fishing is subsequently increasing in the country and is either operated by PNG-based foreign firms or under joint venture partnership (Matsuoka, 1995).

Types of trawl vessels and gear

There are three types of vessels: single rig, twin rigged and quad rigged. All vessels operating within the GoP have a length between 21 m and 30 m and all have onboard licensed processing facilities and storage or freezers. Most of the vessels are twin-rigged with 12 fathoms (24 m) (footrope), except three vessels which are quad-rigged. They also have two main nets, each with a small try net (Evans *et al.,* 1995; Liviko, 2012). The nets used cover a swept area width of 60 meters. This can be achieved by using two large main nets or four smaller size nets. In practice, it has been shown that quad-rigged

[1] Defined in REBYC II CTI Project Document (FAO, 2009).

nets are more efficient over heavy silted bottom (Liviko, 2012). Furthermore, during trawling, the main nets are set for three to four hours while the try net is set from mid-ship, somewhere before the main nets and are checked every 15 minutes to inspect what has been caught in the main net (Evans *et al.,* 1995). Whenever a good school is caught, the vessels are able to make a U-turn, and go over the same ground several times, before the main net is winched up. However, a couple of vessels introduced recently are a great concern to the fishery industry in GoP as they are stern trawlers and these vessels have only one main net that causes more damage to the marine biota.

Table 1 shows the particulars of each vessel type operating in the region with its specifications.

TABLE 1
Type of vessels operating in the Gulf of Papua

Type of vessel	No. of vessels	Ave-length (m)	Ave-gross tonnage registered	Main Aus. Eng (HP)
Quad Rigged	10 vessels	24.45-29.3	145.27-211.02	420 HP-440 HP
Twin Rigged	2 Vessels	24.45	145.27	420 HP
Single Rig	3 Vessels	26.77	177.06	425.00 HP

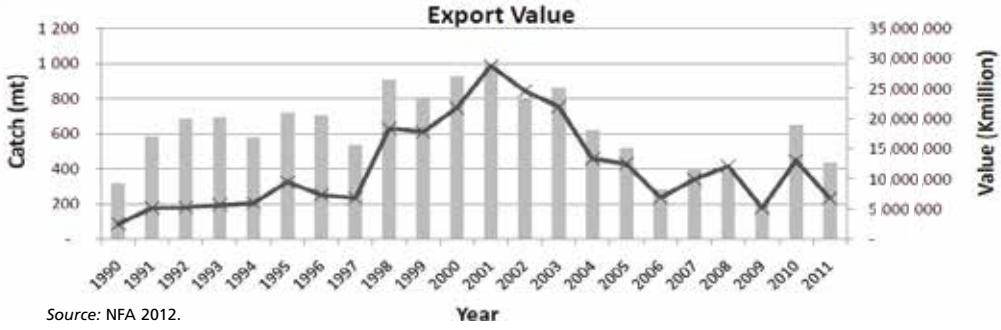
National Prawn Fishery Economic Overview

The fisheries industry is one of the primary sectors expected to develop significantly in most island countries in the South Pacific region including PNG. The industry has been active and is generating much needed revenue for the country. Overall, it has contributed to the national coffers approximately USD 100 million (PGK300 to K400 million) per year with significant contribution coming from the tuna fisheries (NFA, Website).

Prawn fisheries have been a notable contributor to PNG's marine fishery exports as much as it is to other maritime countries of the Pacific. In Australia between 2010 and 2011, the industry recorded a gross value of production (GVP) of USD 27 million (K60.5 million), with a total catch of 1 979 tonnes of prawns (Knight and Tsolos 2012; cited in GoSA 2007). In PNG the industry is fairly small compared to many other countries but contributes a fair share to the national coffers between USD 1.13 million and USD 4.0 million annually (NFA, 2012).

Figure 1 shows the prawn export value between 1990 and 2011. Over the years the export of prawns has increased significantly by 50 percent from 993 000 kg in 1979 to 1 960 000 kg in 1987 thus earning between K3.8 to K8.8 million (Matsuoka, 1995). Between 1990 and 2003, the revenue generated was between K2.5 million and K28 million or USD 0.8 million and USD 10 million (NFA, 2012). The peak revenue period was experienced between 1998 and 2003 where earnings from prawn fishery alone generated between K18 million and K28 million respectively. Most other years produced variable results ranging from K2 million and K13 million with the lowest amount from export was achieved in 1990 where K2 million was generated.

FIGURE 1
PNG's Prawn export value between 1990 and 2011

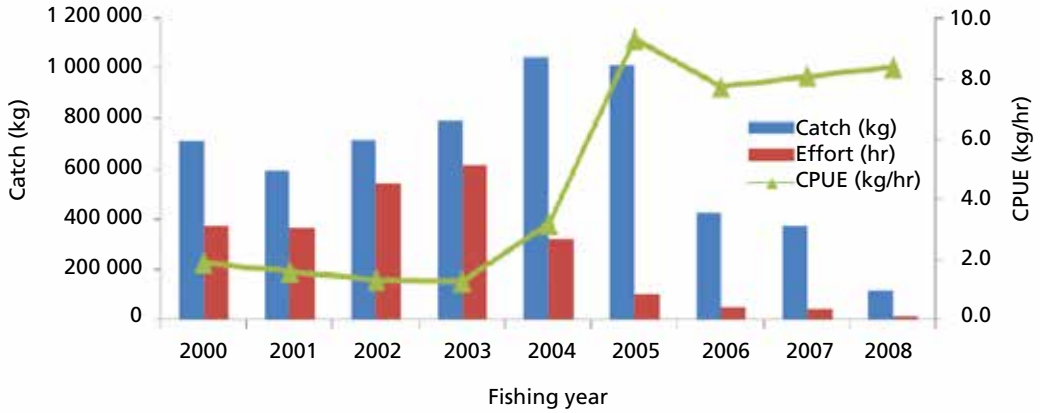


Source: NFA 2012.

The variations in the revenue above is influenced by key factors such as the weather, period of fishing, world price or the amount of vessels used. A study by Evans *et al.*, (1995) confirmed that bad weather affected catching effort. Also ageing vessels and high cost of fuel and maintenance deter catching effort (Liviko, 2012). Between 2000 and 2008, prawn trawling fluctuated between 7 to 12 months (NFA, 2012). During that period a low of 5 vessels to as high as 15 vessels per fishing period took to the waters in the GoP between April and November. Consequently, this affects the annual catch, which ranged between 119 638 kg and 1 046 683 kg.

Figure 2 shows the annual catch and effort with catch rate (CPUE) for all species. This implies that the biomass of the fishery at maximum economic yield (MEY) and maximum sustainable yield (MSY) is about 800 tonnes and 650 tonnes respectively (NFA, 2012) in GoP.

FIGURE 2
Annual catch and effort with catch rate (CPUE) for ALL species



Source: NFA 2012.

Despite the important economic value of prawn fisheries derived in the Gulf province, nothing significant is retained by the province in terms of economic benefits and infrastructure, such as landing sites and processing plants. This is partly attributed to the fact that there is no jetty or wharf in Kerema including storage facilities that trawlers can offload, store and even process their harvest (NFA, 1995; Liviko, 2012).

Gulf provincial government is mandated to receive or keep 5 percent of the total export value at the end of every season per the 1998 GoP prawn fishery policy. For the province to directly access this funding after tax and sales from national government is always inconsistent. Funds are calculated and allocated after exports as shown in Table 2 but remitting it into the provincial government treasury to allow provision of basic services to coastal communities is inconsistent (Philemon, pers comm).

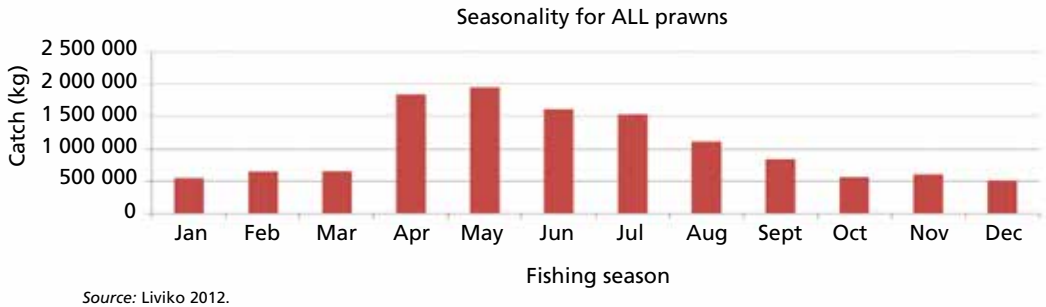
TABLE 2
Five percent (%) export value intended for Gulf province, 1996-2008

Year	Quantity (kg) prawn export	Value (usd)	Value (kina)	5% Export value (kina)
1996	691 698.50	5 553 279.33	7 245 894 72	362 294.74
1997	528.379.00	4 742 651.79	6 785 857.84	339 292.89
1998	905 592.00	8 703 967.25	18 424 521.44	921 226.07
1999	806 338.00	6 928 692.71	17 828 812.15	891 440.61
2000	928 850.20	8 190 362.13	21 977 894.88	1 098 894.74
2001	868 656.00	7 647 955.25	25 910 925.50	1 295 546.28
2002	612 218.00	5 159 936.21	19 916 943.36	995 847.17
2003	677 140.00	5 029 134.39	18 019 990.78	900 999.54
2004	534 440.00	3 688 835.85	11 870 858.30	593 542.92
2005	512 640.00	4 004 108.75	12 430 888.20	621 544.41
2006	284 580.00	2 280 999.77	6 948.427.67	347 421.38
2007	410 060.00	3 440 144.63	10 204 911.97	510 245.60
2008	382 590.00	4 466 150.23	11 979 630.81	598 981.54
Total	**8 143 181.70**	**69 836 218.29**	**182 597 129.95**	**9 477 277.89**

Prawn fishing seasonality

The seasonality of different prawn species varies during the year. However, there is a general trend where the season normally peaks in May then declines between June and December before surging back between March and April (Figure 3). Indian Banana, Endeavour Demon and Banana prawns' season peaks in May. Coral Brown prawn peaks in January; Blue Endeavour, Shimaebi, Akaebi, Green or Groved Tiger in February; White Tiger and Japanese Tiger peaks in April; Greysback (Red Endeavour), Red Spot King and Leader prawn in June; Green Endeavour and King prawns in July; and Brown Tiger prawn peaks in August (Liviko, 2012).

FIGURE 3
Monthly total catch for all prawn species



Source: Liviko 2012.

Moreover, according to Liviko (2012), the main season for fishing for all prawns is from April to August with an average catch of 294 321 kg (249.3 tonnes) per month. The catch begins at 156 tonnes in April and peaks at 159 tonnes in May and gradually declining to about 60 tonnes in March.

As stated above, interaction with local communities from this survey proved that fishing in GoP occurs between April and November with banning taking place between December and March. However, the main season for catching banana prawn in the GOP is from February to August, which normally coincides with the period of highest rainfall (Liviko, 2012). Liviko states that during this period, the average catch is about 96 metric tonnes per month but 100 tonnes per month or more can be reached between April and July. Generally the September to January catches usually average about 100 tonnes per month or lower.

Thus the overall total catch is about 1 200 tonnes/per year with 50 to 60 percent being the targeted banana prawns (*Fenneropenaeus merguiensis*). Majority of the prawns caught are *M. merguiensis*, while *M. eboracensis* comprised about 20 percent and fetch high prices. Tiger prawns make up about 10 to 15 percent of the catch yet still attracts high prices. The remainder of the catch is made up of coral prawns. All catches are processed on board larger vessels and stored into frozen packs for export, while the catches on smaller vessels are either processed on board or chilled and packed later onshore in Port Moresby (NFA, 1995).

Management – Monitoring, Control and Surveillance

The objectives set by the government for the management of the GoPPF as stated in the Gulf of Papua Prawn Management Plan 1998 (NFA, 2002) is:

- To manage the prawn fishery on a sustainable basis;
- To maximise the value of the resource through prevention of growth over-fishing;
- To manage the fishery on a precautionary approach; and
- To increase PNG participation in the fishery industry.

The general strategy for attaining the above objectives is primarily to control input by the industry in terms of number and type of fishing trawlers and secondarily gear restrictions. To control output, such as a total allowable catch, would be inappropriate for a resource that has large abundance or are independent of fishing pressure. Hence, the specific measures presently used in management of the fishery include (NFA, 2002):

- Seasonal closure – December to March;
- Limited entry – only 15 vessels shall be licensed to operate in the management area;
- Restricted entry – only Papua New Guinea companies;
- Gear restriction – vessel size (30 meters), rope and nets size restrictions; and
- Requirement that all licensed vessels have automatic location communicator (ALC) on board.

With respect to enforcement, the NFA Managing Director may appoint any employee of the Authority or anybody he considers appropriate to be Fishery Officers for the purpose of enforcing the Fisheries Management Act. Members of the Police Force and Defense Force are also Fishery Officers for the purposes of fisheries enforcement. Nonetheless, lack or poor communication, coordination, resources, technologies and infrastructures in both NFA and provincial fisheries office is a major obstacle in achieving the objectives. The obstacles mentioned above were obvious during the month-long survey.

Nonetheless, surveillance program of the National Fisheries Authority has three main components:

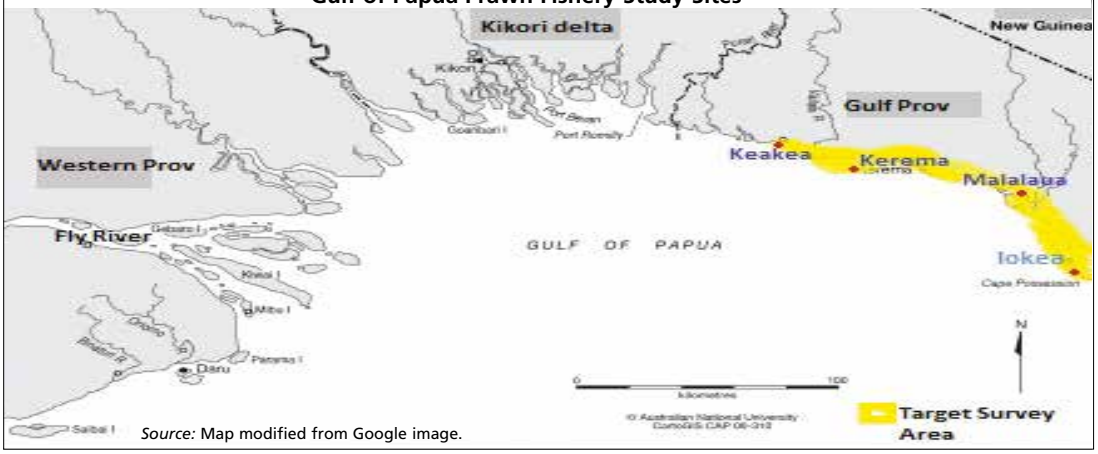
1. the use of NFA fishery observers on selected vessels;
2. cooperation with the PNG Defense Force in the physical surveillance/ enforcement on the fishing grounds; and
3. implementation of the electronic vessel monitoring system.

Generally, representatives from the Fishing Industry Association (FIA), government agencies including NFA and other stakeholders are represented on the National Fisheries Board (NFB) which approves the plan and governs the agency (NFA) that implements the plan. Overall information for management decisions dealing with GoPPF is acquired through various means including record and submitted logbook forms containing position, effort, and catch information (NFA, 2002). This routinely-collected data is entered into a database, analyzed and processed by NFA's Research and Management Branch, and compared to set targets in the management plan. However, the surveillance work has a long way to go to be effective given funding deficiencies and other associated reasons.

2. STUDY SITE AND STAKEHOLDERS

Figure 4 shows the GoP extending from the west of Port Moresby in Central Province to the mouth of Western Province. In terms of Prawn Fishery, GoPPF runs parallel along the coast from the mouth of Fly River in Western Province to the coast of Iokea in the east in Gulf province, and extending seaward to the 40 m depth contour (Liviko, 2012). GoP also contains one of the largest mangrove habitats in the world thus making it an important fisheries habitat. The coastal areas comprised of mosaic of habitats with mangroves forming an extensive belt, some 12 kilometre (km) thick intermingling with brackish swamp forest fringing the coast (Pernetta and Hill, 1981). Moreover, the coastline has long narrow sand beaches stretching kilometres but interrupted by river tributaries and brackish mangrove swamps. The marine substrate varies from fine mud and silts to sandy beaches or rocky shores, thus the diversity of resources available within the region as a whole is highly localised (Pernetta and Hill, 1981). Hence, it constitutes one of Papua New Guinea's important fisheries economic regions because of the extensive prawn harvest from this region.

FIGURE 4
Gulf of Papua Prawn Fishery Study Sites



Source: Map modified from Google image.

The viable area in the GoPPF covers only 9 603 square kilometers, with 1 388 square kilometers being subjected to more than 50 percent of the total fishing effort. Most fishing efforts concentrate at inshore areas between Orokolo Bay, Kerema Bay, Freshwater Bay and the Lakekamu estuary, an area equal to 13.1 percent of the defined trawling area for the whole fishery (Liviko, 2012). Coastal communities visited for the purpose of this survey is denoted in yellow on the map (Figure 4) and includes a total of 21 villages/hamlets with detailed information on the villages in Table 3.

Since the GoPPF covers both Western and the Gulf Provinces, there are separate licenses being issued for trawling in each province. Only larger vessels (cf. 24-30m length) are operating in the area because of the prevailing rough weather conditions experienced (Liviko, 2012). Sometimes smaller vessels occasionally fish as and when weather conditions permit.

Given the frequency of trawler boat-community interaction for various reasons, the study was conducted amongst communities that have direct contact with prawn trawlers per season. Table 3 denotes the 21 communities/villages, their LLG and basic social services available. It must be noted that selection of communities is entirely dependent on viability of team visit and the level of contact observed with prawn trawlers over the years. The survey team also took note of basic social services and estimated population per village as well as household number. This gives us a basic understanding of the general social well-being of communities within the context of social and economic development.

TABLE 3
Community/Village and LLG visited during survey period and their basic social indicators

LLG	Village	Total household	# Respondents	#Health facilities	#Schools (Elementary/ primary)	Distance to main service center
East Kerema LLG	Aviaru	225		12 (9 Aid posts, 3 Health centers)	1 Secondary school, 6 Primary school, 34 Elementary school	All villages stretch between 15 Km to 40 Km from Kerema town
	Mearu	225	8			
	Iokea	314	10			
	Isapeape		5			
	Karaeta		13			
	Uritai	336	16			
	Koaru	133	22			
	Lese	486	5			
	Lalapipi		6			
Kerema Urban LLG	Karama	224	25	1 Provincial hospital	2 High school/ secondary school. 4 Primary school. 39 Elementary schools	Communities within range of Kerema town (1 Km to 5 Km) but access only by boat
	Kukipi	143	15			
	K-Town/Kbay		11			
	Siviri		31			
	Uamai[2]	166	19			
	Silo	219	21			
Central Kerema LLG	Herehere		13	13 (11 Aid posts, 2 Health centers)	43 Elementary school. 5 Primary school. 1 Secondary high school	Furthest villae between 20 Km and nearest at 8 Km from Kerema town
	Meii	242	13			
	Keakea		15			
	Uaripi	149	19			
	Lavare 1					
	Pomaru/Puara		2			

Source: Gulf Provincial Intergrated Plan, 2012-2015.

Different stakeholders involved in the prawn trawling industry, mainly the commercial fishing companies, LLG staff, government workers and administrative staff were also interviewed in addition to the local communities. The different stakeholders above formed the core groups that were crafted from the list of "targeted stakeholder groups" stipulated under the terms of reference (ToR) of the social and economic study of this project. Overall, two sets of questionnaires and a guided interview set were developed targeting coastal village community (including bycatch users, retailers and sellers), trawler crew, government officers and company officials. Hence, questionnaires were designed targeting the following core group:

i) Fishermen/Women;
ii) Transporters;
iii) Bycatch and Discard Users/Sellers/Retailers;
iv) Household/street Sellers;
v) Trawler employees/crew;
vi) Target area (GOP) Community Leaders;
vii) Employers(Department heads/officers and Company executives);
viii) National and Local Fishery industry officers; and
ix) General public.

Crew on board prawn trawlers

Crew members on each fishing vessel are full-time workers including 1 captain (either a national or an expatriate), 1 chief officer (national), 1 chief engineer (expatriate), 1 assistant engineer (national), 1 bossen (national), 1 assistant bossen (national),

[2] There are two Uamai villages located further apart, Uamai 1 is outside of survey area, same for Lavare village 2 which is located further inland.

1 tallyman (national), 1 quality controller (national), and the remaining crews are processors (nationals). In addition, the number of crews employed per vessel by each company is around 14 to 18 crews, all males working on full-time basiss (NFA, 2012). No females are employed to work on prawn trawlers however the employment in post-harvest activities are done by either men or women on full-time, part-time or seasonal employment. Apart from the Captains, chief officer, cooks and engineers, all crew members conduct post-harvest activities and work full-time as well.

In this survey, 18 crew members (out of 50 targeted) were able to return completed questionnaire forms from a sample size of 4 boats from a total of 15 licensed trawlers. All of the 18 crew members were males due to the fact that no females work on board trawlers in the country.

Government and technical officers

Along with the crew members, about 24 government and technical officials were interviewed to gauge their views on the shrimp industry as well as bycatch/discard use policy. These group of respondents represented Gulf Provincial administration (including LLG staff), National Fisheries Authority officers, Department of Environment and Conservation (PNG), and technical officers from prawn exporting companies.

3. METHODOLOGY

Twenty-one communities (defined as hamlets/village or cluster of houses) in three Local Level Governments (LLG) in coastal areas of Gulf Province were visited by the survey team between August 2015 and November 2015. The survey was primarily targeted at coastal communities within 1 km and 5 km from the coastline because of the fact that most inland communities have no direct access to fishing trawlers.

Study Design

A proportional sampling effort was employed in this survey because communities have different population groups and engagement with trawlers depended on distance from the coastline. Given this approach, enumerators were able to fill more questionnaires in communities that are actively involved in bycatch utilization and fewer respondents were interviewed in less active (further inland) areas.

Study Instruments/Questionnaires

The collection of socio-economic information was done using guided interviews for the 21 coastal communities and questionnaires for trawl boat crew and government officers. Survey questions were formulated in English for boat crew and technical officers while guided questions for community consultation was conveyed in Pidgin (national language) and local dialect where appropriate. Interpreters and local guides were used to translate interviews at village meetings in some instances.

The questionnaires comprised two main areas of information needs. Firstly we collected information on individual's bio-data and social standing in terms of education and household economy. Secondly, we precisely targeted respondents' views on prawn resource management, bycatch utilization, contact with trawlers and dependence on discard/bycatch resource.

Each questionnaire was accompanied by introductory remarks on purpose of the exercise and respondents' rights to certain privacy in terms of direct and indirect answers to culturally-sensitive questions. Free, prior, and informed consent (FPIC) of respondents were sought either collectively or individually before the interviews commenced in each village.

Table 4 gives a summary of types of questionnaire distributed, type of target group and the actual number of guided questions filled by enumerators for each category/ target group.

TABLE 4
Summary of question type, target group and number of questions for each thematic area

Thematic areas	Topics covered	Target respondents	Number of questions
Bio-data/Social	Age, marital status, education level, number of children	All	12
Economic	Income level, bycatch utilization information, number of trips to boat trawlers	Bycatch sellers/ buyers	8
Opinion on GoPPF	Management rules, trawler crew behavior, bycatch distribution, participation in prawn industry	All	5
Other information	Assistance from local authorities, suggestions on industry management issues	All	6

Sample Size Selection

Table 5 provides population and household data for the three LLG areas of this survey comparing difference between the 2000 census and 2011 census (2011 Census is current data since the next census is scheduled for 2021). Data from the last census show 3 133 households from central Kerema LLG of which 92 individuals representing their household were interviewed giving coverage of about 3 percent of total households. For East Kerema there were 2 191 households and this survey interviewed 98 individuals representing their household giving coverage of 4 percent of the total. Kerema urban on the other hand recorded a coverage of 12 percent of total households covered with the lowest household of 776 out of the three LLG area. A total of 21 communities were visited with a total output of 281 completed questionnaire sets from the target of 300 (96 percent coverage) (Table 6).

Overall we have covered 5 percent of total households in the three LLG, which is a fair sample size considering the fact that total households in each LLG include those communities who are located away from the coast and have no direct link to marine resource use. Total trawl boat crew stands between 170 and 180 (across all 15 permitted vessels); hence, 18 interviewed crew represents a sample size of 10 percent while 24 government and technical officers filled out responses from the 50 questionnaire sets distributed.

TABLE 5
National Census data for the LLG's visited in this survey

Survey site population by districts and LLGs–2000 and 2011 CENSUS											
		2000 Census				2011 Census/ current data				% of Province total	Average household size (2011)
		Households	Persons	Males	Females	House-holds	Persons	Males	Females		
	GULF Province	18 004	106 898	55 529	51 369	25 819	158 197	81 814	76 383	100.0	6.1
	KEREMA District	11 616	65 498	34 031	31 467	18 009	107 231	56 002	51 229	67.8	6.0
1	Central Kerema rural	2 254	12 864	6 706	6 158	3 133	16 609	8 803	7 806	10.5	5.3
2	East Kerema rural	1 932	11 479	5 994	5 485	2 191	13 134	6 961	6 173	8.3	6.0
3	Kerema urban	776	5 124	2 673	2 451	890	5 885	3 060	2 825	3.7	6.6

Source: NSO,2011.

Although 21 communities within the target area are covered in the survey, most respondents tend to have similar views towards issues and questions raised. As expected, those communities closest to the coastline have direct contact to prawn trawlers with differing responses from those further from the coast and less exposure

to trawlers. The latter group posed a more conservative and radical view of limiting/ restricting trawlers while those in direct contact with trawlers express need to have trawlers within waters for regular bycatch supply.

TABLE 6
Actual allocation of questionnaires against completed sets

Target Group	Total Allocated Questionnaire	Actual Questionnaires completed/returned	% Turnover	Total Questionnaires
East Kerema LLG	100	98	98%	281
Central Kerema LLG	100	92	92%	
Kerema Urban LLG	100	97	97%	
Trawl Boat Crew	50	24	50%	24
Government officials	50	18	36%	18
				323 (81%)

Most populated LLG is Central Kerema with a total population of 16 609 persons (46 percent females) while Kerema urban has only 5 885 people with an average household size of 6.6 persons per household. The 21 communities visited thus far represented 281 respondents which is equivalent to 0.26 percent of the entire district population. Moreover the figures represent a fair share of the coastal community covering some 5 percent of coastal community with disregard to the inland populace.

Data Collection

Approach

Given the scope and magnitude of the target project area it was imperative that appropriate community and stakeholder consultative methodology is applied to determine qualitative and quantitative data collection. In order to obtain this rapidly, participatory methods of data collection such as RRA (Rapid Rural Appraisal) and PRA (Participatory Rural Appraisal) were employed through:

- Stakeholder meeting, key informant interview
- Personal conversation, face-to-face meeting and community discussion
- On Site reconnaissance/ observation (photographic imaging)
- Trawler onboard inspection and crew interview.
- Market survey (Kerema town and Malalaua town including roadsides)

In addition, prior to conducting the survey, a pre-test was conducted and changes were made to the questionnaires, where appropriate. These community entry methods employed for specific target respondent group is listed in Table 7.

TABLE 7
Community entry method and data collection approach

Data collection approach - (Community entry method) - Rapid rural appraisal and participatory rapid appraisal		
Method	**Target respondents/groups**	**Observations/comments**
Public gathering	Coastal community/villages	Effective when few people are willing to participate
Organized woman's or youth group discussion	Coastal community/villages	Community gatherings occurred when elders got involved in organizing
Key informant interview	Community leaders, LLG workers, government officials, boat crew	Done on a one on one basis. Boat crew and Government officers were given questionnaires to be filled and returned in their own time
Market Survey		Random guided questionnaire interview
Onsite inspection, observation (Photographic)	Villages, trawler boats, urban market	Physical observation on board trawlers
Household survey	Bycatch sellers, buyers and general public.	Coastal community visits also included household survey

Enumerators

The team of survey enumerators was selected from Gulf Provincial fisheries and East Kerema LLG Fisheries staff based out of Malalaua and Kerema Township. Several NFA staff and associates from Port Moresby assisted in the survey with logistics and community liaising.

There was no specific criteria used to select the enumerators but the survey team leaders specifically opted for the fisheries officers within the province for the reasons that officers:

- have local knowledge;
- come in regular contact with coastal communities in their everyday line of duties;
- are well versed with issue, needs and general context of GoPPF;
- have sound educational level beyond college/university; and their
- availability for the exercise.

Enumerators' averaged in age group between 25-35, while all of them had educational level at college and above. The average number of years' experience in the fishery sector is at 15 years, the most senior officer had clocked 23 years of service while the youngest officer had spent just two years at the time of survey. Three females were involved in the survey and 11 males in both phases of the survey (14 in total).

The enumerators were given a day's session with survey team leaders to understand each question and what was required from them as important intermediary between respondent and target information gap. Through a group meeting, each enumerator was given time to trial the questions with 5 trial questionnaires filled in the first day in Malalaua and Kerema town. The responses were then analysed and issues faced discussed before the initial survey.

4. RESULTS AND DISCUSSION

Stakeholder analysis

Findings contained in this section and the analyses of data are predominantly taken from information extracted from the 281 respondents from 21 coastal communities/ villages within the target area (GoP). From this sample size, a fair share of 35 percent were female respondents and 65 percent were male. Almost 90 percent of the respondents were married while 7.5 percent were single and a further 2.5 percent were either divorced, separated or had lost a partner at the time of interview.

Further to the local coastal community stakeholder survey, the results and discussion also take into consideration views obtained from trawler boat crew (n=18) who were all males and government and technical officers within the Gulf province and fisheries industry. The latter stakeholder group had three female officers who were able to fill out questionnaires for the survey compared to 21 males. Table 8 provides additional information on the three stakeholder groups consulted in this survey.

TABLE 8
Additional information on the three stakeholder groups consulted

1. Respondents from 21 coastal communities (n=281)		% of Total
Male	183	65%
Female	98	35%
Married	249	89.3 %
Never married	21 (7 youths)	7.5 %
Divorced/separated	2	0.7%
Widow/widower	7	2.5%
2. Respondents from boat trawlers (n=18)		
Males	18	100%
Female	0	
Married	17	99.5%
Single/never married	1	0.5%
3. Respondents from government/Technical Officials (n=24)		
Male	21	88%
Female	3	12%
Married	19	79%
Single/never married	4	17%
Divorced/separated	1	4%

BOAT CREW (n=18), age range, church affiliation & years of work experience							
Age range (years)	Frequency/%		Church denomination	Frequency/%		Years of experience	Frequency/%	
20-24	2	11%	Catholic	2	11%	1-5	8	44%
25-29	4	22%	United Church	9	50%	6-10	4	22%
30-34	4	22%	Lutheran	1	6%	11-15	1	6%
35-39	2	11%	Pentecostal	1	6%	16-20	2	11%
40-44	2	11%	SDA	3	17%	21-25	1	6%
45 and above	4	22%	Non-Christian/other	2	11%	26 and above	2	11%

Technical and Government Officials (n=24): Age distribution, church affiliation & years of work experience							
Age range (years)	Frequency/%		Church denomination	Frequency/%		Years of experience	Frequency/%	
20-24	3	13%	Catholic	4	17%	1-5	9	38%
25-29	6	25%	United church	10	42%	6-10	4	17%
30-34	4	17%	Lutheran	3	12%	11-15	5	21%
35-39	6	25%	Pentecostal	2	8%	16-20	3	12%
40-44	3	12%	SDA	5	21%	21-25	2	8%
45 and above	2	8%	Non-Christian/other	0	0	26 and above	1	4%

Persons per household

The average (mean) number of people living within a household in the 21 coastal communities was 7.2, +/- 2.2 SD (standard deviation). This value is calculated from the 281 respondents of which the most occurring persons per household had a frequency of 42 respondents with 6 persons living together (Table 9). The highest number of people living in a household is 18, a respondent from Siviri village near the fringes of Kerema town (Kerema Urban LLG). Head of this household is a retired public servant

over the age of 55 who has his three married children living with their spouse and children. It was noted that this respondent had the highest number of children at 11, of which 8 are unmarried.

The minimum person per household is 1, observed from a frequency of 16 respondents across all the three LLG. Interestingly a total of 76 respondents (27 percent) indicated the number of people in their household ranging from 9 to 18 which is high for unemployed fisherfolks to maintain in terms of daily expense. Half of people living in the household are dependents (adult children) of respondents or their grandchildren. This trend is typical in Melanesian community whereby extended family members live together as a single family unit. Only two respondents did not indicate the number of people living in their household most probably due to oversight by the enumerator in requesting for the information.

TABLE 9
Number of persons per household in the three LLG's

No. of Persons per household	Frequency (N=281)	No. of persons per household	Frequency (N=281)
Not indicated	2	11	15
1	2	12	13
2	11	13	4
3	20	14	0
4	21	15	3
5	39	16	2
6	42	17	3
7	31	18	1
8	28		
9	21		
10	14		

Age classes of respondents

Age and sex are central variables in all demographic and socio-economic analysis. Our survey findings indicate a slightly different scenario simply because the intent of the survey was to collect information from specific groups instead of random sampling. The focus was on community leaders, women folks and youths within coastal community who one way or the other may have been impacted by prawn fishery and bycatch utilization. As such, the survey questionnaire had a specific cutoff for respondents between 15 years and above.

Age range of 25-34 years old had the highest turn out from interviews with 25 percent responses while 35-44 years old made up 24 percent of respondents (Table 10). The two age groups represent active and able bodied age class in most communities. Given the nature of this survey, community leaders are elderly people who make decisions on fishing rights and land ownership issue, hence a sizable response of 18 percent were beyond the age of 55 years. Only one female from Uritai village did not indicate her age group as she could not remember when she was born.

Sex ratio

According to the 2011 national census, sex ratio for PNG was 108 males for every 100 females indicating that there were slightly more males than females. In terms of age distribution, 36 percent of people enumerated in PNG were below the age of 15 and 3 percent were above the age of 65 years (NSO, 2011). This denotes a growing fertile population that is going to grow exponentially into the future. In terms of sex ratio of respondents (N=281) within the target community, there were a total of 98 females and 183 males interviewed. Only one respondent from Kukipi village (East Kerema rural LLG) did not indicate the sex, an oversight by the enumerator. As such,

the survey team gauged views from 65 percent males and 35 percent females as a balance in opinion due to nature of interaction with trawlers and bycatch utilization being a shared responsibility. The task of going out to trawlers and acquiring bycatch as well as deciding family expenditure is male dominated; on the other hand, utilizing the acquired bycatch, cooking and re-selling is mostly done by women folks. In a typical Melanesian society, menfolks decide on land resource (including marine) use and determine level of participation. As such twice as much male responded to the consultative process. Women on the other hand had a fair share of participation (35 percent) simply because the survey team prioritized their approach to women knowing very well that they would have been overlooked by men if left to decide independently.

TABLE 10
Age group of respondents and frequency

Age group (years)	Respondent frequency (N=281)	% of total
15-24	31	11.2
25-34	70	24.9
35-44	67	23.5
45-54	63	22.4
55-64	48	17.1
Over 65	1	0.4
Not Indicated	1	0.4

Education level of coastal community respondents

Communities within the Gulf of Papua including the province as a whole are amongst the country's least developed in terms of education and related infrastructure. Nevertheless, this survey targeted communities along the coast which stretch beyond major service centers such as Kerema and Malalaua towns; as such respondents are expected to be less educated compared to similar surveys targeting urban towns and cities.

About 4 percent of total respondents (N=281) have no formal education, while 22 percent (61 respondents) had some form of schooling but did not complete grade 6 (Table 11). A good number of people within the target site have completed grade 6 or 8 with primary school certificate (43 percent) and at the same time can do some general reading and writing. Twenty percent of respondents finished high school and had some exposure to formal employment before going back into the village to settle permanently. The rest of survey respondents either went to technical education institutes (Polytech) or further at college level.

Notably only 3 respondents had a college diploma while only one had a university degree. This is not surprising as most educated citizens of each community like any other village in the country live and work outside of their home village, thus result is expected.

TABLE 11
Respondents' education level

Education level (Category 1-9)	Respondent frequency N=281)	% of total
No formal education	11	3.9
Below grade 6	61	21.7
Above grade 6 to grade 8	119	42.3
High sch certificate-year 10	57	20.3
Higher Sch Certificate-year 12	19	6.8
Technical/Vocational/Polytech	7	2.5
College Diploma	3	1.1
University graduate	1	0.4
Others	1	0.4
Not indicated	2	0.7

Access to education facility

All villages within the survey site have access to basic elementary schools (lower primary) within walking distance. The biggest issue confronting communities of the coast of GoP is access to Upper Primary school (grade 4 to grade 8) and High Schools/ Secondary School (grades 9-12). Upper primary schools are located further away from communities making transportation difficult for students let alone secondary schools. Seventy-two percent (72%) of respondents stated that facilities and availability of education infrastructure for their children to attain good education level is a major driver of high dropout rates for school-age children. For instance, heavy rainfall, flooded estuaries, and rough seas deter kids from commuting to and from higher grade schools which are at most times located in other villages some kilometers away.

There is only one secondary school in East Kerema (Malalaua Secondary School) and two secondary schools in Central Kerema (Kerema High School and Don Bosco Aramiri) that are meant to facilitate students graduating from more than 35 primary schools within the district. This is not encouraging at all and is considered a major reason for migration of students of Kerema District to Port Moresby. Several respondents also mentioned that teaching staff do not attend to the students fully during the course of the year as most teachers go off into Port Moresby for extended trips.

There are many impediments to education for GoP coastal community given the geographical location and resource limitations that contribute to social ills faced by students, which discourage them from progressing. These issues are not isolated though, as most communities in the country have similar impediments but Gulf province can improve as a whole given its proximity to the National Capital District (Port Moresby).

Christian church affiliation of community respondents

Faith-based organizations have contributed immensely to the development of PNG since the 1940s and continue to do so. Most health and education services are provided by church-run organizations. The social and economic wellbeing of most communities in PNG is supported by their affiliation with some Christian church denomination. In this exercise we decided to collect affiliations of respondents with each church group and the findings are consistent with 2011 national census on the same undertaken by NSO.

Most people within the survey villages attend United Church (42 percent), followed by Seventh Day Adventist (8 percent) and Roman Catholics (7 percent) (Table 12). Interestingly, 27 percent (75) of respondents did not indicate their church affiliation. Several reasons can be deduced from this: firstly, enumerators failed to ask respondents; secondly respondents do not attend church anymore as such cannot give a response, and finally respondents attend to churches not listed in the questionnaire. Nevertheless, according to the 2011 National Census report, most people in Gulf province attend to United Church (NSO, 2011) which is consistent with the findings of this survey. Seventh Day Adventists, Jehovah Witness, Lutherans, Baptist, Pentecostals and the Salvation Army make up balance of the respondents' church affiliation.

TABLE 12
Church affiliations of respondents

Christian church denomination	Frequency (N=281)	% of total
United church	117	41.6
Not indicated	75	26.7
Seventh Day Adventist	26	9.3
Roman Catholic	22	7.8
Jehova Witness	16	5.7
Pentecostals	18	6.4
Salvation Army	7	2.5

Income Sources within GoP coastal communities

Within the course of this survey the questionnaire designed was able to pick information on different source of income for the family unit and or the respondents' household income. This question was basically meant to determine level of sustenance for the respondents' family and their ability to pay for various services such as health, education, clothing and food.

The question required respondents to provide information on alternative income source within the informal sector small business(s) other than fishery. Respondents were given the opportunity to indicate the economic activity that they are always involved in daily to substantiate their income and meet daily needs in order of most common activity to the least. Table 13 provides a summary of responses to this question and comments on the last column help explain the type of micro-economic activity.

TABLE 13
Alternative source of income other than fishery respondents are actively involved

Alternative income source	% of engagements'	Comments
Betel nut and mustard trade	26	Betel nut provides almost three quarters of the province's rural populace income
Vegetable sales (gardening)	14	Most common only to communities further away from the coast
Baking and roadside sales	12	
Handcraft and weaving (mat, basket)	9	Dominant along East Kerema coastline
Trade store and boat fuel sales	10	Bycatch collectors and fishers are targeted by fuel sellers along the coas
Others-poultry, artifacts, piggery, retail and transport	21	Also any other one off activity other than full time employment
Subsistence livelihood	8	Live of what they produce, do engage in opportunistic income such as working in logging sites and village shops but not a major source of income throughout the year

The responses denoted that fish and fishery related income is a major source of sustenance of the community regardless of alternate livelihoods sources. However fish from bycatch and discards are considered opportunistic sources of income due to the reason that not many people have the ability to go out to prawn trawlers for trade (access to trawler boats is limited to those who can go out to sea and meet trawlers). Nevertheless, bycatch accounts for most of the fish sold at markets in Kerema town and villages as observed by the survey team.

Bycatch/Discards use and value

Most bycatch caught in the Gulf of Papua is usually discarded while some, apparently the most valuable ones, are fetched by locals on board trawlers and sold at the local village markets or in Kerema town. In other cases boat crew and fishing companies keep those bycatch that are high value finfish and process them into blocks of frozen packs and exported to overseas markets at various prices. Several respondents stated that at times, the bycatch are dumped into the water and washed ashore at their beachfronts. This mostly occur during the early hours of the morning, especially when the trawlers are fishing within 3-nautical mile zone of customary waters when locals are asleep. A community leader from Keakea village stated that the smell from the discarded fish is at times unbearable when washed to the shore, closer to villages.

According to NFA (2012) the value of catch/bycatch including trash fish ranges from K3-5 per kg (USD 1 - USD 2) depending on the species. Most bycatch finfish of reasonable sizes are collected from the deck, placed on trays, frozen and then packed and brought to port and sold domestically at prices ranging from K3-5 per kilogram

(NFA, 2012). Majority of coastal community respondents stated that they often purchase or exchange frozen or blocked fish trays with garden vegetables and fruits or purchase with cash ranging from K50 - K70 (USD 13 - USD 23). Some notable high value bycatch is exported overseas at US$ 3.00 per kilo according to respondents from the trawler boats. The utilization of bycatch, including trash fish, is done by locals who are able to go on-board the trawlers to obtain edible bycatch for consumption or sale at the local markets. Currently no bycatch is utilized for animal feed and pellets but the potential is there in the future with increasing aquaculture development activities taking place in the country.

Importance of bycatch to locals in terms of food security is immense. The low-income earners in urban areas, especially Kerema town, utilize bycatch as food to supplement their protein and for cash. In Kerema town alone, individual women and men who sell bycatch fish can earn between K100-K400 per week (USD$ 25-USD$ 100) as demonstrated by survey findings (see Table 14). This however is not the same in terms of market in local villages and door-to-door sales of bycatch in communities as the prices decrease between K50 and K20 per week.

TABLE 14
Weekly income of coastal community respondents from bycatch sales/utilization

Income range from bycatch sales per week	Frequency of respondents (N=281)	% of total
Above 301 Kina (above USD 99)	1	0.4
201-300 Kina (USD 66-99)	22	7.8
101-200 Kina (USD 33-66)	21	7.5
51-100 Kina (USD 17-33)	68	24.2
20-50 Kina (USD 7-16)	105	37.4
Consumption Only	64	22.8

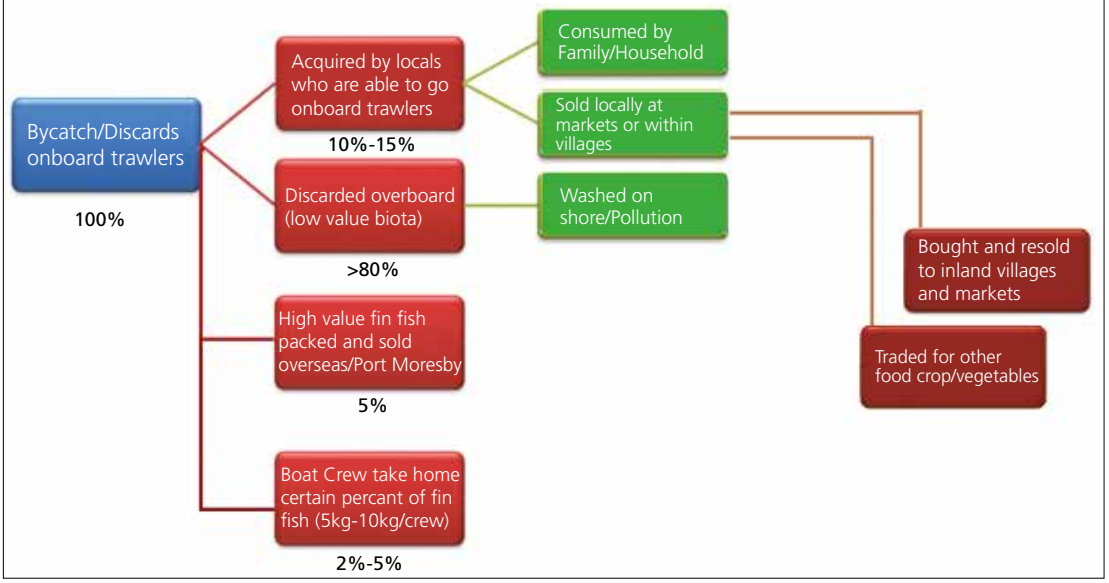
Note: 1 PNG Kina= USD 0.33 (February 2016). This rate is used throughout the report.

Majority of locals and provincial fisheries officers interviewed stated that most bycatch contain many species of no monetary value but high conservation value. Capture of juveniles and larger species (including turtles, sharks, rays, eels and snakes) is prominent with every haul comprising over 80 percent of catch. In fact, approximately 65-85 percent of the trawl catch by weight is made up of bycatch (Evans *et al.,* 1995; Liviko 2012). These juveniles of non-finfish bycatch are discarded into the sea while larger non-finfish and finfish are collected on-board by the community whenever trawler boats come within accessible range. Given the inability of most coastal communities to come out to sea and meet the trawl boats, most of this high value finfish is brought to Port Moresby and sold by boat crew members.

Crew on board trawlers are given between 10 Kg to 50 Kg to take home depending on their position on deck. In other words, captains and engineers take larger share while deckhands and cookies take lower value per trip. This arrangement is recognised under the licensing rules and requirements enforced by NFA on fishing companies' terms and conditions of employing local crew on its vessels. Figure 5 shows different distribution levels of bycatch from a typical haul or trip.

Trawler companies have license for prawn and/or lobster only but often take other high value bycatch for export, something that the GoPPF management plan can accommodate in its review process. This is confirmed by senior provincial officials as well as local fisheries officer, who have had to accept the fact that enforcement of such regulation is non-existent when resources are not adequate for intensive surveillance and enforcement.

FIGURE 5
Value chain of distribution of bycatch



Species composition of discards/bycatch

Table 15 denotes average percentage of marine biota that is retrieved on board as trash fish or bycatch. From this table we see that pony fish, sardines/herrings, anchovies and reef finfish are the most dominant species consisting of 7 percent to 20 percent of the 90 percent bycatch per haul.

TABLE 15
Bycatch species and percentage composition per haul

Bycatch/discards common name	Family	% per haul	Bycatch/discards common name	Family	% per haul
Batfishes *(Plataxspp)*	*Epphidae*	2	Seasnake	*Hydrophiidae*	2
Bullseyes, bigeyes, glasseyes	*Priacanthidae*	2	Stingrays	*Batoidae*	2
Crestfish, oarfish, dealfish, ribbonfish	*Regalecidae*	2	Jewfish	*Sciaenidae*	3
Goatfish	*Mullidae*	4	Anchovies *(Thryssa)*	*Engraulididae*	10
Groupers nei *(Epinephelus spp)*	*Serranidae*	1	Ponyfish	*Leiognathidae*	15
Mackrels nei	*Scombridae*	2	Hairtails	*Trichiuridae*	2
Black pomfret such as Parastromateus niger	*Carangidae*	1	Grunters	*Theraponidae*	3
Porcupine/pineapple fishes	*Diodontidae*	2	Catfish	*Arridae*	3
Seaperches, snappers, sweetlips, redemperor	*Lutjanidae*	7	Tonguesoles	*Cynoglossidae*	2
Sharks	*Carachidae*	2	Pufferfish	*Tetraodontidae*	1
Seasnake	*Hydrophiidae*	2	Threadfinsalmon	*Polynemidae*	2
Stingrays	*Batoidae*	2	Lizardfish	*Synodontidae*	2
Jewfish	*Sciaenidae*	3	Butterflybream	*Nemipteridae*	2
Anchovies *(Thryssa)*	*Engraulididae*	10	Trevallies	*Carangidae*	2
Ponyfish	*Leiognathidae*	15	Sardines/herrings		20
Slipper lobsters or bugs *(Thenus spp)*	*Scyllaridae*	1	Squid	*Architeuthidae*	2
Tropical or saucer bugs *(Amusium spp)*	*Pectinidae*	1	Others (shells, crustaceans, seasnakes, rays, turtles etc.)	various	13

Source: NFA, 2012

Stakeholder views of enforcement, monitoring and surveillance policing

Community consultative process proves that other species of commercial value such as tuna, lobster and various reef fish species are also caught besides the target prawn species. Several provincial fisheries officers from Gulf Province protested that most trawlers are given license to harvest prawns exclusively and no other species, as such there is a need for stringent monitoring by NFA and provincial fisheries monitoring officers as stipulated under the Fisheries Management Act 1998. Currently the provincial fisheries office lacks resources, funding, equipment and technology to perform their mandated roles and functions as stewards of the fishery resource within the province. Also noted is the obvious lack of communication and cohesive coordination of work between national, provincial and district fisheries agencies for prudent monitoring and implementation of fishery management plans. Hence the provincial officers interviewed identified greater need for strengthened administrative power to implement management measures and discipline prawn trawlers that breach license specifications and management regulations habitually.

Breaching of GoP prawn fishery management rules by trawlers is an occasional cause for concern amongst all stakeholders within the GoPPF area. Respondents also stated that there are signs of discarding of bycatch overboard by trawlers within or near village shores. Physical observation from survey teams on board a trawler confirmed the same. There are incidents where villagers experienced foul smell from discarded fishes and onshore landing of tonnes of discarded fish from trawlers during high tides. Most of these illegal activities occur at night and within the no-fishing area reserved for resource owners (within 3 miles off the beach). About 25 respondents indicated that they have witnessed trawler vessels within the 3 mile no take zone at some point in time. Fishing vessels have on board turtle excluder device (TED) and bycatch reduction device (BRD) gears but they are intentionally not used effectively. Given all these constraints and issues, this study has identified the need for a more prudent enforcement of management and surveillance efforts by all parties concerned with sustainable fishing in the GoP area.

Gulf Provincial Fisheries Development initiatives

Administrative leaders and stakeholders of the fishing sector in Gulf province initiated a new direction to have community and the province at large benefit from its marine resource by hatching a localized management plan for fisheries. Stakeholders including NFA, Forum Fisheries Agency (FFA), Tourism Promotion Authority and Provincial officers developed through a weeklong workshop in consultation with community and resource owners a five year fisheries plan in 2015. The outcome of this plan culminated to what is now called *"Gulf Provincial Fisheries Development Plan, 2016-2020"*. This document can be accessed from NFA head office, or the fisheries section in Gulf Provincial Administration.

Basically the major objective and purpose of the plan according to the vision statement is to:

"Actively involve individuals and communities through co-operation and partnership to sustainably manage and develop fisheries for economic development and wealth creation to improve living standards and marine resource sustainability of Gulf people"

In summary, the plan is framed in the context of rich fisheries resources the province has (especially shrimp and reef fish), the strength and weaknesses of social, cultural and economic settings of the people and the opportunities, threats, challenges and issues emanating from hydrocarbon development projects within the province.

Unfortunately, the plan lacks concrete steps to attain the objective in terms of resource and financial implementation. The prawn industry is controlled by vessels and businesses owned by foreign companies trading in partnership with individuals from other provinces and Gulf province has been missing out on direct involvement. The

plan does recognize this missing link but does not provide steps to tap into the prawn industry either as a government or assist small to medium enterprises (SMEs) to have a fair stake in prawn trade.

The second missing link in the plan is its inability to recognize gender and the importance of women in the fishing industry at the domestic level. Women play a big role in fishing, selling, cleaning and utilizing bycatch; however the emphasis on assisting womenfolk is not stated clearly.

Generally on the positive side, the plan is a good initiative to have a roadmap to develop the fisheries sector from its current abysmal stage. Gulf of Papua Prawn Fisheries nets an estimated K18 million annually and as such communities of the coastal fishery area need to tap into this resource and have a fair stake in economic output annually.

Role of women

Fishing is a major contributor to household livelihoods in PNG as it is in the GoP region apart from cash crop farming. While in some societies it is mainly men who fish, in others including the Gulf province both men and women participate. Men have larger average annual catch rates than women, because they are more likely to be engaged in fishing for income, to specialize in fishing, and to spend time away targeting more distant and promising habitats. Because women have more household responsibilities, they are more likely to fish for the family meal, and to stop when they have enough to feed their family, and share with relatives and neighbors. Both men and women sell catches, fresh from roadside coolers, smoked for markets, and in 'takeaway' forms as prepared meals. Women work in marketing fish at all levels, from roadside markets to the main town markets. Men also take part in selling but to a lesser extent compared to women.

Findings of this survey is consistent with roles of men and women in almost all major maritime societies with the country. Information gathering process gave prominence toward views of womenfolk in the target communities by involving female enumerators as well as directing specific questions to womenfolk. Responses to guided questionnaire interview and focus group discussion shows 35 percent representation from women and girls while 65 percent of male folks participated toward overall outcome of the survey. One of the main reasons why males dominated the sessions was the fact that communities are led and organized by men folk than women. Given the nature of such interviews males are head of households and in most cases took up the task of responding to questionnaire more frequently. We also note that Gulf province like most communities in Melanesia are male dominated and women are only allowed free speech when specifically requested.

In this survey, the enumerators and survey team requested specifically to interview women who are actively involved in fishing; thus the turnout of 97 female respondents from a total of 281. It has been therefore noted that women:

- constitute an important aspect of labor in fishing traditionally (however in this aspect the process of accessing bycatch from prawn trawlers is mostly male oriented given the difficult task of travelling out to sea to meet trawlers);
- do most of fish food preparation and marketing at local markets;
- combine roles of food garden tending and undertake fresh water and marine fishery for household consumption. This includes collecting shells mud crabs, and other fringe marine biota;
- work without paid salary in fishing sector unlike other provinces whereby there are fish canning and processing plants that employ more women than men (such as Madang and Lae);

- do not have a big say in expenditure of family income from fishing as most of the income they generate from fishing is mutually decided by male partners. This however does not mean women are not spending what they earn from fish selling; the expenditure is often for family use rather than for self despite occasional misuse by menfolk.

5. CONCLUSION AND RECOMMENDATIONS

Conclusion

Communities of the GoP have long been in contact with prawn trawlers and have associated with the prawn fishery industry since 1969. The level of participation is something outside the scope of this study but findings from this survey indicate that there is much to be desired in terms of impact on livelihood of coastal communities either directly or indirectly from this resource. The annual export earnings ranging from K5 million to K18 million kina (USD 1.5 million to USD 4.5 million) can be a catalyst to social and economic advancement of the coastal people.

As observed in this study, there are a total of 25 819 households in Gulf Province of which 18 009 households are within Kerema District. Furthermore 107 231 people live in Kerema district which comprise 79 percent of the province's total population. In this survey, 281 individuals from coastal communities were interviewed in addition to other stakeholder respondents. It therefore can be deduced that the 21 coastal communities covered in this survey have similar responses to questions posed but differing interest in fishery (bycatch utilization opinion) due to proximity of their village to the coast.

Most respondents have an average of 6 children while the respondents' income level is at less than K20-K50 per week from fishing (105 respondents; 38 percent). A good portion (44 respondents) earn between K200 and K300 weekly (about USD 66 to USD 99) from bycatch utilization thus the potential is there for others to maximize. Only one respondent earns between K300 and K400 (USD 132) weekly; however this respondent had the advantage of support from family unit who utilize their boats and invest in fuel to acquire bycatch from trawlers out in the open sea.

Individuals in communities along the coast have education level below grades 10 completion and a sizable percentage of 43 percent of the respondents have reached only grade 8 (Upper Primary School) so far. This is attributed to distance from higher education institutions apart from the elementary schools that are located in every village. Thirty-five percent of women folks in this survey have shown much desire for further involvement in fishing opportunity but to date there are no programs and initiative to assist women. There is a total gender imbalance in business opportunity in that more women do household chores than those that involve in small to medium enterprise.

Interviews with provincial administration staff and community have pointed to a conservative approach to the fishery but level of participation in resource utilization is still lacking. The GOPPF industry needs a holistic review at the national and provincial level to incorporate changes that might allow participation of coastal communities fully. Social and economic wellbeing potential is there, demonstrated by the level of income generated through bycatch utilization but the management approach of the prawn industry does not support local involvement as it is.

Several areas of deficiency noted during the survey in terms of opportunity for women is similar to womenfolk in other coastal province. Most opportunity for women's economic improvement is minimal or non-existent. Women in the GoP lack holistic support from fisheries officials both nationally and locally. This is due to the fact that most women are not accessing financial assistance from various government and donor grants to take part in small to medium enterprise (SME). Almost all of the women interviewed (100 percent) have no experience of accessing loan and donor

funding for fishing related business. Opportunity is there for women to be trained in terms of aquaculture and business skills upgrade but there is so much to be desired in terms of initiatives from local development leaders to this effect.

Recommendations

Initial assessment of socio-economic situation of the GoP Prawn Fishery resource sites demonstrate that there is opportunity for community progress but current management regimes do not encourage such. The level of participation in bycatch utilization is determined by certain factors, some of which include: "distance of village to the coast", "contact with prawn trawlers and crew by individuals", ability of individuals to meet the cost of transport using motorized boats to meet trawlers at sea" and many other associated factors. These impediments disassociate most individuals from actively utilising bycatch for economic gain and consumption. It is almost a niche market for those who are able to acquire bycatch and discards from trawlers (an opportunistic business so to speak).

Given this scenario the study was able to determine level of participation, income, social standing of each respondent and ability of respondents to partake in bycatch utilization. Furthermore local officials were able to provide insights into how they perceived the prawn industry to operate given current management regimes.

From this analysis the following recommendations are outlined to help further the understanding of the social and economic context of GoP communities and their involvement in prawn industry thus far:

- a thorough review of GoPPF Management plan to accommodate participation of locals in fishery business through public-private partnership;
- consolidated and a holistic program to be devised by the Gulf Provincial government and partner agency (such as NFA) to assist women in fisheries business such as SME assistance. This can be done through micro-financing initiatives in partnership with trawlers or processers.
- devise a separate study or enquiry to list and determine environmental impacts to coastal marine ecosystem from logging, mineral exploration and other extractive industry operations upstream other than extensive fishing.
- fisheries officer within the province to be empowered and obtain resources that will assist them to enforce management rules on trawlers traversing the 3 nautical mile no-take zone. Also the ban period seem to be ignored by certain operators; hence, officers to be resourced to strictly implement ban periods. This can be achieved through a partnership arrangement with local community leaders who can be equally resourced.
- selected individuals from communities along the GoP coastline to be utilized as fisheries observers during trawling season.
- undertake in-depth/further study into household income strictly focused on marine resource in comparison to other income sources of coastal communities of GoP to determine food security and sustainability of marine resources.

6. LIMITATIONS OF THE STUDY

There are several factors that affect the way this study has been carried out; however the factors are mostly associated with localized issues that do not have a one off solution. Firstly interview questionnaires distributed to trawler crew did not return favorably as expected (18 returned from 50 distributed). This is a common problem faced in such study where enumerator does not provide guided interview.

Gulf of Papua is a vast area that the survey team cannot reach within the given timeframe. Large rivers, swamps and rough seas impede progress of the study in terms of coverage. Communities closest to the coastline are able to access trawlers for bycatch; hence their view on management issue differ from those who live away

from the coast. Comparing the two sets of views is not appropriate due to the fact that discards and bycatch do not have economic impact on communities away from the coast apart from it being a source of protein when bought at the market/roadside.

Enumerators overlooked certain questions when they are rushing with time or when confronted with possibility of rain and threat from local drunks who occasionally approach the survey team. Finally a stakeholder workshop or round table consultation is needed to complete information gathering process as planned but this is yet to be done before the final report is produced.

One of the major problems in the survey was that the actual number of respondents expected to be covered could not be achieved due to impossible access to some coastal communities given time and resources. Transportation challenges, rough weather including rough seas, logistic issues and communication problems had impeded the survey target communities in one way or another. Nevertheless a total of 281 questionnaires were filled out of the 300 targeted (95 percent) for GoP coastal community, 18 out of 50 vessel crew were interviewed (45 percent), and 22 government officials. Overall given the challenges a substantial portion of stakeholders within the Gulf province and its coastal communities were consulted in this exercise.

REFERENCES

Evans C.R, Opnai J.L & Kare B.D. 1995. *Research and management of the industrial prawn fishery of the Gulf of Papua. South Pacific Commission SPC/FAA workshop on the management of South Pacific inshore fisheries.* Noumea, New Caledonia. SPC/Inshore Fish. Mgmt./BP 28. 1 (65); pp-1-32.

Liviko I. 2012. *Gulf of Papua Status Report. REBYC-II CTI.* FAO/GEF Regional Workshop on Work Planning – Year 1 REBYC-II CTI, 6-9 November 2012, Bangkok, Thailand.

Matsuoka T. (1995). Fisheries development policy and education in Papua New Guinea. *South Pacific Study 15(2)*: 75-96.

National Fisheries Authority of Papua New Guinea Website http://www.fisheries.gov.pg/FisheriesIndustry/TunaFishery/tabid/104/Default.aspx

NSO (National Statistics Office). 2011. *2011 Census Final Report.* NSO, Port Moresby.

NFA. 1995. *National Report on by-catch management and reduction of discards.* NFA, Port Moresby.

NFA. 2002. *Information on fisheries management in Papua New Guinea.* NFA Port Moresby.

NFA. 2012. *Information on fisheries management in Papua New Guinea. NFA,* Port Moresby.

Pernetta J. C and Hill L. 1981. A review of marine resource use in coastal Papua. *Journal de la Société des Océanistes*, 37(72-73): 175-191.. doi :10.3406/jso.1981.3059. accessed via<http://www.persee.fr/doc/jso_0300-953x_1981_num_37_72_3059>

Socio-economic study of trawl fisheries in Samar Sea, Philippines

Rafael V. Ramiscal
Supervising Aquaculturist
Bureau of Fisheries and Aquatic Resources, Philippines

Jonathan O. Dickson
Chief Aquaculturist
Bureau of Fisheries and Aquatic Resources, Philippines

Napoleon Salvador J. Lamarca
Aquaculturist II
Bureau of Fisheries and Aquatic Resources, Philippines

Efren V. Hilario
Aquaculturist II
Bureau of Fisheries and Aquatic Resources, Philippines

Ronnie O. Romero
Aquaculturist 1
National Fisheries Research and Development Institute, Philippines

ABSTRACT

Samar Sea is one of the major fishing grounds in Northwestern Samar with abundant pelagic and demersal fishery resources. In order to manage the area holistically, the Alliance of Local Government Units in Samar Sea planned to manage the fishery resources collectively using the concept of Ecosystem Approach to Fisheries Management (EAFM). However, the absence of socio-economic data as baseline for assessing and monitoring socio-economic impacts of proposed management actions is one of the important missing information. Therefore, a socio-economic study of trawl fisheries in the Samar Sea was conducted to gather baseline information for the formulation, implementation, monitoring and evaluation purposes of the proposed fishery management measures and contribute to the Samar Sea Fisheries Management Plan (SSFMP) to address its impact on affected fisherfolks.

The socio-economic survey covered both commercial trawls (fish and shrimp trawls) and smaller-scale municipal trawls (shrimp and squid trawls) with a total of 517 respondents and examined age composition, participation of female fishers, and education. Majority of the respondents were male (99 percent in commercial fish trawls and 92.5 percent in commercial shrimp trawls). Most of the fishermen were between 25 to 44 years of age. In general, fishers' education was inadequate with many only with elementary level education. Most respondents were not members of any organization but those that were listed as part of an organization were members of fisherfolk association, which is the most common type. Extended families exist among the respondents. In all types of trawling households, both commercial and municipal, the son, daughter and wife are the primary household members who stay with the respondents.

Fishing was the most dominant source of livelihood of household members. Farming, teaching, carpentry, overseas work, fish processing, aquaculture, livestock rearing, fish brokering and ancillary fishing related occupations were among the household members' livelihood sources. Access to credit is very low and correspond with the low membership in associations. There is a need for training on basic safety at sea, as in general very minimal life-saving equipment and materials are onboard.

The municipal trawler with a 10-16 hp engine seems to be operate more profitably than the municipal trawler with an 80 hp engine, considering operational costs vs. net profit derived from their operations as well as the income for fishermen.

ACKNOWLEDGEMENTS

The authors would like to extend their sincere gratitude to all of those who have toiled and shared their experiences and knowledge in making this paper possible. Specifically, the authors would like to thank Atty. Asis G. Perez, Undersecretary for Fisheries of the Department of Agriculture and concurrent BFAR Director. Gratitude is likewise given to Director Drusila Esther E. Bayate, Interim Executive Director of the NFRDI and concurrent BFAR Assistant Director for Technical Services, to Director Juan D. Albaladejo, BFAR Regional Office No. 8, Mr. Rolando Ay-ay, PFO-Samar and to Hon. Ronaldo P. Aquino, Calbayog City Mayor.

Acknowledgement is further given to the Project Technical Working Group namely Dr. Norberto T. Berida, Mr. Juan Meniano, Mr. Marcos Sabido, Ms. Angelica Realino, Ret. Col. Esteban Conchas, Mr. Cecilio Talagon, Ms. Maridel Bulawit, Mr. Daniel Daguman, Mr. Rodolfo Ybañez, Mr. Dionisio Balili and Mr. Apolinario Catarus.

To Dr. Susana Siar, Food and Agriculture Organization of the United Nations; Mr. Rick Gregory, RFU, Mr. Isara Chanrakij and Ms. Thanyalak Suasi, SEAFDEC/TD, Prof. Renato Diocton and Prof. Jesus Racuyal of SSU and to all enumerators who helped in data collection and analysis, thank you.

Most of all, the authors would like to thank their families for their inspiration and moral support and to those who, in one way or another have helped this paper a success.

ACRONYMS

BFAR	Bureau of Fisheries and Aquatic Resources
BoatR	Municipal Fishing Boat Registration
CPUE	catch per unit effort
CTI	Coral Triangle Initiative
CY	calendar year
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DTI	Department of Trade and Industry
EAFM	Ecosystems Approach to Fisheries Management
EO	Executive Order
FAO	Fisheries Administrative Order
FARMC	Fisheries and Aquatic Resources Management Council
FELIS	Fishing Vessels Electronic Licensing System
FR	footrope
GSI	gonado-somatic index
GT	gross tons
HP	horsepower
HR	headrope
IFARMC	Integrated Fisheries and Aquatic Resources Management Council
JTED	juvenile and trashfish excluder device
LGU	local government unit
MARINA	Maritime Industry Authority
MTE	mid-term evalaution
NFRDI	National Fisheries Research and Development Institute
NGO	non-government organization
NMFDC	National Marine Fisheries Development Center
NSO	National Statistics Office
PA	polyamide
PE	polyethylene
PHP	Philippine Peso
PSA	Philippine Statistics Authority
RA	Republic Act
REBYC	Reduction of Environmental Impacts from Tropical Shrimp Trawling through the Introduction of Bycatch Reduction Technology and change of Management
RFU	Regional Facilitation Unit
SEAFDEC	Southeast Asian Fisheries Development Center
SSFMP	Samar Sea Fisheries Management Plan
TWG	Technical Working Group

I. INTRODUCTION

The REBYC-II CTI "Strategies for Trawl Fisheries Bycatch Management" project aims to contribute to more sustainable use of fisheries resources and healthier marine ecosystems in the Coral Triangle and Southeast Asia waters by reducing bycatch, discards and fishing impacts by trawl fisheries. The project assumes that this can be achieved through the implementation of trawl fisheries bycatch management plans in each pilot site in the five participating countries namely: Thailand, Viet Nam, Indonesia, the Philippines and Papua New Guinea. The pilot project site in the Philippines is Samar Sea and a Samar Sea Fisheries Management Plan (SSFMP) is being developed under the project.

The importance of socio-economic data and information cannot be over-emphasized in planning, implementation, monitoring and evaluation of the SSFMP. Understanding the mechanism and dynamics between biophysical, socio-economic as well as cultural and political realities are critical to rationalize and implement practical strategies in managing a complex environment like the Samar Sea. To date, socio-economic details including relevant gender information have not been readily accessible.

Furthermore, in the project mid-term evaluation (MTE) report, it was noted that little effort had been given so far to crucial socio-economic data collection to understand the role of trawl fisheries, the role of bycatch, and implications of management measures on income, employment, livelihoods and food security. It was also concluded that gender had not been adequately addressed in the project, neither in the design, nor during implementation.

It is recognized that the socio-economic aspects of fisheries are important components in the formulation of the SSFMP to take into account the human well-being component of the Ecosystem Approach to Fisheries Management (EAFM) as it impacts on the fisheries of Samar Sea.

Objectives of the study:

The study aimed to:

a) Generate baseline information on the demography and socio-economic condition of Samar Sea trawl fisheries sector as indicator for monitoring and evaluation of proposed fishery management measures; and
b) Determine potential impact of the Samar Sea Fishery Management Plan (SSFMP) and provide measures to address its impact on affected fishers.

II. OVERVIEW OF MARINE CAPTURE FISHERIES

1. BRIEF DESCRIPTION

a) Administrative Classification

Capture fisheries in the Philippines is administratively divided according to the vessel's gross tonnage. As defined under Republic Act (RA) 8550, otherwise known as the Philippine Fisheries Code of 1998 and as amended by RA 10654, commercial fisheries include all fishing operations that use vessels of over 3.1 gross tons (GT). Municipal fisheries, on the other hand, involves the use of vessels of 3 GT or less as well as fishing operations that do not use fishing boats (Ramiscal and Dickson, 2010).

Under the Philippines National law, commercial fishing is further sub-classified according to the following:

a) Small scale commercial fishing - fishing with passive or active gear utilizing fishing vessels of 3.1 gross tons (GT) up to twenty (20) GT;
b) Medium scale commercial fishing - fishing utilizing active gears and vessels of 20.1 GT up to one hundred fifty (150) GT; and
c) Large scale commercial fishing - fishing utilizing active gears and vessels of more than one hundred fifty (150) GT.

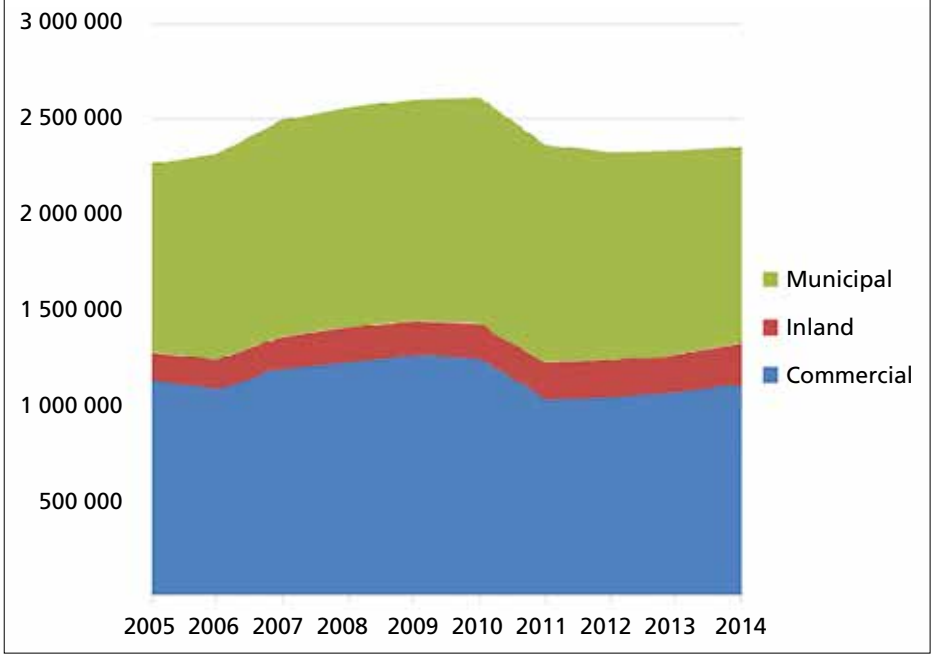
Municipal fisheries roughly translate to traditional, artisanal, subsistence or small-scale fisheries while the commercial fisheries corresponds to the industrial or large-scale type fisheries.

b) Production

Overall, commercial capture fisheries provided the most significant contribution (Figure 1) to fisheries production in the Phillipines with 47 percent while municipal capture contributed 44 percent. Inland fisheries contributed 9 percent of the total produce (Philippine Statistics Authority, PSA).

Total production slightly increased from CY 2005 till 2008 reaching the highest in 2009. It was however observed to slightly decrease from thereon until 2012 and again slightly increase in 2013 till 2014.

FIGURE 1
Fisheries production (in tonnes) in the Philippines in 2005-2014 (Philippine Statistics Authority)



c) Fishing fleet

As of May 2016, commercial fishing fleet comprised of 3 483 catcher vessels that are licensed by the Bureau of Fisheries and Aquatic Resources (BFAR). However, considering the unofficial list from various organizations and local government units, there are more than the official number as many vessels remain unregistered. Major commercial fishing gears used are ring net, trawl, handline, purse seine, bag net and longline. Trawl is used by about 14 percent of the total number of registered commercial fishing vessels (Table 1).

In order to facilitate municipal fishing boat registration, BoatR was launched by BFAR in 2015 to obtain a more realistic inventory of fishing boats in the country. As of May 2016, there are a total of 178 000 registered municipal fishing boats in the Philippines. The most common fishing gears used in municipal fisheries are hook-and-line, gillnets, cast nets, traps/pots, beach seine and fish corral.

TABLE 1
Number of registered commercial fishing boats in the Philippines

Fishing gears	Type			Grand total
	Large	Medium	Small	
Ring net		348	429	777
Trawl		156	338	494
Handline		128	229	357
Sardine/mackerel/scad purse seine	58	221	15	294
Tuna purse seine	86	64	3	153
Bag net	1	28	103	132
Longline	24	23	68	115
Push net		9	39	48
Beach/drag seine	1	14	20	35
Gill net		6	22	28
Paaling/drive - in net	18	8	1	27
Round haul seine	1		1	2
Others	31	435	545	1 011
Grand Total	**220**	**1 440**	**1 813**	**3 473**

Source: Bureau of Fisheries and Aquatic Resources- Fishing Vessels Electronic Licensing System (BFAR- FELIS).

d) Employment

The fisheries sector provides employment to 1 614 368 fishing operators nationwide, 85 percent (1 371 676) of which are from the municipal fisheries and 1 percent (16 497) from the commercial sector. The aquaculture sector employed 14 percent (226 195 operators) (NSO, 2005).

2. THE TRAWL FISHERIES INDUSTRY

Following the general administrative classification of fishing boats based on the size of the vessel, trawling boats are correspondingly classified as municipal and commercial.

a) Municipal trawlers

Municipal trawlers are fishing boats that are 3 gross tons or less and are made of wooden dugout. Popularly called as "*banca*," they commonly measure about 5 to 12 meters long, powered by inboard gasoline engines and fishing is manually operated. The smallest trawler is referred to as *mini-trawl* and is a simple dugout powered by 10 hp or smaller engine and is usually used to catch sergestid shrimps (*Acetes*) and anchovy. It is operated by 1 to 2 fishermen. On the other hand, *baby trawl* is an outriggered banca propelled by 10-16 horsepower gasoline or diesel engine and operation also requires 1 to 2 crew. These boats are small and categorized as municipal fishing boats. Operation is limited in shallow and nearshore areas with short fishing trips normally leaving late in the afternoon and returning the following morning.

Many trawlers considered as municipal are however under-measured or inaccurately classified with actual size exceeding 3 gross tons, thus actually qualifying as small commercial trawlers. These boats are more than 12 meters powered by 80-130 horsepower 'marinized' truck (diesel) engines and operated by 2-5 fishermen. Short daily trips are also usually done. However, trips lasting more than one day are also common as they are able to reach more distant fishing grounds.

b) Commercial

Trawling using more than 3 gross ton boats are classified as commercial and is further classified as 1) small-commercial (3.1 to 20 GT); 2) medium-commercial (20.1 to 150 GT; and, 3) large-commercial type (>150 GT). The over-all length usually exceeds

12 meters and boats are driven by 80-500 horsepower engines. In general, the boats are mechanized where winches and pulleys are rigged for hauling. Fishing trips lasting 2-4 days are common but shorter trips are also done in areas when target fishing grounds are close to fish ports or fish landing centers. Fish finders are common on medium-commercial boats and some take on 5-7 days fishing trips.

c) Gear designs

Two basic trawl net designs are employed depending on the target catch. The V-type net is a low-opening trawl that is intended to principally catch shrimp. The German two-seam type (Herman Engel) trawl is widely used to catch squid, sergestid shrimp and anchovy and high opening fish trawl to catch not only demersal but also small-pelagic fishes. Boats commonly change gear types depending on the area of operation and target species.

The size of net used is related to the size or power of the boat. For example for a baby trawler using 10 hp gasoline engine, the typical head rope (HR) of the V-type net measures 4-6 m and the foot rope (FR) 7-10 m; for boats powered by 80 hp engine, 11-18 m HR and 16-25 m FR. High-opening net used by medium commercial trawler measures 30-32 m HR and 35-39 FR.

d) The trawl fleet

Trawling has been in use in the Philippines since the early part of 20th century and were popularized after the Second World War when American surplus marine engines were readily available (Umali, 1950; Thomas, 1999). Exploratory surveys in the 1950s demonstrated the potential of trawling in the country and it became widespread by the 1960's (Thomas, 1999). In 1967, 600 commercial trawling units were reported to be in operation (Encina, 1976). By the early 1980s, the number increased to about 700 to 900 units that peaked in 1983 when the total number of registered vessels was 932 boats (BFAR Fisheries Statistics, 1981-1988).

Meanwhile, the expansion of commercial trawlers subsequently effected adoption in smaller boats. Locally called as "baby trawl" outriggered boats powered by 10-16 horsepower engines use small nets that are dragged in the shallow coastal area to catch shrimps. This also evolved into the larger outriggered trawler boats fitted with surplus diesel (truck) engines of about 80 horsepower to fish in the deeper portions of the bays and gulfs. Because of the size of the boats, baby trawls are classified as municipal while larger version of outriggered bancas are also commonly classified as municipal. However, the size of the boats are in fact more than 3 gross tons making them as small commercial vessels. While these municipal trawls are evidently widespread in bays, gulfs and coastal areas, their actual number has generally been indeterminate, much less registered or licensed.

Declining catch, at the same time increasing cost of operations mainly by the increase in the price of fuel oil, conflicts with other users and restrictions resulted in the decline of the commercial fleet (Armada, 2004; Thomas, 1999). By 1997, the registered trawlers numbered 445 units and further reduced to 398 units a decade later (2007). It was, however, noticeable in major trawl fishing grounds that many commercial trawlers continue to operate but remain unregistered and unlicensed.

The decrease in the number of trawlers was replaced with the gear that similarly catches demersal species. The local Danish seine is a modified version of the original Danish seine in the northern regions of Europe by using heavy "tom" weight to close the scare lines. Registered commercial modified Danish seine in 1988 was only 59 units that increased to 672 vessels in 2007. Similar situation is also apparent in municipal boats in many coastal areas.

e) Trawl fishing grounds

Trawl fishing is conducted in relatively flat, muddy/sandy bottom and in shallow to moderate depths usually not exceeding 100-150 meters along coastal areas, bays, gulfs and inlets. The major trawl fishing grounds in the Philippines are Samar Sea, Visayan Sea, San Miguel Bay, Lingayen Gulf, Ragay Gulf, Carigara Bay, Guimaras Strait and Manila Bay.

Despite the consequent closure of the greater parts of these major trawl-fishing areas due to the expansion of municipal waters to 15 km, trawlers have persisted and maintained their uncontrolled operations in these areas. While there has been a decline in the officially registered and licensed commercial trawlers in recent years, the actual number of operating vessels is perhaps higher considering that many have remained unregistered/unlicensed. This same situation is more apparent in the municipal fisheries sector.

f) Fishes caught and status of stocks

Major fish species landed are roundscads, Indian sardine, frigate tuna, bigeye scad, fimbriated sardines, slipmouths, squids, anchovies, eastern little tuna and Indian mackerel. Small pelagics (scads, sardines, herrings, mackerels, small tunas) and demersal fish stocks are considered overfished and exploited beyond MSY levels (Dalzell *et al.,* 1987; Zaragoza *et al.,* 2004; Barut *et al.,* 2004; Armada, 2004).

Overfishing brought about by increased number of fishers and the general open access to fisheries is common to both municipal and commercial fisheries. Commercial fishing boats continued operations in municipal waters and the use of destructive fishing methods (i.e., dynamite, cyanide fishing and the use of fine mesh net fishing gear) have also contributed to the rapid decline of fish stocks and habitat degradation.

g) National policy framework

Fisheries policy and regulatory framework are primarily founded on three important legislations – the Fisheries Code of 1998 (Republic Act 8550) as amended by RA 10654, the Local Government Code of 1991 (RA 7160), and the Agriculture and Fisheries Modernization Act of 1997 (RA 8435).

The Fisheries Code of 1998 sets out the general framework for managing the country's fisheries sector with the BFAR as leading government agency responsible for conservation and management of fishery resources beyond municipal waters.

The Local Government Code of 1991 provides the local government units (municipal and city governments) the jurisdiction and responsibility to manage the fisheries within their jurisdiction (municipal waters – 15 km from the shoreline). It also grants preferential use of municipal waters to municipal or small-scale fisherfolks. Within the structure of RA 8550 and RA 7160, local fisheries ordinances for the management of municipal waters in accordance with the National Fisheries Policy mainly provides rules and regulations on licensing, issuance of permits and other fisheries related activities. These ordinances prohibit commercial and active fishing gears in their respective jurisdictional waters.

The Agriculture and Fisheries Modernization Act of 1997 sets out measures to modernize the fisheries sector particularly through credit and extension.

In addition, Executive Orders that provide rules for marine coastal environment protection include:

- E.O. 305 (2004) devolving the municipal and city governments the registration of fishing vessels 3 gross tons or below;
- E.O. 240 (1995) creating the Fisheries and Aquatic Resource Management Councils (FARMCs) in barangays (villages), cities and municipalities and their composition.

According to the Local Government Code of 1991 and as reiterated in the Fisheries Code of 1998, fisheries management and regulation of municipal waters are devolved to the Local Government Units (LGUs). The LGUs are the municipal/city governments, which are under the Department of Interior and Local Government (DILG). The LGUs in consultation with the FARMC enact ordinances in accordance with the national fisheries policy set out by the Fisheries Code. Such ordinances are reviewed by the Sanggunian Panlalawigan (Provincial level council) pursuant to Republic Act No. 7160. The LGUs also enforce all fishery laws, rules and regulations as well as valid fishery ordinances enacted by the municipality/city council.

The LGUs however, through its local chief executive and appropriate ordinance, may authorize or permit small and medium commercial fishing vessels to operate within the 10.1 to 15 kilometer area from the shoreline in municipal waters with certain conditions.

The Fisheries and Aquatic Resources Management Councils (FARMCs) are established at the national and local (municipalities/cities) levels. The organization and formulation of FARMCs undergo the process of consultation among LGUs, non-government organizations (NGOs), fisherfolk, and other concerned people's organizations. The National Fisheries and Aquatic Resources Management Council (NFARMC) comprising of representatives of stakeholders is the advisory/recommendatory body at the national level.

In contiguous fishing grounds and fishery resources such as bays and gulfs, which straddle several municipalities, cities or provinces, the Integrated Fisheries and Aquatic Resources Management Councils (IFARMCs) are also created to recommend the enactment of integrated fishery ordinances and assist in the preparation of the Integrated Fishery Development Plan and enforcement of fishery laws, rules and regulation. The LGUs sharing or bordering such resources may group themselves and coordinate with each other to achieve the objectives of integrated fishery resource management.

Besides BFAR, other government agencies that are mandated to implement relevant management or conservation of aquatic resources are the Department of Environment and Natural Resources (DENR), which has jurisdiction on habitats, protected areas, endangered species and biodiversity, the Department of Trade and Industry (DTI) that regulates fisheries business, and the Maritime Industry Authority (MARINA) on the regulation of fishing vessels.

3. OVERVIEW OF SAMAR SEA FISHERIES

Samar Sea is located in the province of Samar, Region 8 in Eastern Visayas Region. The province is divided into two (2) congressional districts that comprise of two (2) cities and twenty four (24) municipalities of which the majority are coastal cities/municipalities. Samar Sea has an estimated area of about 198 km^2. This fishing ground is muddy to sandy bottom and relatively shallow with prevailing depth of less than 50 meters. Deeper areas of less than 100 meters are located towards the northern portion.

a) The trawl fleet

Samar Sea is one of the most important fishing grounds for both municipal and commercial trawls. In 2007, baby trawl was the 3rd most dominant among municipal gear (23 percent) next to bottom set gillnet and shrimp gillnet. It was also the second in terms of catch rate after ring net. Other important municipal gears are the modified Danish seine and ring nets.

According to the rapid survey conducted in selected Samar Sea areas as part of the activities under REBYC-II CTI in 2014, there are 73 small commercial trawlers, 66 large municipal and 266 baby trawlers.

b) Stock assessment

Studies in Samar Sea had been focused on assessment of demersal stocks. The otter trawler (Theodore N. Gill survey) averaged 42 kg/hr of marketable fish with the highest yield of 112 kg/hr at 20 fathom (37 m) contour. The resources consisted of cutlass fish, turbots, nemipterids, lizardfish, crevalles (jacks) and insignificant amount of shrimp (Warfel and Manacop, 1950). By 1979-80, the biomass from trawl surveys conducted by the University of the Philippines was 1.56-1.88 t/km^2 (Saeger, 1981) which was well below the accepted tolerable level of 3 t/km^2. Average daily catch also reduced from 30 kg/day in the 1960s to 8 kg/day in 1981, and to 3.5 kg/day in 1991 (Saeger, 1993).

The average municipal landing of shrimp trawls for the period 1992-1995 was about 812.25 tonnes/year (Mines, 1995). This implies that each shrimp trawl landed about 40 tonnes/year on the average or 0.33 tonnes/month (15.2 kg/day). During the survey, seven species of shrimps belonging to three genera, *i.e., Penaeus, Metapenaeus* and *Trachypenaeus sp.* were identified of high commercial value. *Penaeus merguiensis* locally known as "puti" was the most abundant and dominant landing among the genus Penaeus. The catch per unit effort (CPUE) of 1.39 kg/haul for this species was already at a low level. Other penaeid shrimps identified were the *Penaeus semiculcatus* (bulik), *P. latisulcatus* (tigbason), *P. monodon* (lukon), *Metapenaeus ensis* (guludan), *Metapenaeus endeavouri* and *Trachypenaeus fulvus* (bangkigan).

The bycatch of demersal finfishes consisted of 7.35 percent of the total catch. These include common slipmouth (sap-sap), common whiting (aso-os), goat fish (ti-ao), sole fish (palad), threadfin bream (sagisi-on), eel (obod), cardinal fish (moong), goby (manloloho), lizard fish (alho), soldier fish (baga-baga), grouper (tingag), theraponids (bagaong), mojarras (baisa), flathead (sunog), black pomfret (sandatan), carangids and *Carangoides malabaricus*. The bycatch is usually used for food consumption by the fishers and operator. However, there is also a large portion of bycatch as small sizes of finfishes and fishers call them as "rejects" (also called trash fish, which are basically juvenile and immature finfishes) which comprised about 39 percent of the total catch. Though widely used among fishers, "rejects" is not officially used, thus is not reflected in national statistics for fisheries.

In general, the state of the demersal fish stocks in the Philippines including Samar Sea is generally considered overfished (Barut *et al.,* 2004). Various trawl surveys indicated declining biomass primarily due to excessive fishing. Declining catch rates and major changes in species composition, particularly increase in squids, shrimps, anchovies and herrings and declines of large commercially valuable species like snappers, sea catfish and Spanish mackerels are also indicative of overfishing in major trawl fishing grounds like San Miguel Bay, Lingayen Gulf, Visayan Sea and Manila Bay (Barut *et al.,* 2004; Armada, 2004; Green *et al.,* 2004).

The more recent survey conducted by MV DA-BFAR using a high opening trawl in Samar Sea indicated a biomass of about 2.88 t/km^2 and the catch belonging to 107 genera. While the biomass of Samar Sea was observed to be somewhat higher than Visayan Sea (2.4 t/km^2), it is however noticeable that the number of genera has declined in Samar Sea and diversity is comparatively inferior in contrast to the high diversity observed in Visayan Sea (DA-NSAP, 2013).

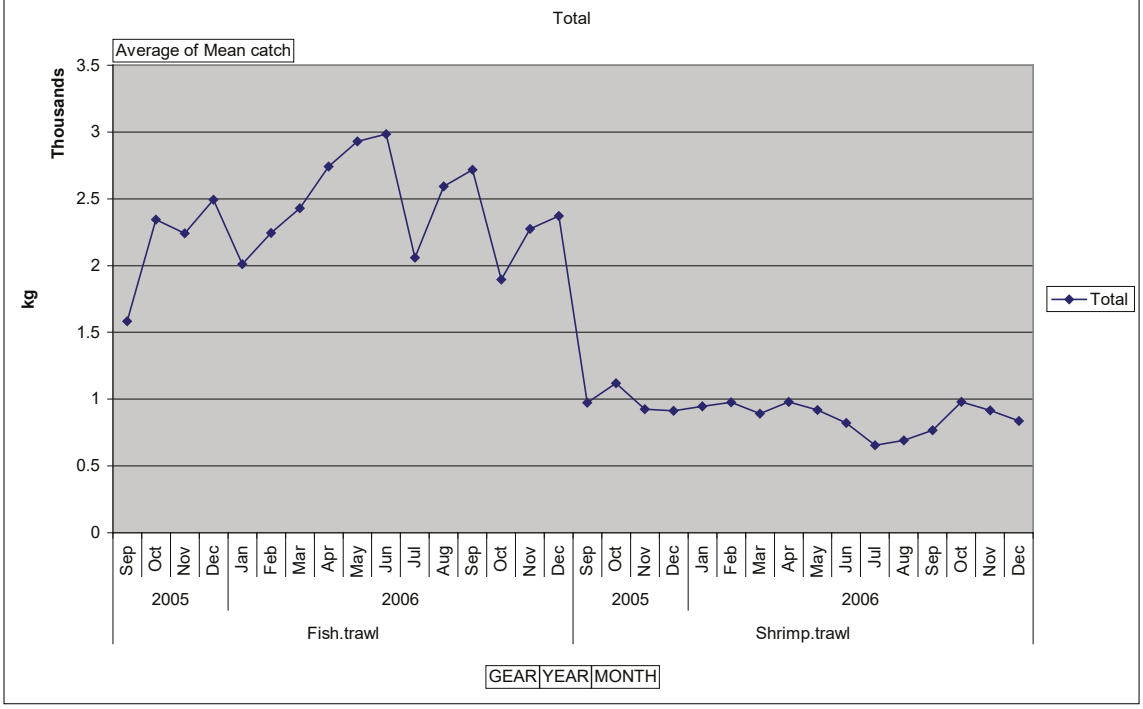
Most recently under the REBYC-II CTI Project, the estimated biomass based on the landing of shrimp trawl was about 2.1 t/km^2.

c) Catch of juveniles and trashfish

The pilot implementation of the Juvenile and Trashfish Excluder Device (JTED) in Calbayog City provided comprehensive information on the catch of trawlers operating in Samar Sea (Dickson *et al.,* 2008). For the period September 2005 to December 2006, the local fleet of 18 trawlers based in the City landed a total catch of 1 289 tons of fish

from 991 fishing trips. Moreover, the average catch per unit effort (CPUE) for shrimp trawl was just below 1 ton (0.94 tons) per 2 days (3 nights) fishing trip while CPUE for fish trawl was 2.4 tons per fishing trip in the same period. For shrimp trawl, peak months were indicated in the month of October and lean in July-August. For fish trawl, lowest mean catch was observed in September and highest in June (Figure 2).

FIGURE 2
Catch-per-unit-effort (CPUE) for shrimp and fish trawl, Samar Sea, 2005-2006



d) Spawning of commercial species

The spawning months of major commercially important species was determined based on 5-point maturity scale and through determination of the species Gonado Somatic Index (GSI) (Dickson, *et al.*, 2008) and ichthyoplankton survey conducted by the Samar State University–College of Fisheries and Marine Science (SSU-CFMS) under the REBYC-II CTI project.

Meanwhile, the ichthyoplankton study provides reference to spawning months based on relative densities of fish eggs and larvae over the monthly period of the survey.

Based on the above methods, the spawning months of major commercially important species was indicated to mainly occur during the months of April, May, July and August (Table 2).

TABLE 2
Spawning months of selected commercial species

Species	J	F	M	A	M	J	J	A	S	O	N	D
Bisugo *(Nemipterus spp.)*								1,2				
Kalaso *(Saurida sp.)*												
Saramulyete *(Upeneus sp.)*							1,2			1		
Tambong *(Leiognathus equulus)*							2					
Baga-baga *(Priancatnhus spp.)*							2					
Lawayan *(Leiognathus)*												2
Agumaa *(Rastralliger faughni)*				1, 2	1							
Galunggong *(Decapterus spp.)*												1, 2
Hairtail				2	2							
Hasa-hasa *(Rastrelliger brachysoma)*					2							
Alumahan, Burao *(Rastrelliger kanagurta)*				2	2	2						
Matambaka *(Selar crumenopthalus)*							2					

Legend:
1 Results of study during REBYC 1, 2005-2006
2 Results of assessment conducted by SSU, 2013-2014

Month of high proportion of matured (stage IV-V)
Anticipated high occurrence of juvenile

e) Coral reef status

Survey of 19 sites with an estimated total area covered of 8 500 m^2 was conducted under the REBYC-II CTI Project. Overall estimated average coral cover was about 30 percent with estimated fish density of 0.43 fish/m^2. Based on local knowledge, destruction of corals can be attributed to human activities including various forms of destructive fishing.

Areas of relatively better coral cover were observed in Tagapul-an Tarangnan, Canhawan goti, (Catbalogan), Tigdaranaw Goti Is. (Tarangnan) and Cabilosan Is. (Almagro) (Table 3).

TABLE 3
Estimated coral cover and fish density in selected sites, 2013-2014

Municipality	Site	Total area (ha)	Transect area (m^2)	Coral cover (%)	Est. fish density (fish/m^2)
Almagro	Poblacion	5	500	15.0	0.0
Almagro	BgyMalobago	6	500	25.0	1.0
Almagro	Cabilosan Is. (lighthouse)	40	500	35.0	0.7
Calbayog	Salhag Point		250	30.0	0.2
Calbayog	Punta Tinambacan	-	250	30.0	0.2
Calbayog	Tinambacan reef	-	250	25.0	0.1
Calbayog	Malajog point	-	250	15.0	0.2
Catbalogan	Lutao reef	10	500	25.0	0.3
Catbalogan	Sampotan Island	9	500	30.0	0.8
Catbalogan	Canhawan Goti Is	2	500	45.0	0.6
Tagapul-an	Bgy Lipot baybay	6	500	45.0	0.4
Tagapul-an	Bgy Labang baybay	6	500	35.0	0.3
Tagapul-an	Bgy Baquiw	4	500	40.0	0.4
Tagapul-an	Bgy Sugod	-	500	45.0	0.0
Sto Nino	Bgy Baras	4	500	25.0	0.9
Sto Nino	Ilijan Cove, BgyIlijan	10	500	20.0	0.6
Tarangnan	Libucan dacu	6	500	30.0	0.5
Tarangnan	SitioBaras, Bgy. Rama	2	500	15.0	0.2
Tarangnan	Tigdaranaw Goti Is.	18	500	40.0	1.1

Source: REBYC II-CTI Project Critical Habitat Survey, 2013-2014.

4. HISTORICAL ACCOUNT ON FISHING EFFORT

While the Local Government Units (LGUs) have variable accounts on the number of fisherfolk and fishing boats as part of the Fisheries Profile, there is no record on the types of gear. The dominant active fishing gear in Samar Sea was mini-otter trawlers used in the municipal waters of Zumarraga, Catbalogan, Daram and Tarangnan and in some cases encroached into shallower waters of Maqueda Bay in the municipalities of San Sebastian, Jiabong, Calbiga, Pinabacdao and Villareal. They were operated year round to target highly priced penaeid shrimps/prawns, blue crabs, squids and octopus.

a) Fishing Fleet (Boats and Gears) Inventory

Inventory on fishing boats and gears in Samar Sea as Pilot Project Site of REBYC-II CTI was developed in 2013 with the participation of the 11 LGUs.

The total number of fishing boats was 10 938 of which 59 percent were motorized and 31 percent non-motorized. The majority of the municipal fishing boats were from Daram, Tarangnan and Calbayog while commercial-sized fishing boats were observed only in Calbayog, Catbalogan, Daram, Zumarraga and Tagapul-an.

There were more than 24 types of municipal gears with a total of 13 875 units. The dominant gears were bottom set gillnet (*palubog*, 24.6 percent), simple handline (*kawil*, 10 percent), bottom set longline (*kitang*, 9 percent), crab pot (panggal, 9 percent), multiple handline (*undak*, 8 percent) and crab gillnet (*pang-alimasag*, 7.4 percent). Municipal fishing gears considered as active were baby trawl, ringnet, pushnet, bagnet and modified Danish seine; they were about 9 percent of the total.

There are 96 units composed of three (3) types of commercial fishing boats in Samar Sea. Trawl (*shrimp and fish*) was the most common comprising 42 percent, ringnet 40 percent and modified Danish Seine (*Pahulbot*) 19 percent.

In general, hook & line and trap/pot fishing operate on motorized or non-motorized bancas with about 0.2 GT and 0.7 GT, respectively. Common engines in motorized banca ranged 5-7 hp gasoline engines. Larger motorized bancas powered by 14-16 hp gasoline engines are used for gillnet fishing.

Commercial boats averaged 12 GT, powered by 150 hp Mitsubishi 6D15 automotive diesel engine.

TABLE 4
Inventory of fishing boats and gears by municipality, Samar Sea, 2013

City/ Municipality	No. of boats (Motorized)	No. of boats (Non-Motorized)	Total boats	Municipal																													Commercial				
				Beach seine	Fish corral	Squid Pot (Panggal pusit)	Crab Pot (Bintol, Panggal)	Fish pot/traps	Bottom set gillnet (palunod, palubog)	Drift gillnet (Barangayan, kurantay)	Encircling Gillnet (warlog)	Crab Entangling Net	Shrimp Entangling net (pamasayan)	Trammel Net (Tribol)	Hook & Line (kawil)	Bottom Set Longline (Kitang)	Multiple Hook & line (Undak)	Troll Line (Subid, Tapsay, lambo, Rambo, pahawin)	Spear fishing (Pamana)	Modified Danish Seine (hulbot)	Squid jig (Sanit)	Lift net (paarak, Sarap-sarap)	Ringnet (Ligkop, tambogan, likos)	Bagnet (basnig)	Baby Trawl	Push net	Others	Total	Modified Danish Seine	Ringnet	Bottom Trawl	Total
Almagro	684	131	815					0	37	2						248	424	49	32		123						915				0
Calbayog	879	486	1 365		51			348	425	131					408	271			132				60	2	15	99		1 942	10	7	17	34
Catbalogan	663	336	999			15	1 102	15	210			129	126		235	78			77	94	124		4		61			2 270		14	6	20
Daram	1 196	1 256	2 452				68	32	947		45	95	26	406	199	39	106		4	125		1	67		157			2 317	8	7	17	32
Gandara	194	62	256		56			64	102							48											270				0
Pagsanghan	67	191	258		117		20	99	166						80	18											500				0
Sta Margarita	178	58	236				2	1	71	5		47	41			45									53	41	11	317				0
Sto Nino	366	82	448				3	8	115	6						38	235	50	10			21	6			8	500				0
Tagapul-an	300	471	771	2				0	68	16					153	82	404	285	91								1 101		4		4
Tarangnan	1 194	702	1 896		5	42	3	79	763		109	557	43	32	328	225					25				319	2	2 532				0
Zumarraga	703	739	1 442	2				62	518			202		51		169			22	22			15		148		1 211		6		6
TOTAL	**6 424**	**4 514**	**10 938**	**4**	**229**	**57**	**1 198**	**708**	**3 422**	**160**	**154**	**1 030**	**236**	**489**	**1 403**	**1 261**	**1 169**	**384**	**368**	**241**	**272**	**22**	**152**	**2**	**753**	**142**	**19**	**13 875**	**18**	**38**	**40**	**96**

b) Major ports and landing sites

Major fishing ports for commercial trawlers operating in Samar Sea are located in the cities of Calbayog and Catbalogan. Landing sites for municipal boats are in their respective villages and communities.

III. METHODOLOGY

1. PREPARATORY ACTIVITIES

Socio-economic information of the fisheries in the pilot area is not readily accessible. To address this issue, a workshop on participatory approaches and socio-economic and gender mainstreaming was organized on 12-18 November 2014 at Catbalogan City, Western Samar. The workshop was one of the major national activities in preparation for the formulation of the Samar Sea Fisheries Management Plan (SSFMP). The workshop was aimed at providing the participants with understanding and appreciation of how socio-economic and gender information could be utilized in the management plan development process. City/Municipal Agriculturists/Planning Officers of the eleven (11) Local Government Units (LGUs) under the Alliance of Local Government Units bordering Samar Sea attended the activity.

Other participants came from the academe, Bureau of Fisheries and Aquatic Resources (BFAR) Regional Office 8, National Fisheries Research and Development Institute (NFRDI), the National Marine Fisheries Development Center (NMFDC), BFAR Central Office, the Provincial Government of Western Samar, the REBYC-II CTI Technical Working Group (TWG) and representatives from the postharvest, fish traders, and the municipal and commercial fisheries sectors.

As an output of the Workshop, two sets of interview guides were prepared, namely: Trawl Fisheries Socio-economic Interview Guide and the Socio-economic Interview Guide for Other Fisheries (Annex 1 & 2). These were developed through working group sessions that were guided by the following questions: (1) What is the contribution of trawl fisheries to livelihoods? (2) What is the contribution of trawl fisheries to food security and nutrition? (3) What are the markets for the trawl fisheries products? and (4) What are the costs associated with trawl fishing and how does the cost structure compare with the returns?

The two guides were translated to the local "Waray" language by key stakeholders and the project TWG. After the formulation, role playing where two of the participants acted as the interviewer and the other the interviewee was conducted to obtain initial reaction with regards to the survey guide. Thereafter, these were field tested in Barangay Estaka, Catbalogan City, a fishing village where trawl operators and other fishing gear operators reside. Field testing was initiated to determine and improve the questions and address other difficulties in the interview guides. After the pre-test, the participants in the workshop analyzed and presented the information collected, and the guides were revised according to their comments and suggestions.

Prior to the actual survey, another workshop attended by key stakeholders and Project TWG was conducted to determine the target list and distribution of respondents for the socio-economic surveys in the 11 local governments units from the Alliance of LGUs in Samar Sea. It was agreed that at least 10 percent of operators of each fishing gear type are to be interviewed. With regards to the socio-economic part, the list and distribution of respondents was drawn randomly based on the inventory of fishing boats and gears conducted in 2013. There were no agreed certain number of crews and boat owners to be interviewed, rather it depended on who would be available during the survey.

The surveys for the socio-economics of trawl and other fishing gears were administered by the Municipal Agriculturists/Fishery Technicians and members of the TWG REBYC-II CTI Project in the 11 coastal municipalities who are members of the Alliance of LGUs bordering the pilot project area. The 11 municipalities were Calbayog, Catbalogan, Sta. Margarita, Tarangnan, Almagro, Pangsanghan, Daram, Zumarraga, Gandara, Sto. Nino, and Tagapul-an, all located in Western Samar. These municipalities border the Samar Sea pilot area with about 167 km^2 (Figure 4).

FIGURE 4
Map of Samar Sea and the 11 local government units (LGUs) covered by the survey

2. SURVEY GUIDE AND DATA ANALYSIS

The survey guides were drafted and prepared by the Project Technical Working Group and key stakeholders with technical backstopping from FAO-Rome and REBYC-II RFU.

The survey guide, with translation to the local "Waray" language, contains four (4) major parts. The first part tackles the demographic profile such as personal information of respondents, educational attainment, household information, source of livelihood, membership in organization and availment/access to credits and extension services.

The guide also contains technical information such as the type of fishing gears used onboard, power and engine details, boat specifications, participation in fishing activities, catch and effort data, utilization of income generated from fishing, sharing system, fishing ground, etc.

Meanwhile, other data needed in cost and return analysis of trawl in Samar Sea was included while another part aimed to generate perception of respondents on the social and technical issues related to trawl fishery.

The trawl fisheries socio-economic survey was conducted from December 2014 - April 2015 while the survey on other fishing gears was held from May 2015 - June 2015.

Data analysis and a write-shop on the socio-economics of trawl and other fishing gears was conducted in Calbayog City, Samar from July 1-4, 2015 with technical backstopping from FAO Rome and the SEAFDEC, Training Department, Thailand. The write-shop aimed to share experiences and lessons learned during the data collection phase, consolidate and analyze results from the surveys, prepare an outline of the socio-economic and gender components, carry out analysis on the economic performance of trawls and other fishing gears, and prepare a draft of the socio-economic component of the SSFMP.

IV. RESULTS AND DISCUSSION

In the Trawl Fisheries Socio-economic survey, there were 517 respondents coming from the six (6) trawling municipalities of Calbayog, Catbalogan, Daram, Sta, Margarita, Tarangnan, and Zumarraga. The trawl fisheries target respondents were divided into municipal and commercial trawls, and respondents covered both crew and operators (Table 5).

TABLE 5
Distribution of respondents (trawl fishers) in commercial and municipal categories by municipality

Survey area	Com trawl		Com trawl total	Mun trawl		Mun trawl total	Grand Total
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
Calbayog City	28	23	51	9		9	60
Catbalogan City	27		27	60	2	62	89
Daram	1	1	2	112		112	114
Sta. Margarita	5	1	6	55		55	61
Tarangnan	15	4	19	115		115	134
Villareal	1		1				1
Zumarraga	14		14	44		44	58
Grand total	**91**	**29**	**120**	**395**	**2**	**397**	**517**
Percentage	**75.8**	**24.2**	**100**	**99.5**	**0.5**	**100**	
Overall percentage	**17.6**	**5.6**	**23.2**	**76.4**	**0.4**	**76.8**	**100**

Majority of the respondents came from municipal trawl i.e. 77 percent while commercial trawl respondents were 23 percent. Out of the 120 respondents from commercial trawls, 76 percent were fish trawlers while 24 percent were shrimp trawlers. Meanwhile, majority of the 397 respondents from municipal trawls were shrimp trawlers with 99.5 percent and only 0.5 percent were squid trawl respondents.

1. DEMOGRAPHIC PROFILE

There were two types of trawl namely: commercial (fish and shrimp) and municipal (shrimp and squid) categories. Table 6 shows that respondents were mainly male (99 percent in commercial fish trawls and 92.5 percent in commercial shrimp trawls). For municipal shrimp trawls, only 1 percent of the respondents were females while squid trawling was an exclusively male occupation.

TABLE 6
Socio-demographic characteristics of trawlers in Samar Sea, Philippines

Category	Commercial trawl		Commercial trawl overall (%) (N=120)	Municipal trawl		Municipal trawl overall (%) (N=397)
	Fish (%) (N=93)	Shrimp (%) (N=27)		Shrimp (%) (N=395)	Squid (%) (N=2)	
Sex of respondent						
Female	1.3	2.5		1.0	0	
Male	98.7	92.5		99.0	100	
Age bracket						
15 to 24	19	18	18	5	0	5
25 to 34	29	33	30	19	50	19
35 to 44	27	20	24	36	0	36
45 to 54	19	20	19	23	0	23
55 to 64	5	5	5	14	50	14
65 and over	1	0	1	3	0	3
No response	0	5	2	0	0	0
Average age	**36**	**37**	**37**	**42**	**46**	**44**
Civil status						
Married	70.9	60.0	67.2	92.7	100.0	92.7
Single	25.3	35.0	28.6	5.6	0.0	5.5
Widow	0.0	0.0	0.00	0.5	0.0	0.5
Widower	3.8	0.0	2.5	0.5	0.0	0.5
No response	0.0	5.0	1.7	0.8	0.0	0.8
Total %	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Highest education attained						
Elementary level[1]	29.1	25.0	27.7	39.1	50.0	39.2
Elementary graduate	34.1	30.0	32.7	22.7	0.0	22.6
High school level[2]	13.9	20.0	15.9	17.4	50.0	17.5
High school graduate	13.9	2.5	10.0	10.8	0.0	10.8
Unspecified	1.2	7.5	3.3	4.5	0.0	4.5
College level[3]	3.8	5.0	4.2	3.0	0.0	3.0
College graduate	2.5	7.5	4.2	0.7	0.0	0.7
Vocational	0.00	2.5	0.8	0.7	0.0	0.7
Never attended school	1.2	0.0	0.8	0.7	0.0	0.7
Total%	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

[1] Have attended elementary but did not graduate.
[2] Have attended High School studies but did not graduate.
[3] Have attended College studies but did not graduate.

The relative age distribution of respondents from commercial and municipal trawlers are further shown in Table 6. Commercial trawlers have higher percentage of single respondents as they require heavier works aside from having to spend more fishing days onboard compared to municipal trawlers who are operating closer to the shore and on a daily basis. Likewise, these are apparent on their ages as older fishers are engaged in municipal trawls, with shrimp trawls are dominated by the age bracket 35-44 years. Half of squid trawl respondents were between 25-34 years, with the remaining 50 percent were found in the 55-64 years of age bracket.

A comparatively similar distribution was observed for commercial shrimp trawlers, with the highest proportion, (33 percent) of the fishers in the 25-34 years age bracket, 20 percent of the respondents were in the 35-44 years and 20 percent in the 45-54 years bracket. Relatively fewer fishers (17 percent of respondents) were engaged in shrimp trawling fishery at age 55 years or over. Respondents showed a higher average age in municipal trawl compared to commercial trawlers. This is expected as work onboard involves and requires heavier manual labor and longer fishing days.

Trawl fishers, similar to other types of fishers, were in general only educated to elementary level (37 percent). Only 17 percent studied but dropped out of high school and only 11 percent graduated. This was more pronounced in the municipal sector where about 39 percent did not even finish elementary education. With this background, it is understandable that the fishers have limited options and find it difficult to compete in other sectors, except in fishing, which they have been exposed to and engaged in for most of their lives. With the program of the government providing free elementary and high school education in public schools, they still find it hard to afford paying additional expenditures like miscellaneous and other daily expenses which, according to them is also difficult to sustain. The need to assist their parents in providing income to the family runs as their foremost obligation and is apparently reflected in the low educational attainment of the respondents.

The closeness of family ties in the Filipino culture was evident from the survey as it has proven that extended families exist among the respondents. In all types of trawls both commercial and municipal, son, daughter and wife are the primary household members who stay with the respondents. Moreover, father, mother, grandfather, grandmother, nieces, nephews and other relatives were the other household members identified by the respondents.

When interviewed on livelihood sources of household members, fishing was the most dominant response with 51 percent, followed by housekeeping with 10 percent and non-fishing related with 7.9 percent. Farming, teaching, carpentry, former overseas Filipino worker, fish processing, aquaculture, livestock rearing, fish brokering and ancillary fishing occupations were likewise identified as sources of livelihood by the household members.

TABLE 7
Membership of respondents in organizations

Organization	Commmercial (com) trawl		Com trawl total	Municipal (mun) trawl		Mun trawl total	Grand total
	Fish	Shrimp		Shrimp	Squid		
Homeowner's association	0	0	0	0.5	0	0.5	0.3
Religious association	2.5	2.5	2.5	1.2	0	1.2	1.5
Fisheries and aquatic resources management council (farmc)	2.5	0	1.6	2.2	0	2.2	2.1
Barangay council	1.2	2.5	1.6	5.8	0	5.7	4.8
Fisherfolk association	8.8	22.5	13.4	6.5	0	6.5	8.1
Not a member of any	12.6	25	16.8	44.6	0	44.4	38.1
No response	72.1	47.5	63.8	37.6	100	37.9	43.9
Other organization	0	0	0	1.2	0	1.2	0.9
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**

It is noticeable that the most dominant response indicate that they are not members of any organization (Table 7). Moreover, a higher percentage of respondents with membership in an organization particularly from the municipal fisheries sector are members of fisherfolk organizations. Less than 20 percent of all respondents are members of any association, of which less than 10 percent as members of a fisherfolk association. It is worth noting that only a few of the respondents are members of the FARMC, who acts as the advisory body of BFAR on fishery management. Considering

the voluntary nature of the survey and even with much encouragement from the enumerators for a response, the other respondents did not reply to the question on their membership.

TABLE 8
Access to credit facilities in Samar Sea, Philippines

Have availed of credit	Commercial trawl		Com trawl (%)	Municipal trawl		Mun trawl (%)	Total (%)
	Fish (%)	Shrimp (%)		Shrimp (%)	Squid (%)		
No	62	78	67	51	0	50	54
Yes	9	15	11	29	0	29	25
No response	29	8	22	20	100	21	21
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**

TABLE 9
Extension services provided to trawl fishers in Samar Sea, Philippines

Availment of extension services	Com trawl		Com trawl total	Mun trawl		Mun trawl total	Grand total
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
Yes	20	7	27	206	-	206	233
BFAR	3		3	2		2	5
DOH		1	1	10		10	11
LGU	-	1	1	84	-	84	85
DSWD	15	5	20	100		100	120
Other agencies	2	-	2	10	-	10	12
No response[1]	**19**	**3**	**22**	**53**		**55**	**77**
None[2]	**40**	**30**	**70**	**137**		**137**	**207**
Grand total	**79**	**40**	**119**	**396**	**-**	**398**	**517**

[1] Respondent chose not to respond to the question
[2] Respondents did not receive any extension service

Low access to formal credit for fishers is apparent with only 11 percent of the respondents from commercial, and 29 percent from the municipal trawlers able to access formal credit (Table 8). This is apparently due to low membership of most of the respondents in organizations where credit institutions prefer to provide credit to organizations/associations. No response was obtained of credit from informal lenders.

Commercial trawlers' exposure to extension services was rare, with more than 60 percent of respondents claiming to have not been reached by government agency extension services (Table 9). A higher percentage was observed on municipal trawl. The most common extension service accessed by trawl operators was the Department of Social Work and Development (DSWD). This is through the conditional cash transfer program otherwise known in the country as the 4Ps (Pangtawid Pamilyang Pilipino Program) that provides financial assistance to poorer families for education of their children. Though quite low, extension services from the Bureau of Fisheries and Aquatic Resources (BFAR) was observed to be the 4th highest government agency to have provided extension services in the survey area. Services rendered were typhoon assistance and basic training on fishery livelihoods.

2. ECONOMICS OF TRAWL AND OTHER FISHING GEARS

Trawlers in the Samar Sea are generally categorized as commercial fish trawls (*palupad*), commercial shrimp trawls (*pakayod*), and municipal trawls (*pakayod*). Other gears include fishing methods not classified as trawls that are commonly used in Samar Sea.

The commercial fish trawl or locally known as palupad usually has an average overall length of 22 meters, powered by 120-280 horsepower (hp) diesel engines. The fishing gear used by commercial trawlers are relatively bigger consisting of 9 panels of polyamide (PA) and polyethylene (PE) nettings. The size of the net is proportionate to the size and horsepower of the fishing boat. This trawler type is capable of operating

in areas from 10 to 50 meters deep. A fishing trip consists of an average of two (2) days continuous fishing operation with 2 to 4 hours of dragging per setting. This type of trawl employs an average of 10 crew members. The commercial shrimp trawl has an average overall length of 12 meters and usually employs 4 crew, while the municipal trawl has an overall length of 9 m with 1 or 2 crew. A fishing trip for commercial shrimp trawls consists of an average of 1.6 days while the municipal trawlers consists of 1 day fishing operation.

Municipal trawlers had the highest average number of fishing trips per month (21.6 trips). The commercial shrimp trawlers had an average of 14.5 trips per month while the commercial fish trawlers had 10.6 trips per month. It is apparent that commercial trawlers spend more fishing days per trip compared to municipal as they have stronger engines, larger boats and larger fishholds. All types of trawls had a very similar annual fishing effort, ranging from 10 to 11.6 fishing months per year. The average catch per trip was relative to the type of engine used, with those boats powered by 160 hp averaging 690 kg/trip, 80 hp averaging 100 kg/trip and 10-16 hp averaging 12 kg/trip. The average catch per year for the 3 categories in Samar Sea is estimated as 73 140 kg, 16 800 kg and, 2 796 kg respectively (Table 10). With these estimates, trawling has an annual production of 92 736 kg.

TABLE 10
Average catch and fishing effort of trawl by engine horsepower category

Engine horsepower	Number of respondents	Average fishing days per trip	Average fishing trips/month	Average fishing months/year	Average fishing trips/year	Average catch per trip (kgs)	Estimated annual catch (kgs)
160 hp (6D14) (commercial)	14	2.42	10.6	10	106	690	73 140
80 hp (4DR5) (commercial)	5	1.6	14.5	11.6	168	100	16 800
10-16 hp (single piston) (municipal)	123	1	21.6	10.8	233	12	2 796

It was observed that an average of 3 kg of fish are being brought home for family use by crew onboard commercial trawlers. Fish trawlers bring home an average of 2.6 kg while shrimp trawlers bring home an average of 4.5 kg. Meanwhile, municipal fishermen bring home an average of 1.6 kg of fish. Overall, trawl respondents bring home an average of 1.9 kg.

Fishers and fish traders use the category "reject"to refer to catch that is landed, usually comprised of small-sized fish of low or no commercial value, as well as juveniles of commercially important species. High value rejects are caught by commercial trawlers which are normally bought by traders for dishes/viands and also for further processing such as drying, fish paste/sauce and fish meal (Table 11). Prices of rejects from commercial fishermen are significantly high as these quite often comprised of high-value fish species.

TABLE 11
Average weight of fish per trip that boat captain and crew taken for home consumption

Respondent type	Average reject* catch/trip (kg)	Average reject* value/kilogram (PHP)	Total reject* value/trip (PHP)
Commercial trawl	68.8	47.67	3 279
Municipal trawl	2.0	18.45	36

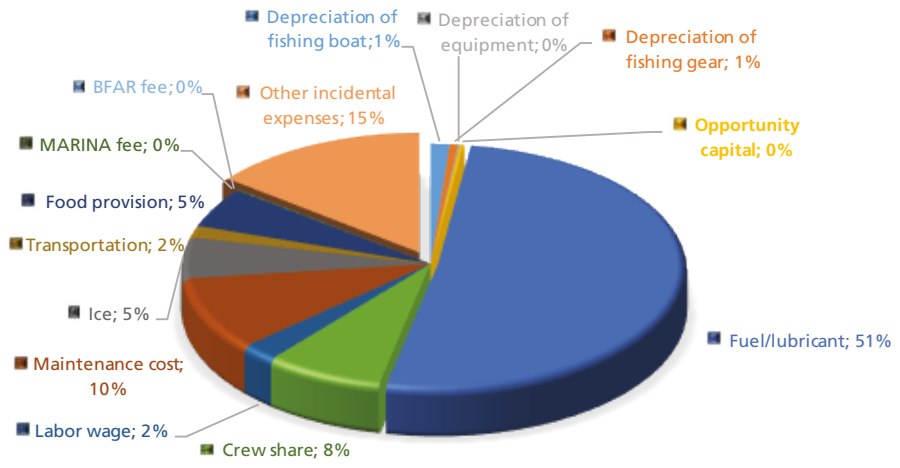
Note: US$ 1.0 is equivalent to PHP46.98.
* Also known as trash fish in the Philippines.

TABLE 12
Annual economic performance analysis for 160 hp trawl

Type of cost	Cash (PhP)	Non-cash (PhP)	Total (PhP)
Fixed cost			
Depreciation of fishing boat		69 601	69 601
Depreciation of fishing gear		28 750	28 750
Depreciation of equipment		8 706	8 706
Opportunity capital		11 268	11 268
		118 325	***118 325***
Operational cost			
Fuel/lubricant	2 769 379		2 769 379
Crew share	416 017		416 017
Labor wage	127 167		127 167
Maintenance cost	526 151		526 151
Ice	293 937		293 937
Transportation	83 930		83 930
Food provision	288 431		288 431
MARINA fee	5 579		5 579
BFAR fee	1 448		1 448
Other incidental expenses	784 800		784 800
	5 296 836		***5 296 836***
Total cost			5 415 161
Total revenue			7 339 770
Operating profit			**2 042 934**
Net profit			**1 924 609**

Note: US$1.0 is equivalent to **PHP**46.98.

FIGURE 5
Distribution of cost of 160 HP commercial fish trawl



Source : Socio-economic survey 2015.

Table 12 indicates the economic performance analysis of a typical commercial trawler with a 160 hp engine. The total annual cost was PHP5 415 161. Out of this, PHP2 769 379 or (51 percent) was spent for fuel and lubricant (Figure 5). Considerable amount was also spent for the other incidental expenses which was PHP784 800 or 15 percent. The maintenance cost contributed PHP526 151 (10 percent). Other significant expenses went to crew share PHP416 017 (8 percent), ice and food (5 percent).

The high cost of fuel and maintenance for 160 hp commercial trawl indicated that the fishing boats, particularly the engines used onboard, were fuel inefficient and old.

Incidental costs are other expenses which are supposed to be low in nature. However, it was observed to be significantly high in their operations. When asked, the respondents chose not to reveal the breakdown of the cost for other incidental expenses due to confidentiality reasons.

The total annual revenue from 160 hp commercial trawling was calculated as PHP7 339 770 with a net profit of PHP1 924 609 or about 26 percent of the total annual revenue. Individual revenue was the product of the average catch per trip and the average catch value (PHP100/kg), while total revenue was the product of average individual revenue and the average number of trips per year.

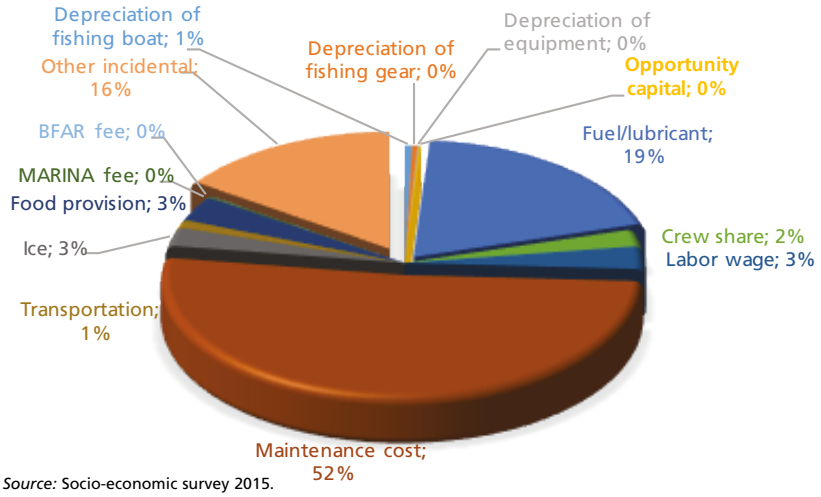
TABLE 13
Annual economic performance analysis for commercial shrimp trawl with 80 HP (Socio-economic survey 2015)

Type of Cost	Cash (PhP)	Non-cash (PhP)	Total (PhP)
Fixed cost			
Depreciation of fishing boat		8 400	8 400
Depreciation of fishing gear		5 900	5 900
Depreciation of equipment		2 000	2 000
Opportunity capital		1 743	1 743
		18 043	***18 043***
Operational cost			
Fuel/lubricant	315 840		315 840
Crew share	36 960		36 960
Labor wage	50 400		50 400
Maintenance cost	840 000		840 000
Ice	41 664		41 664
Transportation	16 800		16 800
Food provision	56 000		56 000
MARINA fee	3 300		3 300
BFAR fee	533		533
Other incidental expenses	252 000		252 000
	1 613 497		***1 613 497***
Total cost			1 631 540
Total revenue			1 680 000
Operating profit			**66 503**
Net profit			**48 461**

Note: US$1.0 is equivalent to PHP46.98.

Of the total annual cost of PHP1 631 540 for 80 hp commercial trawl, 52 percent was spent for maintenance which formed the highest expenditure for this category. The cost of fuel and lubricant contributed only 19 percent and for other incidental expenses was 16 percent. A small amount was spent for food, ice and labor which was 3 percent each. The high maintenance cost manifested the poor condition of the fishing boat. The absence of cost for Maritime Industry Authority (MARINA) and Bureau of Fisheries and Aquatic Resources (BFAR) indicated that the fishing activities were illegal. Since laborers' wage was missed in the survey guide, the information for the analysis of annual economic performance of commercial trawl using 80 hp category was based on the prevailing minimum daily wage in the area which is PHP300 (Table 13).

FIGURE 6
Distribution of cost of 80 hp commercial shrimp trawl



Source: Socio-economic survey 2015.

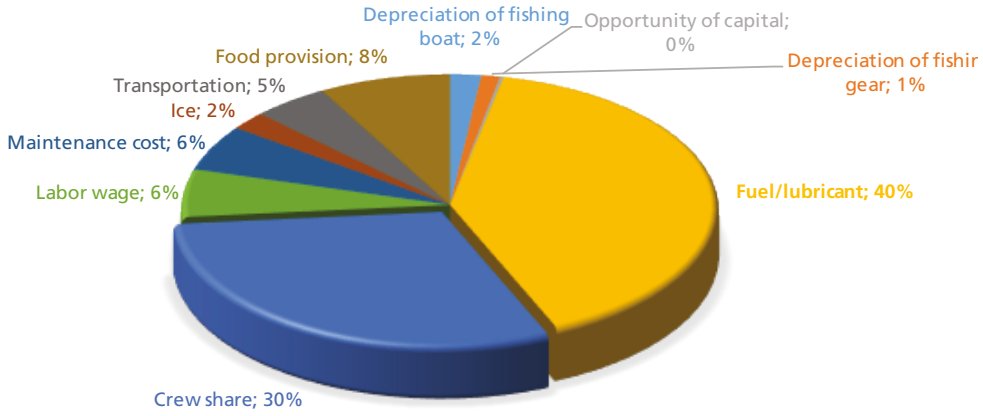
For municipal trawls with 10-16 hp single piston engines, the total annual cost amounted to PHP185 869 (Table 14 and Figure 7). The bulk was spent for fuel and lubricant, crew share (30 percent), food (8 percent) maintenance cost and labor (6 percent). The opportunity cost was insignificant because there was no equipment used in the fishing operation aside from the fishing boats and engines onboard. It was evident that no MARINA and BFAR payments made for municipal trawl in the analysis of economic performance because only commercial fishing boats or fishing boats more than three gross tons are required to secure permit from the Maritime Industry Authority (MARINA) and Bureau of Fisheries and Aquatic Resources (BFAR). On the other hand, the registration of municipal fishing boats or fishing boats below three gross tons is under the mandate of the Local Government Units (LGUs) through enabling city or municipal ordinance. However, fishing licence is not given to trawl because it is classified as an active gear which is prohibited to fish within municipal waters.

TABLE 14
Annual Economic Performance Analysis of Municipal Trawl, 10-16HP. (Socio-economic survey 2015)

Type of Cost	Cash (PhP)	Non-Cash (PhP)	Total (PhP)
Fixed Cost			
Depreciation of Fishing boat		3 544	3 544
Depreciation of Fishing gear		2 136	2 136
Opportunity capital		436	436
		6 116	***6 116***
Operational cost			
Fuel/lubricant	74 746		74 746
Crew share	55 839		55 839
Labor wage	10 790		10 790
Maintenance cost	10 449		10 449
Ice	4 131		4 131
Transportation	8 775		8 775
Food provision	15 025		15 025
	179 753		***179 753***
Total cost			185 869
Total revenue			280 410
Operating profit			**100 657**
Net profit			**94 540**

Note: US$1.0 is equivalent to PHP46.98.

FIGURE 7
Distribution of cost of municipal trawl



Source: Socio-economic survey 2015.

TABLE 15
Annual economic performance (PHP) of trawlers, according to type and engine horsepower. (Socio-economic survey 2015)

Type of cost	Commercial fish trawl (160 HP)	Commercial shrimp trawl (80 HP)	Municipal trawl (10-16 HP)
Fixed cost	118 324	18 043	6 116
Operational cost	5 296 836	1 613 497	179 753
Total cost	5 415 161	1 631 540	185 869
Total revenue	7 339 770	1 680 000	280 409
Operating profit	2 042 933	66 503	100 656
Net profit	1 924 609	48 461	94 540

Note: US$1.0 is equivalent to PHP46.98.

TABLE 16
Net profit and income for owners and crew (Socio-economic survey 2015)

Gear	Net profit (PHP)	Crew share based on survey response (PHP)	Crew share based on 50-50 sharing system (PHP)	Number of crew	Income of lowest rank crew (PHP)
Commercial trawl (160 hp)	1 924 609	416 017	962 304	8	160 384
Commercial trawl (80 hp)	8 461	36 960	24 230	5	18 520
Municipal trawl (10-16 hp)	94 540	55 839	47 270	2	31 513

Note: US$1.0 is equivalent to PHP46.98.

In terms of production and economic performance, there is a clear disparity between the 3 main categories of trawlers. Obviously, the 160 hp trawler is the most profitable, having the highest economic return (Table 15), although it also requires the highest operational cost. The municipal trawler with a 10-16 hp engine seems to operate more profitably than the commercial shrimp trawler with an 80 hp engine, considering operational costs vs. net profit derived from their operations as well as the income for fishermen (Table 16).

Table 17 elaborates the benefits from the 3 types of trawler based on net profitability. The response to the inquiry on crew share was weak. However from the data available, the 50-50 sharing system that splits net profit between the owner of the fishing boat/gear and crew, is common for 160 hp and 80 hp trawler operators. For 10-16 hp trawlers, a 60-40 percent sharing system is the usual practice. The share among the crew members themselves depends on the crew member's position or responsibility, as indicated in Table 17, with the fishermen/deck hands receiving the lowest share.

Information from the Philippine Statistics Authority[1] shows that the food threshold (minimum monthly income required to meet basic food needs and satisfy the nutritional requirements set by the Food and Nutrition Research Institute to ensure that one remains economically and social productive) and poverty threshold (similar concept, expanded to include basic non-food needs such as clothing, housing, transportation, health and education expenses) for 2015 are PHP 6 329 and PHP 9 064, respectively. Comparing these thresholds with the income received by a fisherman/ deckhand, only those in the 160 hp trawler have incomes above the poverty threshold and those in the 80 hp and 16 hp are below the food threshold.

TABLE 17
Sharing system according to position

Position	No. of shares	Estimated income (PHP)
1 Captain/Master fisherman	3 + 10% of the owners share	416 998.62
1 2nd officer/MF	3	320 768.17
1 Engineman	2.75	294 037.49
1 hauler/storageman	2.5	267 306.81
1 Cook	2.25	240 576.13
3 fishermen/deckhand	1.5 each	160 384.08 (each)
80 hp trawler		
1 Captain/Master fisherman	3 + 10% of the owners share	43 832.82
1 Engineman	2.75	33 955.00
1 Cook	2.25	27 781.36
2 fishermen/deckhand	1.5 each	18 520.91 each
16 hp trawler		
1 Master fisherman	2	63 026.67
1 fisherman/deckhand	1	31 513.33

Note: US$1.0 is equivalent to PHP46.98.

3. TRAWL CATCH AND BYCATCH LANDING SURVEY

During the REBYC I Project (executed in 2002-2008), regular monitoring of landed catch including onboard sampling were undertaken. Sampling was undertaken every other two (2) days which is adopted from the National Stock Assessment Program of the BFAR and NFRDI.

Based on the monitoring of landed and sampling of catch from boat landings under the REBYC I Project, more than one third (38 percent) of the catch of shrimp trawls were lizard fish (*Saurida* spp), followed by threadfin bream (*Nemipterus* spp., 10 percent). Shrimps which were considered as the target species were just about 1 percent of the total catch. The rejects which comprised of small-sized fish of low or no commercial value as well as the juveniles of commercially important species was 15 percent of the total landings (Figure 8).

The composition of rejects in shrimp trawl indicated high incidence of juveniles of commercially important species, among which were the lizard fish 8 percent (*Saurida* spp.), purple spotted bigeye 5 percent (Dilat, Priacanthus tayenus), cardinal fish 9 percent (Muong, Apogon sp.), hairtail 1 percent (espada, Trichiurus spp.) (Figure 9).

For fish trawl, the catch was dominated by small pelagic species, e.g. roundscad 48 percent (Galunggong, *D. maruadsi*), sardines 11 percent (tamban, *Sardinella longiceps*) and mackerel 8 percent (agumaa, *R. faughni*). Demersal fish which are the dominant catch for fish trawl constitute a small portion of the catch like lizardfish

[1] Philippine Statistics Authority (https://psa.gov.ph/poverty-press-release

(kalaso, *Saurida* spp.) 0.4 percent and threadfin bream 0.3 percent. The reject portion of the catch was also comparatively lower, with only 4 percent of the total catch (Figure 10).

FIGURE 8
Catch composition of shrimp trawls, Samar Sea (Dickson *et al.*, 2008)

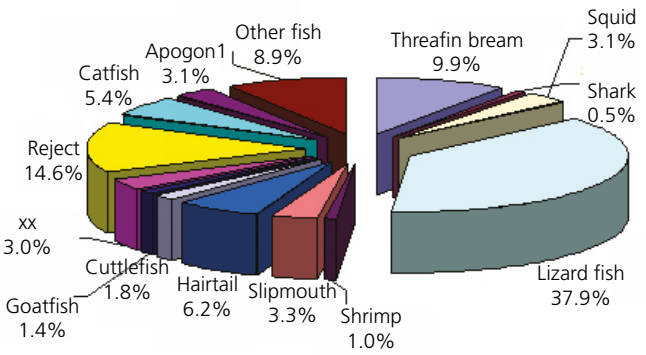


FIGURE 9
Composition of rejects (trash fish), shrimp trawl (Dickson *et al.*, 2008)

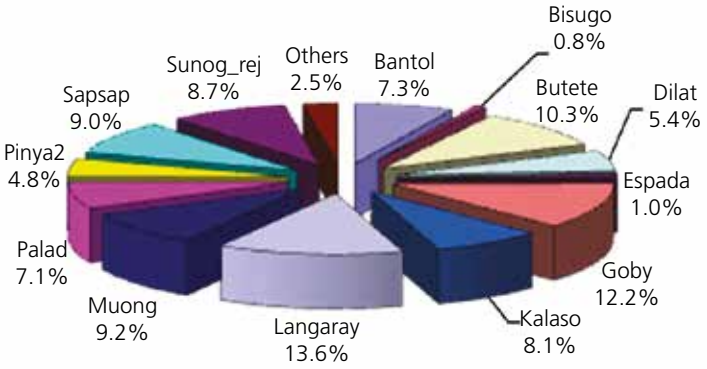
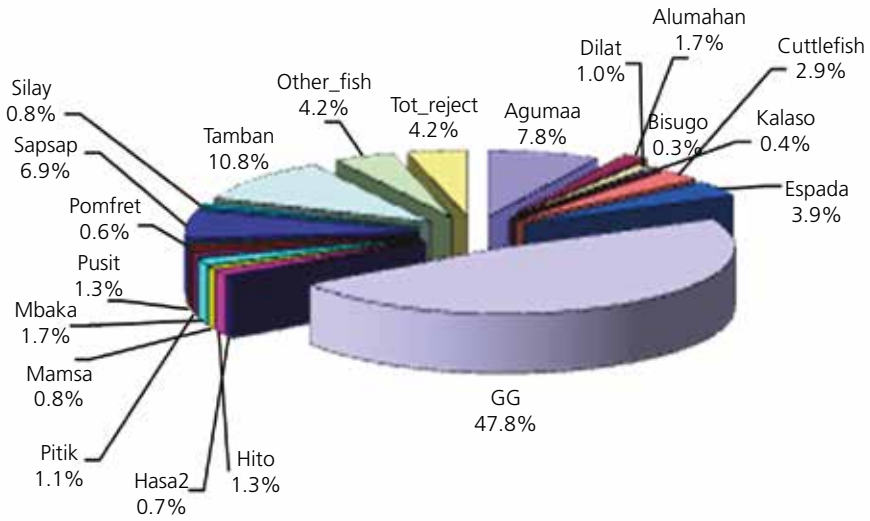


FIGURE 10
Catch composition of fish trawl, Samar Sea (Dickson *et al.*, 2008)



The survey was conducted under the REBYC I Project. Of the total of 811.7 tonnes for six months (October 2013 to March 2014), commercial trawls in Calbayog City contributed 35 percent and municipal (4DR5[2]) contributed 7 percent while the municipal 4DR5 in Catbalogan City contributed 44 percent and for the municipal small gasoline trawl catch in Catbalogan and Brgy. Burabud, Sta. Margarita was 14 percent. For the whole Samar Sea the total count for commercial trawl was 40 and 753 medium and small trawl respectively operating in Samar Sea.

Figure 11 shows the Good Catch and rejects in Samar Sea. Good catch refers to high quality and high value commercial species. These are also called commercial species in local language. Meanwhile, rejects also called trashfish by the locals, are small or juvenile species normally used as raw materials of local fish meal. A total of 135 052 kg of bycatch was recorded from the sampling area. The bycatch in commercial trawl has 2 percent with use of JTEDs in Calbayog City while the municipal 4DR5 got

FIGURE 11
Good catch and rejects in commercial and municipal trawl, Samar Sea

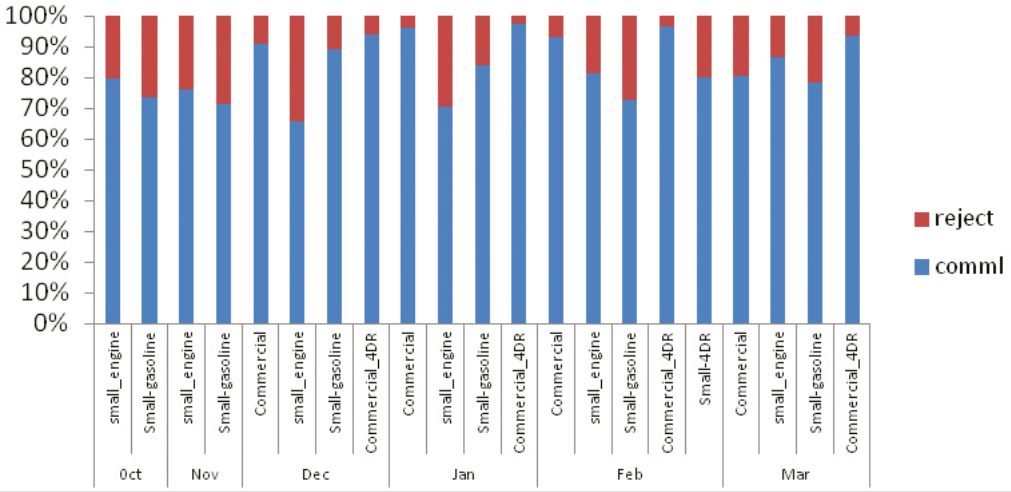
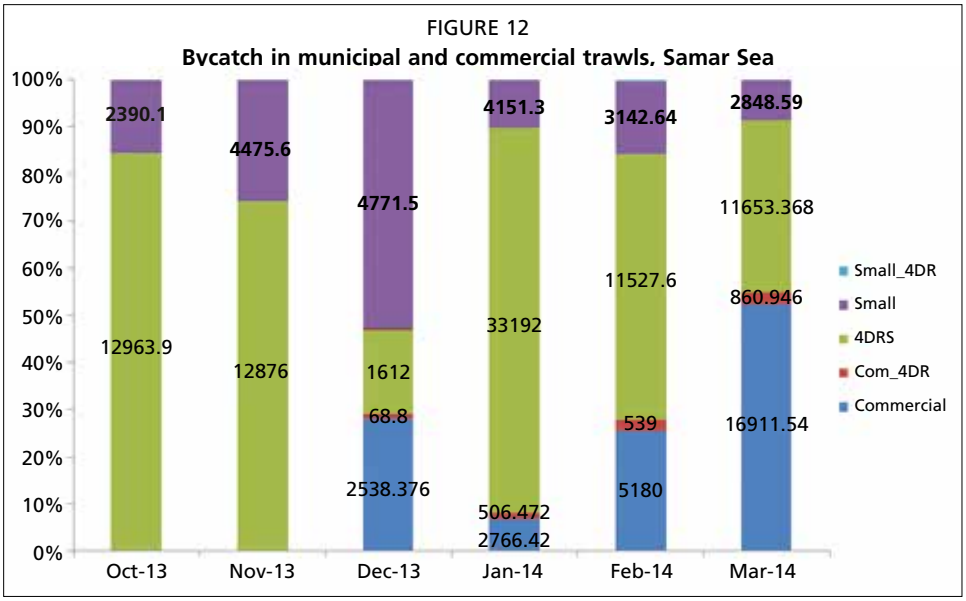


FIGURE 12
Bycatch in municipal and commercial trawls, Samar Sea

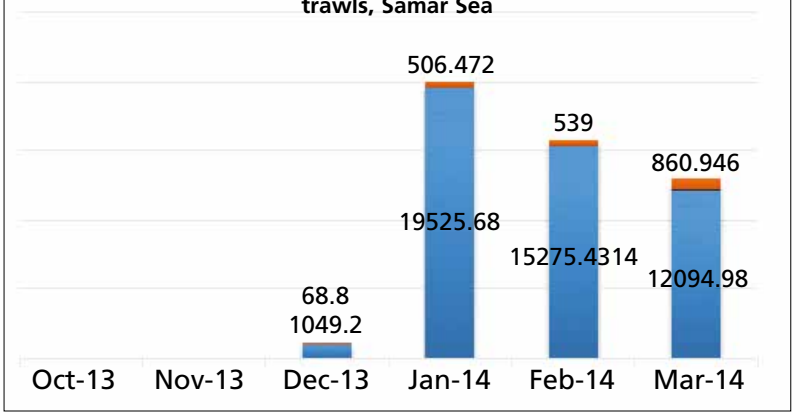


[2] For operational definition "4DR5" an automotive engine used by medium trawl with a gross tonnage ranging from 3 to 14 GT considered as commercial under R.A 8550 otherwise known as Fisheries Code of the Philippines of 1998. "Small municipal" refers to trawlers below 3 GT normally with outrigger powered by 16BHP gasoline or diesel engines.

62 percent in Catbalogan City and the municipal small gasoline in Catbalogan City and Sta. Margarita was 16 percent. Catbalogan City medium trawler (4DR5) does not use JTEDs due to the revision of the local ordinance.

A total of 676 654 kg of good catch was recorded for the last six months. Catbalogan City 4DR5 contributed about 44 percent of the catch landing followed by Calbayog Commercial contributing about 35 percent and next are the small engine and 4DR5 in Sta. Margarita which contributed 14 percent and the last was commercial 4DR5 which contributed about 7 percent.

FIGURE 13
Good catch (kg) from commercial and municipal trawls, Samar Sea



For Calbayog City commercial trawl, no operation of trawl due to fuel cost escalation of diesel from October to November 2013 while in December they only landed 11 percent due to super typhoon "Haiyan". January 2014 landed 29 percent while February and March both got 30 percent as monthly catch (April, May, June, July close season).

A total of 298 482 kg of demersal fish caught by trawl was recorded for the months of October 2013 to March 2014 for Catbalogan City medium trawl (4DR5). The bycatch ranged from 2 to 40 percent. During October and November 2013 the bycatch was 15 percent for both months while January 2014 got highest bycatch recorded, about 40 percent, and for the months of February and March was recorded 14 percent of bycatch consisting of juveniles of commercially important finfishes.

A total of 108 112 kg of demersal fish caught by trawl was recorded for the months of October 2013 to March 2014. On catch quality, October has 74 percent of good catch and 26 percent of bycatch, November has 72 percent of good catch and 28 percent of bycatch, December has 91 percent of good catch and 9 percent of bycatch. In January, 84 percent was comprised of good catch and 16 percent of bycatch, February had 73 percent of good catch and 27 percent of bycatch while March had 78 percent of good catch and 22 percent of bycatch.

4. OTHER MUNICIPAL FISHING GEARS

A number of other municipal fishing gears were also analysed. Hook and line, bottom set longline and bottom set gillnet were comparable in terms of production (Table 18) and net profit (Table 19).

TABLE 18
Estimated average annual catch and fishing effort of other common gears. (Socio-economic survey 2015)

Common municipal gears	Number of samples	Average fishing trips per month	Average fishing months per year	Average fishing trips per year	Average catch per trip (kg)	Estimated annual production (kg)
Hook & line	77	21.68	10.83	234.01	6.32	1 479
Bottom set longline	50	20.76	10.38	213.50	7.82	1 670
Bottom set gillnet	49	22.36	10.59	236.49	7.30	1 726
Crab pot	60	21.15	9.53	201.42	3.88	782

Table 19 summarizes the economic performance of the other commonly used municipal fishing gears showing that bottom set longlines have the highest net profit (PHP 99 245) and crab pot fishing, the least (PHP 16 780). In terms of production and income per fishermen, the range of income for the lowest ranked crew member was PHP 10 000-20 000 per year (Table 21). Bottom set longlines derived the highest individual income and crab pots, the least. The income derived from municipal trawling (16 hp) was comparatively higher than for the other municipal fishing gears.

TABLE 19
Summary of the economic performance of other common municipal fishing gears in Philippine pesos per year (Socio-economic survey 2015)

Type of cost	Hook & line (PHP)	Bottom set longline (PHP)	Bottom set gillnet (PHP)	Crab pot (PHP)
Fixed cost	2 775.44	4 365.19	7 626.52	4 332.41
Operational cost	57 948.74	63 346.19	90 889.90	57 104.01
Total cost	60 724.18	67 711.38	98 516.42	61 436.42
Total revenue	148 005.62	166 957.00	172 782.34	78 216.81
Operating profit	90 056.88	103 610.81	81 892.44	21 112.80
Net profit	87 281.44	99 245.62	74 265.92	16 780.39

Note: US$1.0 is equivalent to PHP46.98.

TABLE 20
Comparison according to share of fishermen/crew per year (Socio-economic survey 2015)

Gear	Net profit (PHP)	Crew share based on survey response (PHP)	Crew share based on 40-60 sharing system	Number of crew	Income of lowest rank crew
Hook & line	87 281	-	52 368	2	17 456
Bottom set longline	99 245	-	59 547	2	19 849
Bottom set gillnet	74 265	23 649.00	44 559	2	14 853
Crab pot	16 780	-	10 068	1	10 068

Note: US$1.0 is equivalent to PHP46.98.

The annual total costs for hook & line, bottom set longline, bottom set gillnet and crab pot amounted to PHP60 724; PHP67 711; PHP98 516 and PHP61 436, respectively, while the total revenue from each fishing gear was PHP148 005; PHP166 957; PHP172 782 and PHP78 216, respectively. Net profits were PHP87 281.44, PHP99 245.62, PHP74 265.92 and PHP16 780.30 (Tables 21-24).

TABLE 21
Annual Economic performance analysis for hook & line fishing (Undak/Kawil) based on socio-economic survey, 2015

Type of cost	Cash (PHP)	Non-cash (PHP)	Total (PHP)	%
Fixed cost				
Depreciation of fishing boat		1 874.24	1 874.24	3.08
Depreciation of fishing gear		736.37	736.37	1.21
Depreciation of equipment			0.00	
Opportunity capital		164.83	164.83	0.27
		2 775.44	2 775.44	4.56
Operational cost				
Fuel/lubricant	29 255.67		29 255.67	48.17
Crew share			0.00	
Opportunity cost of labour – can use the minimum wage for agricultural workers in the area (Non-cash cost)			0.00	
Maintenance cost	15 912.68		15 912.68	26.20
Ice	2 852.69		2 852.69	4.69
Transport			0.00	
Food provision	9 927.70		9 927.70	16.34
Other incidental expenses			0.00	
	57 948.74		57 948.74	95.40
Total cost			60 724.18	
Total revenue			148 005.62	
Operating profit			**90 056.88**	
Net profit			**87 281.44**	

Note: US$1.0 is equivalent to PHP46.98.

TABLE 22
Economic performance analysis for bottom set longline (kitang) fishing. (Socio-economic survey 2015)

Type of cost	Cash (Php)	Non-cash (PHP)	Total (PHP)	%
Fixed cost				
Depreciation of fishing boat		2 291.44	2 291.44	3.38
Depreciation of fishing gear		1 849.70	1 849.70	2.73
Depreciation of equipment			0.00	
Opportunity capital		224.05	224.05	.33
		4 365.19	4 365.19	6.44
Operational cost				
Fuel/lubricant	28 822.50		28 822.50	42.56
Crew share			0.00	
Labor wage			0.00	
Maintenance cost	18 977.78		18 977.78	28.02
Ice	2 588.67		2 588.67	3.82
Transpo			0.00	
Food provision	12 957.24		12 957.24	19.13
MARINA fee			0.00	
BFAR fee			0.00	
Yearly maintenance			0.00	
Other incidental expenses			0.00	
	63 346.19		63 346.19	93.53
Total cost			67 711.38	
Total revenue			166 957.00	
Operating profit			**103 610.81**	
Net profit			**99 245.62**	

Note: US$1.0 is equivalent to PHP46.98.

TABLE 23
Economic performance analysis for bottom set gillnet (palubog) fishing. (Socio-economic survey 2015)

Type of cost	Cash (PHP)	Non-cash (PHP)	Total (PHP)	%
Fixed cost				
Depreciation of fishing boat		3 270.21	3 270.21	3.31
Depreciation of fishing gear		3 960.88	3 960.88	4.02
Depreciation of equipment			0.00	
Opportunity capital		395.43	395.43	.40
		7 626.52	7 626.52	7.73
Operational cost				
Fuel/lubricant	33 854.86		33 854.86	34.36
Crew share	23 649.00		23 649.00	24.00
Labor wage			0.00	
Maintenance cost	14 606.74		14 606.74	14.82
Ice	4 702.51		4 702.51	4.77
Transport			0.00	
Food provision	14 076.79		14 076.79	14.28
MARINA fee			0.00	
BFAR fee			0.00	
Yearly maintenance			0.00	
Other incidental expenses			0.00	
	90 889.90		90 889.90	92.23
Total cost			98 516.42	
Total revenue			172 782.34	
Operating profit			**81 892.44**	
Net profit			**74 265.92**	

Note: US$1.0 is equivalent to PHP46.98.

TABLE 24
Economic performance analysis for crab pot (panggal) fishing. (Socio-economic survey 2015)

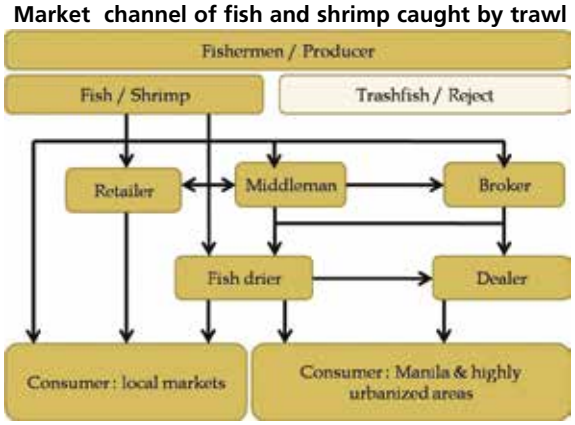
Type of cost	Cash (PHP)	Non-cash (PHP)	Total (Php)	%
Fixed cost				
Depreciation of fishing boat		2 358.83	2 358.83	3.83
Depreciation of fishing gear		1 757.08	1 757.08	2.85
Depreciation of equipment			0.00	
Opportunity capital		216.50	216.50	.35
		4 332.41	4 332.41	7.03
Operational cost				
Fuel/lubricant	30 466.21		30 466.21	49.58
Crew share			0.00	
Labor wage			0.00	
Maintenance cost	11 329.88		11 329.88	18.44
Ice	2 014.20		2 014.20	3.27
Transpo			0.00	
Food provision	13 293.72		13 293.72	21.63
MARINA fee			0.00	
BFAR fee			0.00	
Yearly maintenance			0.00	
Other incidental expenses			0.00	
	57 104.01		57 104.01	92.92
Total cost			61 436.42	
Total revenue			78 216.81	
Operating profit			**21 112.80**	
Net profit			**16 780.39**	

Note: US$1.0 is equivalent to PHP46.98.

5. CATCH UTILIZATION

Interviews corroborated the report of Ramiscal and Dickson (2010) showing that the distribution of the catch of trawlers follows various channels. The commercially important fish and shrimp catch is usually marketed through the channel of fish driers, retailers, middlemen or brokers. Direct selling in markets is also practiced particularly by female members of family of small trawlers (Figure 14).

FIGURE 14
Market channel of fish and shrimp caught by trawl



In established fishing ports and landing centers, a very common method of marketing is the *bulungan* or silent (whispered) auction.

The catch is sold in local markets although a significant portion of the catch–especially shrimps–are shipped to Manila or other urban centers. The bulk of the catch is consumed fresh. Fish drying is the most common form of processing particularly the smaller size commercial trawl caught species. Smoked and salted fish are also to a lesser extent prepared in various forms for selected species like anchovies (Ramiscal and Dickson, 2010).

6. BYCATCH UTILIZATION

The utilization of the bycatch could be summarized as for: (1) human consumption; (2) processing dried, salted, fish sauce; (3) direct feed for aquaculture; and (4) production of fishmeal. The proportion utilized in each segment is difficult to quantify considering the lack of information. Legaspi (1999) assessed that around 50-60 percent of bycatch and trash fish were for fresh utilization.

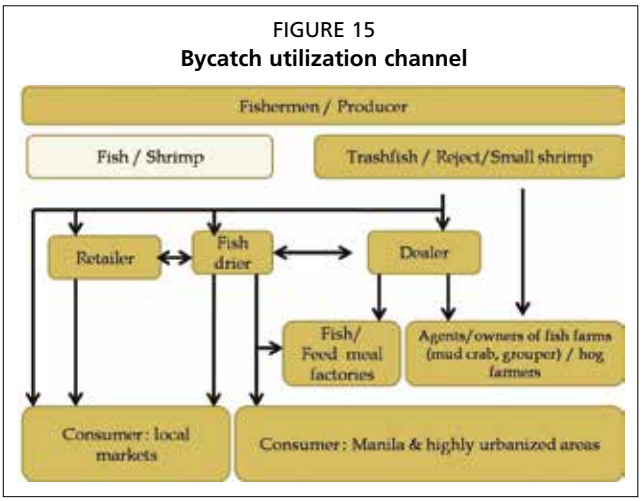
An important portion of the bycatch, particularly small-size juveniles of commercially important and low-value species are consumed fresh or dried. Relatively inexpensive fresh small-sized fish of commercially important species are widely acceptable and bought from wet markets especially by poor households. Dried fish is a traditional food consumed both by high and low income families, with prices depending on species and size. Fish drying is an important livelihood in many trawl landing centers.

So-called "rejects" from trawl, also called trash fish by the locals, is an important component in the culture of high value species like grouper, seabass and mud crab fattening. Bycatch are given fresh whole or in chopped form. Trash fish are also raw materials used in the preparation of local fish meal. Mixed species generated from demersal fisheries are commonly used by small-scale feed millers. Medium and large-scale feed producers utilize imported fishmeal.

The prevailing price of trashfish is in the range of PHP5-15 per kg, depending on the landed volume and available buyers. When trashfish is scarce, even small-size commercial fish are bought as feed for aquaculture, with prices reaching up to PHP60/kg.

The trade of trash fish caught by trawlers is carried out in various schemes: (1) directly sold to markets/consumers; (2) retailers; (3) fish driers; (4) dealers; and (5) fish/hog farmers (Figure 15).

FIGURE 15
Bycatch utilization channel



Trashfish is most of the time handled onboard without any preservation or icing. Those that are caught by boats on short trips (usually overnight) are often of better quality trashfish and are commonly used for human consumption (fresh or dried). Trashfish caught from longer fishing trips are normally sold fresh or dried and used as direct feeds for aquaculture, swine and fish/feed meal plants.

Fishermen land their catch mainly in fishing ports and landing places. Good quality trashfish are sold directly in markets by family members or to retailers or driers. The portions of the trashfish that can be consumed as fresh are usually sold directly to fish markets or fish driers. Trashfish that are not intended or fit for human consumption are sold in fresh or dried forms to dealers/ wholesales or agents and owners of aquaculture or hog farmers. In some places buying stations are established by dealers of trashfish and consign to feed/fish meal/processing plants in volumes. In some areas, trashfish are bought at sea by agent-buyers on small boats and dispatch them to fish traders and fish farmers on commission basis.

Fresh small shrimps, particularly the brown rough shrimps, are usually sold directly to market or retailers (consumed fresh) or sold to driers/processors to produce *hibe*, a very popular dried small shrimps used as mixing ingredient in many local dishes.

7. PERCEPTION OF RESPONDENTS ON OTHER ISSUES

It should be noted that the Samar Sea has no available fishing ground for commercial fishermen. The emerging issue on the commercial sector was apparently shown by the respondents where operations of law enforcement was the factor affecting their fishing operations (Table 25). The Samar Sea Fisheries Management Plan tries to finally institutionalize this issue as it adopts the Ecosystem Approach to Fisheries Management (EAFM) concept, which is already stipulated under the RA 10654. Mechanical breakdown together with competition with other gears tied at 2nd rank. Other Filipino culture, the Fiesta syndrome is highlighted as the 3rd (4th) important factor affecting the fishing operations of commercial and municipal trawl fishermen. Health and safety issues, including operation conditions during southwest monsoon, were also given importance by both sub-sectors of the trawl fisheries.

TABLE 25
Ranking of type of event/activities affecting fishing operations (1=most important) (Socio-economic survey 2015)

Factors affecting fishing operation (Commercial)	Com trawl	Factors affecting fishing operation (Municipal)	Mun trawl
Operations of law enforcement	1	Mechanical breakdown	1
Mechanical breakdown	2	Operations of law enforcement	2
Competition with other fishing gears	2	Fiestas and other social events	3
Fiestas and other social events	3	Health (operator and crew)	4
Health (operator and crew)	4	Southwest monsoon	5
Red tide occurrence	5	Red tide occurrence	6
Southwest monsoon	6	Fuel price	7
Fuel price	7	Local market price	8
Northeast monsoon	8	Northeast Monsoon	9
Local market price	9	Competition with other fishing gears	10
Seasonality	10	Seasonality	11
Politics	11	Politics	12
Strict compliance of JTEDS	12	Strict compliance of JTEDS	13

With regards to municipal trawlers, mechanical breakdown was the most dominant event affecting their fishing operations. Same with the commercial trawlers, where low-cost engines (old second-hand engines) were being used to lower the investment costs. Seasonality of fish species as well as politics were the two events with the least impact on trawl fishing operations in the area.

It is interesting to note that the least issue affecting their fishing operations was compliance of JTEDs. This can be attributed to the regular participation of both the commercial and municipal trawlers in all aspects of both the REBYC I and the REBYC II-CTI Projects in the country. Moreover, it should be noted that these stakeholders have been involved in the planning, implementation and monitoring of the projects.

TABLE 26
Perception on the status/condition of fishing grounds. (Socio-economic survey 2015)

Perception of respondents	Com trawl		Com trawl total (N=114)	Mun trawl		Mun trawl total (N=403)	Grand total (N=517)
	Fish trawl (N=76)	Shrimp trawl (N=38)		Shrimp trawl (N=401)	Squid trawl (N=2)		
Declining	31.6	15.8	26.3	27.9	-	27.8	27.5
Depleted	10.5	-	7.0	28.9	-	28.8	24.0
Still Good	38.2	60.5	45.6	11.5	-	11.4	19.0
No changes	6.6	2.6	5.3	0.2	-	0.2	1.4
No comment	1.3	2.6	1.8	-	-	-	0.4
Seasonal	3.9	2.6	3.5	-	-	-	0.8
Others	-	-	-	3.5	-	3.5	2.7
No response	7.9	15.8	10.5	27.9	100.0	28.3	24.4
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Varying perceptions were observed from commercial and municipal trawlers with respect to the condition of the resources and fishing grounds (Table 26). While 46 percent of the commercial trawlers perceived that the fishing grounds are still good, only 11 percent of the municipal trawlers sees it. These can be attributed to the fact that commercial trawlers have higher production as compared to the municipal trawlers. Aside from lower exposure to commercial trawling, this can also be the main reason why some of the respondents perceive that there had been no changes to the fishing ground.

Meanwhile, more than half of the municipal trawl respondents perceive that the fishing ground is already in bad condition as 29 percent and 28 percent stated that the fishing ground is depleted and resources declining, respectively.

TABLE 27
Top ten (10) specific fishery issues affecting fishing activities (Socio-economic survey 2015)

Specific fishery issues	Com trawl ranking	Specific fishery issues	Mun trawl ranking
Illegal fishing activities	1	No legal fishing ground	1
Competition with commercial fishing boats	2	Strict law enforcement	2
Boat and gear damage	3	Illegal fishing activities	3
Lax enforcement	4	Declining catch	4
No legal fishing ground	5	Others	5
Declining catch	6	Over capacity	6
Allow fishing near shore	7	Boat and gear damage	7
Apprehension	8	Close season	8
Fad support	9	Competition with commercial fishing boats	9
Others	10	Lax enforcement	10
		Others	11

Varying responses on specific fishery issues affecting the fishing activities of trawl respondents were recorded. The imposition of Fisheries Administrative Order (FAO) 201 banning the operation of active gears in municipal waters is primarily affecting the municipal trawlers as according to them, they have no legal fishing grounds (Table 27). Interestingly, this issue just ranked 5th for commercial fishermen which should be more affected by the aforesaid issue. Either this response was not elicited by the enumerators or were merely overlooked by the respondents.

Same observation was obtained with regards to competition with commercial fishing boats which was ranked 2nd by the commercial while 9th by the municipal. It was elicited that both respondent types refer to the intrusion of Danish Seine in their fishing grounds. However, with the banning of Danish Seine, this issue is expected soon to be resolved.

TABLE 28
Awareness of respondents on fishery rules/regulations. (Socio-economic survey 2015)

Laws/regulations known by respondents	Com trawl		Com trawl total	Mun trawl		Mun trawl total	Total %
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
Mesh size regulation	39	50	43	39	100	39	40
Regulations on jted	25	28	26	32	0	32	31
City fishery ordinances	24	8	18	12	0	12	14
Ban of active gear in municipal waters	0	0	0	2	0	2	1
Confused on law	0	0	0	1	0	1	0
Fao 244	1	3	2	0	0	0	0
R.A. 8550	1	0	1	0	0	0	0
Others	3	13	6	0	0	0	2
No idea	4	0	3	2	0	2	2
No response	3	0	2	13	0	13	10
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**

The question regarding awareness of fishery rules/regulations was open-ended, but only single responses have been attained. Based from the results, it was mesh size regulations that emerged as the regulation with the highest awareness among

respondents (Table 28). Interestingly, the regulation requiring all commercial trawlers to install JTEDs in their operations emerged as the second.

TABLE 29
Use of income from trawl fishing. (Socio-economic survey 2015)

Use of income	Com trawl		Com trawl total	Mun trawl		Mun trawl total	Grand total
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
Education	29	0	19	42	0	41	36
Basic needs	33	28	31	28	0	27	28
Source of fishing	0	0	0	4	0	4	3
None	3	13	6	1	0	1	2
Financial	10	8	9	1	0	1	3
Appliances	3	5	3	0	0	0	1
House	4	3	3	0	0	0	1
Others	5	15	8	0	0	0	2
No response	14	30	19	25	100	26	24
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Filipinos have a deep regard for education, which they view as a primary avenue for upward social and economic mobility and that individuals could get ahead through attainment of a good education. Middle and low income class parents make tremendous sacrifices in order to provide secondary and higher education for their children. This observation was corroborated by the data from the survey that the most dominant response on the use of income from fishing is on education of their children (Table 29). Moreover, it is also in fishing where they get their daily and basic needs. In most cases especially for the crew, daily or per trip income is mainly sufficient for daily needs and the possibility of savings from fishing is slim to none.

TABLE 30
Perception on income derived from fishing. (Socio-economic survey 2015)

Perception of income	Com trawl (%)		Com trawl total (%) (N=119)	Mun trawl (%)		Mun trawl total (%) (N=398)	Grand total (%) (N=517)
	Fish trawl (N=79)	Shrimp trawl (N=40)		Shrimp trawl (N=396)	Squid trawl (N=2)		
Enough	26.6	60.0	37.8	48.7	0.0	48.5	46.0
Just enough	41.8	5.0	29.4	12.9	0.0	12.8	16.6
Not enough	16.5	10.0	14.3	7.6	0.0	7.5	9.1
Not always	3.8	0.0	2.5	4.8	0.0	4.8	4.3
Not sure	0.0	0.0	0.0	1.8	0.0	1.8	1.3
Sometimes excessive	1.3	2.5	1.7	0.0	0.0	0.0	0.4
No response	10.1	22.5	14.3	24.2	100.0	24.6	22.2
Total %	**100**	**100**	**100**	**100**	**100**	**100**	**100**

In the interviews, respondents were asked about their perceptions on the sufficiency of their incomes to sustain their livelihood in which varying responses were recorded (Table 30). Almost half of the respondents said that their income was 'enough' (46 percent) whilst 17 percent said it was 'Just Enough'. More municipal trawler respondents said that their income was Enough (48 percent) compared to commercial trawlers (38 percent). More shrimp trawler operators (60 percent - commercial and 49 percent - municipal) perceived that their incomes were 'Enough' compared to fish trawlers (27 percent). No response was obtained from squid trawl operators.

TABLE 31
Willingness to shift from trawl to other fishing gears. (Socio-economic survey 2015)

Willingness to shift gears	Com trawl (%)		Com trawl total (%)	Mun trawl (%)		Mun trawl total (%)	Grand total (%)
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
No	38.0	55.0	43.7	22.7	0.0	22.6	27.5
Yes	29.1	20.0	26.0	44.9	0.0	44.7	40.4
No response	30.4	25.0	28.6	30.1	100.0	30.4	29.9
Indecisive	1.3	0.0	0.8	2.3	0.0	2.3	1.9
No comments	1.3	0.0	0.8	0.0	0.0	0.0	0.2
Total %	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Overall, 40 percent of respondents expressed their willingness to shift to other fishing gears if required, while more than a quarter (27 percent) did not (Table 31). Data also showed that fewer commercial trawl operators were not interested in shifting to other gears (26 percent), as compared to municipal trawlers (44.7).

Incidentally, responses from the income derived from fishing can be the main reason why the most dominant response of the commercial trawlers was "prefer not to shift to other gears". Among municipal trawlers, four out of 10 fishermen are willing to shift gears considering their perception of the fishing ground though their income is "enough" to sustain their daily needs.

Those who were willing to shift gears preferred encircling gillnet to be their alternative gear should they be required to do so (Table 32). Among the other preferred alternative gears were: bottom set gillnet, gillnet, bottom set longline and ringnet. For commercial trawlers, gillnets were the most dominant preferred gear (13 percent) followed by ring nets. Like trawls, ringnets are considered as an active gear and are also prohibited in municipal waters.

TABLE 32
Suggested alternative gears (Socio-economic survey 2015)

Gears identfied	Com trawl (%)		Com trawl total (%)	Mun trawl (%)	Mun trawl total (%)	Grand total (%)
	Fish trawl	Shrimp trawl		Shrimp trawl		
Encircling gill net	0.0	0.0	0.0	11.8	11.8	10.0
Bottom set longline	0.0	0.0	0.0	5.6	5.6	4.8
Ring net	8.7	0.0	6.4	1.1	1.1	1.9
Gill net	17.4	0.0	12.9	0.0	0.0	1.9
Drift gill net	0.0	0.0	0.0	1.7	1.7	1.4
Tuna handline	8.7	0.0	6.4	0.0	0.0	0.9
Shrimp gill net	0.0	0.0	0.0	0.5	0.5	0.5
Bottom set gill net	0.0	0.0	0.0	0.6	0.5	0.5
Handline	0.0	12.5	3.2	0.0	0.0	0.5
Crab gill net	0.0	0.0	0.0	0.6	0.56	0.5
No particular gear	47.8	75.0	54.8	69.1	69.1	67.0
Other gears	17.4	12.5	16.1	9.0	9.0	10.0
Total%	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

In most of the fishing operations onboard, the fishermen seem to mostly base their operations and navigation on experiences. When interviewed, navigational lights (29 percent) are the most common equipment bought by the trawler operators for safety at sea, followed by 'practicing carefulness' (10 percent) (Table 33). Only 6 percent had mobile phones and radio for weather updates, while only 6 percent listened to weather forecasts. three percent of respondents did not use or practice any of the above safety measures.

TABLE 33
Responses on safety of life at sea (Socio-economic survey 2015)

Row labels	Com trawl (%)		Com trawl total (%)	Mun trawl (%)		Mun trawl total (%)	Grand total (%)
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
Navigational lights	26.6	12.5	21.8	31.8	0	31.6	29.4
Carefulness	10.1	0	6.7	11.4	0	11.3	10.2
Weather updates	7.6	2.5	5.9	6.3	0	6.3	6.2
Life jacket	3.8	20	9.3	5	0	5	6
Listen to weather forecast	0	0	0	5	0	5	3.8
None	5	15	8.4	1.3	0	1.3	2.9
Safety first	7.6	2.5	5.9	0.5	0	0.5	1.8
Cell phone for communication	3.8	2.5	3.4	0.3	0	0.3	1
Ability to swim	3.8	2.5	3.4	0	0	0	0.8
Compass	1.3	2.5	1.7	0	0	0	0.4
No response	25.3	32.5	27.7	36.8	100	37.2	35
Others	5.1	7.5	5.8	1.5	0	1.4	2.6
Total %	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

It has been observed that debris and other trash materials are hauled during trawl operations. For this reason, respondents were asked on their willingness to bring onshore any debris that were hauled. More than 3/4 (76 percent) expressed their willingness to bring such materials to the shore for proper disposal, while only a small portion (5 percent) were not willing to do so (Table 34). There are also those who said sometimes (1.35 percent), or conditionally yes (0.39 percent). Willingness to land debris and trash did not appear to be linked to trawl type.

TABLE 34
Willingness to bring onshore debris/trash hauled by trawls. (Socio-economic survey 2015)

Response	Com trawl (%)		Com trawl total (%)	Mun trawl (%)		Mun trawl total (%)	Grand total (%)
	Fish trawl	Shrimp trawl		Shrimp trawl	Squid trawl		
Yes	78.5	52.5	69.7	77.8	0.0	77.4	75.6
No response	11.4	27.5	16.8	17.6	100.0	18.1	17.8
No	7.6	15.0	10.1	3.0	0.0	3.0	4.6
Sometimes	1.3	2.5	1.7	1.2	0.0	1.3	1.3
Conditional yes	1.3	2.5	1.7	0.0	0.0	0.0	0.4
Not sure	0.0	0.0	0.0	0.3	0.0	0.3	0.2
Total %	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

V. SUMMARY/CONCLUSIONS

1. The survey covered both commercial (fish and shrimp trawls) and municipal trawls (shrimp and squid trawls). There were a total of 517 respondents where the majority were male. Most of the fishermen were between 25 to 44 years of age;
2. Older fishers were engaged in municipal trawls, especially in squid trawls. 50 percent of squid trawl respondents were 55-64 years. A higher percentage for 65 years and over was also observed in municipal sector with 3 percent of the total respondents;
3. Most trawl fishers were married, however a relatively higher percentage of married respondents were observed in municipal trawls (92 percent) compared to commercial trawls (67 percent). The average fishing experience was shorter in the commercial sector than for the municipal fishery;

4. There were 25 types/categories of household members with large and extended families that included not only the spouses and children but also nephews, nieces and in-laws.;
5. In general, fishers' education was inadequate with many only able to reach elementary level education. Most were not members of any organization, but those that were, listed fisherfolk associations as the most common type;
6. There is low access to credit in both sectors, and extension services from government were inadequate and did often not reach the beneficiaries;
7. Mechanical Breakdown and Law Enforcement Operations were considered events that affected fishing operations the most. Fishers also regarded Declining and Depleted Catches and that No Legal Fishing Grounds as major issues;
8. Catch from trawling contributes to fish for home consumption. On average, a crewmember brings home the following per trip: 2.6 kg for fish trawlers; 4.5 kg for shrimp trawlers; and 1.6 kg for municipal trawlers.
9. Economic performance analysis showed that commercial fish trawlers, commercial shrimp trawlers, and municipal trawlers are all profitable, with commercial fish trawlers having the highest profit that is 40 times and 20 times that of municipal and commercial shrimp trawlers, respectively. The profit of municipal trawlers is twice that of commercial shrimp trawlers.
10. Using the concept of food threshold and poverty threshold, the economic performance analysis showed that the income of the lowest-ranked crewmember (fisherman/deckhand) in the commercial shrimp and municipal trawlers are below the food threshold and only those in the commercial fish trawlers are above the poverty threshold.
11. Most respondents considered that their income from trawling was enough and that those 40 percent of the total respondents who are willing to shift their fishing gears prefer gillnets should they be required to do so.
12. Bottom set longlines have the highest net profit among commonly used fishing gears and the income derived from municipal trawling (16 hp) was comparatively higher than for the other municipal fishing gears.
13. Navigational Lights were the most common safety provision. Generally, safety at sea practices were not followed consistently; majority of respondents expressed a willingness to bring debris/ trash collected in their trawls to shore, for proper waste disposal.
14. The municipal trawler with a 10-16 hp engine seems to be more profitable than the municipal trawler with 80 hp engine considering operational costs vs. net profit derived from their operations as well as the income for fishermen.
15. April to June is observed to be the spawning months for commercially important fishes in Samar Sea.

VI. RECOMMENDATIONS

Based on the above information, the following recommendations, in line with the implementation of the Samar Sea Fisheries Management Plan (SSFMP) are proposed:

1. Capacity and awareness building activities to improve community organizations and promote alternative livelihoods;
2. Improvement of the delivery of extension services for fisheries related livelihoods through capacity improvement program, including strengthening the Fisheries Livelihood Development Technicians (FLDTs), that BFAR has recently deployed in all coastal LGUs nationwide.
3. An Integrated Fishery Law Enforcement Team with specific Manual of Operations should be formed to conduct regular monitoring of Samar Sea;

4. Regular fish landing, catch and fish maturity monitoring should be undertaken to support further adoption of fishery management should it be necessary;
5. There is a need to form the fisherfolk into accredited organizations/ associations to bolster credit assistance and subsequent assistance for easier access to credit facilities;
6. Basic life-saving equipment onboard should be required by the relevant authorities coupled with training on basic safety of life at sea (SOLAS) to improve safety at sea by the trawl fishermen;
7. Gillnets should be considered as the preferred alternative fishing gear, when providing assistance to trawl fishers affected by trawl fisheries management actions such as closed seasons;
8. Considering the willingness of fishers to bring onshore trashes and other marine litter for proper disposal, an incentive based scheme should be devised to foster clean-up of Samar Sea;
9. Fisherfolk children should be considered a priority in the provision of scholarship programs implemented by BFAR.
10. Closed season is recommended during the months of April to June each year to potentially replenish the commercially important stocks in Samar Sea; and
11. The data can be used for Fishery Management of Samar Sea using the EAFM Concept should Samar Sea be considered as one Fishery Management Unit.

VII. REFERENCES

Armada, N. and W. Campos. 2004. *A Hydrobiological Survey of the Visayan Sea (Trawl, Plankton, and Oceanography): Status of demersal resources.* Unpublished Research Report, University of the Philippines in the Visayas.

Armada, N.B. 2004. State of the demersal fisheries. pp. 42–46. In: DA-BFAR, 2004. *Turbulent seas: The status of Philippine marine fisheries*. Coastal Resource Management Project, Cebu City, the Philippines. 378 p.

Barut, N.C., Santos, M.D. & Garces, L.R. 2004. *Overview of Philippine marine fisheries.* pp. 22–31. *In:* DA-BFAR, 2004, q.v.

BFAR Fisheries Statistics 1981-1988. *Bureau of Fisheries and Aquatic Resources, Quezon City.*

BFAR. (Commercial) Fishing Vessel Electronic Licensing System (FELIS) 2015.

BFAR-NSAP. 2013. *National Stock Assessment Program* (various reports). BFAR/ NFRDI (2011-2013).

Dalzell, P., P. Corpuz, R. Ganaden and D. Pauly. 1987. *Estimation of Sustainable Yield and Maximum Economic Rent from the Philippine Small Pelagic Fisheries.* ICLARM Technical Paper Series, Vol. 10, Number 3.

Dickson, J.O., A.T. Realino, N.T. Berida, R.V. Ramiscal, N.J. Lamarca, E.V. Hilario, R.O. Romero, E.B. Alba and M.B. Ramos. 2008. *Juvenile and trashfish excluder device (JTED) Pilot Project in Samar Sea.* Report submitted to FAO-REBYC1 Project.

Encina, V. B. *A report on two-boat bottom trawl fishing in the Philippines.* Proc. Indo-Pacific Fish Council, 13 (III). Philippine Fisheries Commission, Intramuros, Manila, Philippines.

Green, S.J., Flores, J.O., Dizon-Corrales, J.Q., Martinez, R.T., Nunal, D.R.M., Armada, N.B. & White, A.T. 2004. *The fisheries of Central Visayas, Philippines: Status and trend.* Coastal Resource Management Project of the Department of Environment and Natural Resources and the Bureau of Fisheries and Aquatic Resources of the Department of Agriculture, Cebu City, Philippines. 159 p.

Legaspi, A. S. 1999. *Bycatch utilization in the Philippines. In* Report and Proceedings of FAO/DFID Expert Consultation on Bycatch Utilisation in Tropical Fisheries, Beijing, China, 21-28 September 1998. Publ. Nat. Res Inst (NRI), Chatham (UK), pp.105-113.

NSO (National Statistics Office). 2005. 2002 Census of Fisheries.

Philippines Statistical Authority. *Fisheries Statistics of the Philippines for 2004-2015*

Ramiscal, R.V. and Dickson, J.O. 2010. *Bycatch Management and Discard Reduction Strategies National Report – Philippines.* Unpublished

Saeger, J. 1981. *Do Trawling Bans Work in Tropical Waters?* ICLARM Technical Report 11, 80 pp. Institute of Fisheries Development and Research; College of Fisheries, University of the Philippines in the Visayas, Quezon City, Philippines; ICLARM, Manila, Philippines.

Saeger, J. 1993. *The Samar Sea, Philippines: a decade of devastation.* Naga, the ICLARM Quarterly, 16(4), pp.4-6.

Thomas, F.C. 1999. *The Commercial Fishery Sector of the Philippines: A Centennial Chronicle 1898-1998.* Cataloging-in-Publication Data, BFAR Main Library.

Umali, A.F. 1950. *Guide to the classification of fishing gear in the Philippines* (No. 17). US Fish and Wildlife Service.

Warfel, H.E. and C. Manacop. 1950. *Otter Trawling in the Philippine Waters.* Research Report, 25:1-25.

Zaragosa, E.C., Pagdilao, C.R. & Moreno, E.P. 2004. *Overview of the small pelagic fisheries.* pp. 32–37. In: DA-BFAR, 2004, q.v.

ANNEX

TRAWL FISHERIES SOCIO-ECONOMICS SURVEY GUIDE

(For Owners/Operators, Boat Captains, Masterfishermen and Crew)

I. RESPONDENT'S PERSONAL INFORMATION:
Impormasyon han Tagabaton

Full Name:_____
Ngaran

Municipality/City:_____
Munisipyo/Syudad

Barangay/Sitio/Purok:_____
Barangay

Age: _____ **Sex:** _____ **Civil Status:** _____
Edad *Kinatawo* *Estado*

Religion: _____ **Dialect/s Spoken:** _____
Relihiyon *Yakan*

No. of Years Engaged in Trawl Fishing:_____
Pira na katuig nga nangisda han Trawl

II. EDUCATIONAL BACKGROUND:
Ang gin Adman

- ☐ **Never Attended School** *Waray makaeskwela*
- ☐ **Elementary Level**
- ☐ **Elementary Graduate**
- ☐ **High School Level**
- ☐ **High School Graduate**
- ☐ **Vocational**
- ☐ **College Level**
- ☐ **College Graduate**
- ☐ **Post Graduate**

III. HOUSEHOLD INFORMATION:
Impormasyon han Panimalay

No. of Household Members/Sources of Income: _____
Kadamu-on han naukoy ha Panimalay

Household Member *Myembro han Panimalay*	**Relation** *Relasyon*	**Gender** *KInatawo*	**Age** *Edad*	**Types of Livelihoods** *Klase Han Pangabuhian*	**Specify Months** *Ano nga mga Bulan*	**Ave. Monthly Income** *Kita kada Bulan*

OTHER SOURCES OF MONTHLY INCOME INCLUDING REMITTANCES? HOW MUCH (Respondent)?
Iba nga surok han pangabuhian kaupod an nakakarawat tikang ha gawas? Pira man?

Income sources	**Amount (p)**

IV. ARE YOU A MEMBER OF ANY ORGANIZATION: YES ☐ NO ☐
Myembro kaba han bisan ano nga organisasyon:

☐ **Community/Religious Organization:** _____
Organisasyon ha Communidad/Relihiyon

☐ **Women Organization:** _____
Organisasyon han Kababayenhan

☐ **Fisherfolk Association:** _____
Organisasyon han mga Parapangisda

☐ **Fisherfolk Cooperative:** _____
Cooperatibahan Parupangisda

☐ **Others** _____*Lain pa*

HAVE YOU AVAILED OF ANYCREDIT FACILITY? YES ☐ **NO** ☐
Nakatagamtam ka na ba han pautang?

If **NO,** Why None?_____
Kun waray, kay ano?

If **YES,** Please Specify_____
Kun mayda, ano ini?

V. HAVE YOU AVAILED OF ANY EXTENSION SERVICES FROM:
Nakatagamtam kana bahan mga bulig tikang:

A. GOVERNMENT YES ☐ NO ☐
Gobyerno

If **NO,** Why None? _____
Kun waray, kay ano?

If **YES,** What Agency & Services? _____
Kun mayda, ano ini nga mga Ahensya ngan Serbisyo

B. **NON-GOVERNMENT ORG. YES ☐ NO ☐**
If **NO,** Why None? _____
Kun waray, kay ano?

If **YES,** What Agency & Services? _____
Kun mayda, ano ini nga mga Ahensya ngan Serbisyo?

VI. TYPES OF TRAWL GEAR/S USED?
Ano nga klase han pukot imo ginagamit?

Commercial Trawl	**No. of Fishing Gears**	**Municipal (Baby) Trawl**	**No. of Fishing Gears**
Squid Trawl *(pan noos)*		Pakayod	
Fish Trawl *(palupad)*(alho)		Padanas*	
Fish Trawl (galunggong/bolinao)		Galad-gad	
Others, Specify		Palupad	
		Others, Specify	

*Note: *Padanas in Zumaragga is not considered as Trawl*

No. of Fishermen (Officers and Crew) onboard?: _____
Kadamo-on han upod/sakay?

VII. ENGINE BRAND AND HORSE POWER:
Tatak han makina ngan kabalyos

Engine Brand: _____ Horse Power: _____
Tatak han makina *Kabalyos*

VIII. NAME AND MEASUREMENT OF BOAT(TONNAGE MEASUREMENT in meters). *Pls. indicate unit of measure.*
Sokol Han Sakayan/Baloto

Name of boat *Ngaran han Baloto*	**Length** *Kahalaba*	**Breadth** *Kahaluag*	**Depth** *Kataas*

IX. WHAT IS YOUR PARTICIPATION IN TRAWL FISHERIES? (one or more answers)
Ano an imo partisipasyon dida han trawl nga panagat?(usa o subra nga baton)

☐ Owner *Tag-iya* ☐ Masterfisherman *Manulong/Maestro* ☐ Captain *Kapitan*

☐ Crew *Tripulante* ☐ Others, Specify _____ *Iba pa, ano ini?*

X. DISTRIBUTION OF AVE. MONTHLY HOUSEHOLD EXPENSES:
Pag bahin-bahin han gastos han panimalay:

Expenses	**Amount (p)**
Food	
Health	
Education	
Shelter/Rental (repair, maintenance, renovation)	
Transportation	
Billings: Electricity Mobile Phone Load Water Cable	
Others	

XI. CATCH AND EFFORT DATA:
Lista han dakop kada panagat:

Ave. No. of Hauls/Day (24 hrs)	**Ave. No. of Fishing Days per Trip**	**Ave. Catch per Trip (kg)**	**Ave. Fish Discard per Trip (kg)**	**Ave. Debris per Trip**	**No. of Average Trips per Month**	**No. of Fishing Months per Year**
Libada	*Pira ka adlaw kada byahe*	*Pira ka kilo an dakop kada Byahe?*	*Pira ka kilo an gin hapil/ labog ha dagat*	*Pira ka kilo an basura nga nakukuha kada byahe*	*Pira ka byahe kada bulan*	*Pira ka bulan han byahe ha usa ka tuig*

WHAT IS THE CATCH ARRANGEMENT/SHARING SYSTEM?
Nano an partida?

	Share from Net Income (percent)	**Catch Incentive (percent)**
Owner **Tag-iya**		
Crew **Tripulante**		

XII. HOW MUCH FISH DO YOU GET FOR HOME CONSUMPTION PER TRIP?
Ano ka damo han dakop han iyo gin gagamit para pagkaon ha balay?
_____ kg.

XIII. WHERE IS YOUR USUAL FISHING GROUND?
Diin dapit han pirme mo ginapanagatan?

Fishing grounds *Panagatan*	**Bulan** *(Month)*	**Dominant fish caught** *Kasagaran nga isda nga nadadakop*

XIV. BASED ON THE AVERAGE CATCH PER TRIP, PLS. INDICATE THE FOLLOWING:
Base han normal nga nadadakop nga isda kada byahe, alayon iglista an masunod:

Type	**Species**	**Price Range**	**Total Weight (kg)**
Fish Trawl			
Deklase			Prepare list of different types
Buyod			
Parotpot			
Jako			
Reject			
Shrimp Trawl			
	Lukon		
	Bulik		
	Puti		
	Suahe		
	Tigbason		
	Guludan		
Pasayan	Bangkigan		
Jako			
Reject			
Squid Trawl			
Deklase			
Buyod			
Parotpot			
Squid			
Jako			
Reject			

XV. COST AND RETURN ANALYSIS:

Bana-bana han benta ngan ganansiya:

a. Fixed Investment:

Assets *Propiyedad*	**Year acquired/ year built** *Kakano ginpalit o ginhatag/ginhimo*	**Price (p)** *Kantidad*	**Economic life (year) how long can you use your asset?** *Pira katuig magagamit han imo propiyedad?*
Boat *Sakayan*			
Gear *hulaw/higamit*			
Equipment *Ekepahis o garamiton* Fish box Fish tubs Styro foam Mobile phone GPS Compass Navigational Maps/ Charts Handheld Radio Life Saving Devices Life Buoy			
TOTAL			

b. Operational and Marketing Costs per Trip:

Items	**Price (peso) /trip or operation**
Fuel & Lubricants *Krudo ngan asete*	
Crew Share *Sweldo han tawo*	
Laborers Wage (at port, market, etc.) *Suhol han mga trabahante*	
Maintenance Cost *Gastos han pagmentenar han sakayan*	
Ice Cost *Batonaw/yelo*	
Transportation Cost *Gastos ha pamasahe*	
Food Provision Cost *Gastos ha pagkaon*	
Cooking Paraphernalia *Gamit Panluto*	
TOTAL	

c. Other Expenses:
Iba pa nga Garastuhan

Items	**Amount**
MARINA Registration Fees	
BFAR Commercial Fishing Vessel/Gear License	
Municipal Boat and Gear License	
Boat Maintenance Cost (yearly) *Gastos han pagmentenar han sakayan (tinuig)*	
Other Incidental Expenses *Iba pa nga garastuhan*	
TOTAL	

XVI. WHAT EVENT AND ACTIVITIES WOULD AFFECT YOUR TRAWL OPERATION? WHY?

Ano nga mga panhitabo /burohaton /higwaos nga makakaappekto han pagtrawl? Kay ano?

Events/Activities	Explanation
Typhoon *Bagyo*	
Southwest Monsoon *Habagat*	
Northeast Monsoon *Amihan*	
Operations of Law Enforcement *Operasyon han mga Otoridad*	
Local Market Price *Presyo ha lokal nga Merkado*	
Fuel Price *Presyo han Gasoline*	
Competition with Other Fishing Gears *Kumpetensya han iba nga Panagat*	
Fiestas and Other Social Events *Patron, semana santa ngan kalagkalag*	
Seasonality *Kutsitsa*	
Red Tide Incidence *Insidente han Red Tide*	
Strict Compliance of JTEDs *Strikto han pagsunod han paggamit han JTEDs*	
Health (Operator & Crew) *Panlawas (Tag-iya ngan Tripulante)*	
Politics *Politika*	
Mechanical Breakdown *Na aberya*	
Others *Iba pa*	

XVII. OTHER IMPORTANT QUESTIONS RELATIVE TO FISHERIES ACTIVITIES OF THE RESPONDENTS.

1) What is your perception on the status/condition of your fishing ground?

Anu an imo pagkita han kamutangan han imo gin papangisdaan?

_____

_____

2) What are the problems and recommendations relevant to fishing activities?

Anu-ano an mga problema ngan mga rekomendasyon nga importante para ha pangisdaan?

Problems	Recommendations

3) What fishery law or regulation do you know that affects your fishing?
Ano nga mga balaod/regulasyon nga nakakaapekto han imo pangisda?

_____

_____

4) What are the benefits and other household amenities gained from your trawl fishing?
Ano nga mga benepisyo ngan iba pa nga nakukuha han imo pamilya tikang han imo panagat nga trawl?

_____

_____

5) Is your income from trawl fishing enough to sustain your daily family needs? Why?
An imo ba kita tikang han panagat nga trawl sadang para han kada-adlaw nga panginahanglanon han imo pamilya? Kay ano?

_____

_____

6) Would you like to shift or retain your fishing gear? If yes, what gear? If no, why not?
Kon tagan tyansa, maruruyag ka ba mag balyo ngadto han iba nga klase nga panagatan? Kon oo, ano? Kon diri, kay ano?

_____

_____

7) What measures do you practice and equipment you have to ensure your safety at sea?
Ano nga mga pitad nga imo ginbubuhat ngan ekepahis nga may da ka para malikyan ang disgrasya ha kadagatan?

_____

_____

8) Are you willing to take the debris/basura you collected into port for proper disposal?
Naruruyag kaba nga dad-on han mga basura nga nakukuha tikang han imo panagat ngadto sa ligid sa pantalan para ha tama nga bubutangan?

_____

_____

Name of Interviewer: _____ **Date:** _____

Socio-economic status of trawl fishers in Prachuap Khiri Khan-Chumphon Provinces and fishers in Trat Province, Thailand

Sirisuda Jumnongsong
Department of Fishery Management
Faculty of Fisheries, Kasetsart University
Bangkok, Thailand

PREPARATION OF THIS REPORT

This report was prepared as a deliverable for the project "Strategies for Trawl Fisheries Bycatch Management - REBYC-II CTI" (GCP/RAS/269/GFF) in Thailand. The project is funded by the Global Environment Facility (GEF) and executed by the Food and Agriculture Organization of the United Nations (FAO).

The aim of this report is to review existing socio-economic data as baseline information and to present a study of the socio-economic status of trawl fishers in Prachuap Khiri Khan Province and Chumphon Province and fishers in Trat Province conducted via two surveys at the two project sites as following:

1. **PART I**: Socio-economic status of trawl fishers in Prachuap Khiri Khan Province and Chumphon Province, Thailand and
2. **PART II**: Socio-economic status of fishers in Trat Province, Thailand

At the first site the study focused on trawl fisheries while at the second site small-scale and medium to large-scale fisheries were included. The results in this study can be used as supplementary information to support the implementation of the recommendations made on trawl fisheries management by the REBYC-II CTI Project in Thailand.

This report was written based on the following Terms of Reference:

1. Review of existing data and analysis of data from questionnaire survey (Two project sites-Data collection will be the responsibility of the Chumphon Marine Fisheries Research and Development Center (CMDEC) and the Eastern Marine Fisheries Research and Development Center (in Rayong) (EMDEC) staff).
   a) Review (report) of existing data (Prachuap Khiri Khan Province and Chumphon Province): Socio-economic data of otter board trawl (OBT) and (pair trawl) PT fishers including numbers of fishers and fishing boats, landing sites, fish price, and related socio-economic data of OBT and PT fisheries in Prachuap Khiri Khan Province and Chumphon Province. Existing data can be accessed from Department of Fisheries (DOF) at central and local offices, statistical records and other relevant agencies;
   b) Review (report) of existing data (Trat Province): Socio-economic data of small-scale and commercial-scale fishers including numbers of fishers and fishing boats, landing sites, fish price, and related socio-economic data of fisheries in Trat Province. Existing data can be accessed from DOF at central and local offices, statistical records and other relevant agencies;
   c) Analysis of data from survey on socio-economic aspects of trawl fisheries in Prachuap Khiri Khan Province and Chumphon Province; and
   d) Analysis of data from survey on socio-economic aspects of small-scale and commercial-scale fisheries in Trat Province;
2. Design the interview schedules for the socio-economic studies for trawl fisheries (OBT and PT) in Prachuap Khiri Khan Province and Chumphon Province and for small-scale and commercial-scale fisheries in Trat Province;
3. Provide guidance for CMDEC and EMDEC staff in using the interview schedules;
4. Prepare the presentations for the Advisory Committee Meeting and Local Stakeholder Consultation Meetings; and
5. Draft final reports in English for review by the National Technical Officer (NTO) before submission to FAO.

ABSTRACT

This report has been prepared to support the implementation of the recommendations made by the REBYC-II CTI Project (Strategies for Trawl Fisheries Bycatch Management - GCP/RAS/269/GFF) by focusing on socio-economic aspects of fisheries in the two project pilot sites in Thailand. The works consisted of the following studies: (1) Socio-economic status of trawl fishers in Prachuap Khiri Khan-Chumphon Provinces and (2) Socio-economic status of fishers in Trat Province.

The primary objective of these two studies was to review existing socio-economic data and to study the socio-economic status of trawl fishers in Prachuap Khiri Khan-Chumphon Provinces and fishers in Trat Province. The existing socio-economic data were collected from DOF central and provincial offices, statistical records and other relevant agencies. Two sets of structured interview schedules were translated into Thai and used for interview survey with fishers in the two sites.

In the first study in Prachuap Khiri Khan-Chumphon Provinces, 30 respondents including otter board trawl (OBT) fishers (63.3 percent), beam trawl (BT) fishers (20 percent) and pair trawl (PT) fishers (16.7 percent) were interviewed by the officers of CMDEC during the period of August - November 2014 at three main fishing ports. Seventy percent of respondents in the study had no second occupation. The mesh size of codend in the trawl-net of 87 percent of respondents was less than 4 cm (2-3 cm for OBT, 3.8-4 cm for BT and 2-2.5 cm for PT). The average price of trash fish per kg was THB 5.5 and the estimated income per trip from selling trash fish caught by BT, OBT and PT were THB 550, THB 13 365, and THB 110 000 respectively. The cost of fuel was perceived to be the highest single operational cost of trawl fishing by the respondents (67 percent of total cost). Most respondents (83 percent) were satisfied with the benefit returned from trawl fishing (more than half of the respondents were slightly satisfied) and 77 percent of respondents mentioned that they could continue trawl fishing.

In the second study in Trat Province, 233 respondents including small-scale fishery households (83 percent) and medium to large-scale fishery households (17 percent) were interviewed by EMDEC staff during the period of September - October 2014 at the respondents' houses. Most of the respondents (68 percent) had a single occupation, which was fishing. The main fishing gear used by small-scale households were shrimp trammel nets, crab gillnets and crab traps while for medium to large-scale households, push nets, trawls and purse seines were more common. There were, however, 200 trawlers (6 percent) and 112 push netters (4 percent). Household incomes before deducting the cost of fishing were about seven times higher for medium to large-scale households compared to that for small-scale fishers households (THB 7 000 vs THB 1 000 per day). Nearly 60 percent of the respondents were moderately satisfied with the benefits from fishing in the study area. Most of the respondents (84 percent) believed that they could continue with their current fishing activities. An ordinal logistic regression was used to investigate differences in responses for the small-scale fishers and medium to large-scale fishers for each of the 14 options and there were five options where there were statistically significant differences between the responses of the two groups. The small-scale fishery households were more likely to agree or strongly agree with option 5 (no use of some fishing gears in zone 2 and zone 3 in May-October), option 6 (No fishing in spawning season in zone 3 in February-May), option 7 (No use of any fishing gears having net mesh size smaller than 4.5cm), option 9 (Publicity campaign for no take fish larvae) and option 12 (Promote more and maintain crab bank project) than medium to large-scale fishery households.

The socio-economic status of fishers, and some key recommendations and lessons learned, are presented in this report. It is noted that the studies were conducted in 2014, prior the new fisheries law in Thailand entered into force in 2015. To compare

the situations and examine the socio-economic impacts of the new fisheries law on fishers at the project sites, it is recommended that a similar study be conducted at a later period, using the results of these studies as a baseline.

ACKNOWLEDGEMENTS

The author would like to extend her appreciation to the Directors and the officers of Central Gulf Marine Fisheries Research and Development Center (CMDEC) and Eastern Gulf Marine Fisheries Research and Development Center (EMDEC), Department of Fisheries (DOF) for their cooperation, consultation and data collection of the two studies in the project sites.

The participation of the respondents at the two project sites was valuable and appreciated by the author. Without their willingness to answer the interview schedule, the study goals could not have been achieved.

Advice provided by Mr. Richard Gregory (REBYC-II CTI/RFU and SEAFDEC/TD) throughout the study period has been a great help in conducting the study and writing the report. Special thanks are also extended to Dr. Susana Siar (FAO resource person) for her advice on report writing and Mr. Petri Suuronen for report editing. Furthermore, support and coordination from the staff of FAO and SEAFDEC (RFU) was much appreciated.

The author would like also to express her gratitude to Dr. Mala Supongpan (National Technical Officer [NTO], Thailand) and Mr. Suchart Sangchan (National Project Coordinator) for their valuable and useful guidance throughout the study. Special grateful thanks to Mr. Piyachoke Sinanun and Mr. Akanit Kiuapeag for their help in data collection.

Finally, the author wishes to acknowledge the Global Environment Facility (GEF) for providing the fund for conducting this study.

ACRONYMS AND ABBREVIATIONS

BT	beam trawl
CDD	Community Development Department
CMDEC	Chumphon Marine Fisheries Research and Development Center
DOF	Department of Fisheries
EMDEC	Eastern Marine Fisheries Research and Development Center (in Rayong)
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
IUU	illegal, unreported and unregulated
MFRDB	Marine Fisheries Research and Development Bureau
NESDB	Office of National Economic and Social Development Board
NSO	National Statistics Office
NTO	National Technical Officer
OBT	otter board trawl
OBBT	otter board with boom trawl
PT	pair trawl
REBYC-II CTI	Strategies for Trawl Fisheries Bycatch Management (GCP/RAS/269/GFF) project
SEAFDEC	Southeast Asian Fisheries Development Center
THB	Thai Baht

INTRODUCTION

The "Strategies for Trawl Fisheries Bycatch Management – REBYC-II CTI" is a four-year collaborative project between the Department of Fisheries (DOF), Food and Agriculture Organization of the United Nations (FAO) and the Southeast Asian Fisheries Development Center (SEAFDEC). The project is funded by the Global Environment Facility (GEF) and executed by FAO with additional support by the governments of the five participating countries (Indonesia, Papua New Guinea, the Philippines, Viet Nam and Thailand), private sector, and regional and international organizations.

The key objective of the REBYC-II CTI Project is to build management approaches to trawl fishing that will result in sustainable marine resources and livelihoods and provide income, food security, and the balance of marine ecosystems within the project areas. The project activities focus on reducing trawl fisheries bycatch and the overall impact of trawl fisheries on biodiversity and environment through a participatory process of marine resources management by stakeholders in the project area.

Trawl bycatch includes juveniles of economically valuable fish species which are not in marketable size and are sold as trash fish (e.g. mackerel, threadfin bream and bigeye), true trash fish which are non-commercial species (e.g. *Siganus* spp., *Leiognathus* spp. and cardinal fish) and unwanted invertebrate species such as echinoderms and crustaceans (Noranarttragoon, 2014). Trash fish or 'Pla Ped' (local name) consists of small sizes of economic fish species, which are low quality because of fishing and harvest handling methods, in addition to small adult fish with low economic value that are used in preparation of fishmeal for animal feed and fish feed for aquaculture. The volume of trash fish sent directly to the fishmeal plants was not included in the Statistics of Marine Fish at Landing Place by DOF (DOF, 2013a).

During the Project, the following activities were conducted in two project sites in Thailand:

1. Experiment on enlarging trawl codend mesh size in the areas of Prachuap Khiri Khan and Chumphon Provinces, conducted by Chumphon Marine Fisheries Research and Development Center in Chumphon (CMDEC); and
2. Survey and research for the purpose of demarcation of conservation zone for juvenile fish and breeding stocks in the area of Trat Province, conducted by the Eastern Marine Fisheries Research and Development Center in Rayong (EMDEC).

This socio-economic study was conducted to support the implementation of the recommendations made by the REBYC-II CTI Project in the two project sites in Thailand. At the first site the project focused on trawl fisheries while at the second site small-scale fisheries and medium to large-scale fisheries were included. These respondent targets were set according to the different objectives and activities conducted at each site. The two case studies are presented in two parts, **PART I**: Socio-economic status of trawl fishers in Prachuap Khiri Khan Province and Chumphon Province, Thailand, and **PART II**: Socio-economic status of fishers in Trat Province, Thailand. Lessons learned and recommendations for future socio-economic studies are presented.

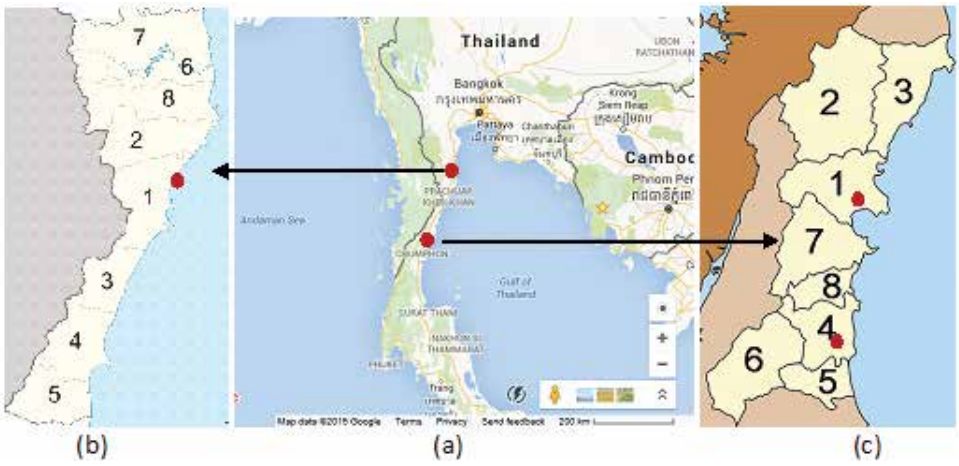
PART I: SOCIO-ECONOMIC STATUS OF TRAWL FISHERS IN PRACHUAP KHIRI KHAN PROVINCE AND CHUMPHON PROVINCE, THAILAND

1.1 Overview of the project site

The first project site of the REBYC-II CTI for trawl fisheries management is in Prachuap Khiri Khan Province and Chumphon Province, which are located in the upper part of the Western Gulf of Thailand (Figure 1-1). Prachuap Khiri Khan Province has the longest coastline in Thailand (251 km), while the length of the Chumphon coastline is 222 km (http://www.mkh.in.th/index.php/2010-03-22-18-06-15). The neighboring

provinces of Prachuap Khiri Khan are Phetchaburi to the north and Chumphon to the south, while the neighboring provinces of Chumphon are Prachuap Khiri Khan (north), Surat Thani (south) and Ranong (west). To the west there is a border with Myanmar while to the east is the Gulf of Thailand.

FIGURE 1-1
Study area of REBYC-II CTI project in Prachuap Khiri Khan and Chumphon Provinces



Source: (a) Study area of REBYC-II CTI: Prachuap Khiri Khan Province and Chumphon Province in the southern Gulf of Thailand (google.co.th); (b) Mueang Prachuap Khiri Khan District (No.1) in Prachuap Khiri Khan Province (wikipedia.org); (c) Mueang Chumphon District (No.1) and Lang Suan District (No.4) in Chumphon Province (wikipedia.org)

1.2 Objectives of the study

This study was carried out to investigate the "Socio-Economic Status of Trawl Fishers in Prachuap Khiri Khan Province and Chumphon Province, Thailand". The specific objectives of this study are:

1. To review existing socio-economic data relating to trawl fisheries in Prachuap Khiri Khan and Chumphon Provinces, Thailand.
2. To analyse the data from the survey on socio-economic status of trawl fishers in Prachuap Khiri Khan and Chumphon Provinces.

1.3 Methodology

1.3.1 Review of existing socio-economic data on trawl fisheries in Prachuap Khiri Khan and Chumphon Provinces, Thailand

Existing socio-economic data on trawl fisheries in Prachuap Khiri Khan and Chumphon Provinces were collected from DOF at central and local offices, statistical records and relevant agencies. Socio-economic data of trawl fisheries included: the number of fishers and fishing boats; landing sites; fish prices; and related data on trawl fishers in Prachuap Khiri Khan and Chumphon Provinces.

1.3.2 Survey on socio-economic status of trawl fishers in Prachuap Khiri Khan and Chumphon Provinces

Activities undertaken prior to the study

The following activities were undertaken prior to the conduct of the study:

- REBYC-II CTI Advisory Board Meeting on 18 October 2013. In the meeting an overview and background of the project were presented. This enabled the researcher to develop a deeper understanding of the project and its goals.
- REBYC-II CTI Stakeholder Consultation Meeting in Chumphon on 7 November 2013. During the meeting, the researcher had the opportunity to meet with the key stakeholders, e.g. officers of the Fisheries Provincial Offices of the two provinces and Chumphon Coastal Research and Development Center, to discuss and introduce the objectives and scope of the study.
- Data collected on the number of fishing licences for trawl fishing gears recorded in Prachuap Khiri Khan Province and Chumphon Province that were provided by the officers of the Fisheries Provincial Officers in the two provinces. The number of fishing licences issued was used for planning of sampling design.
- The interview schedule was developed based on the study objectives. This interview schedule was translated into Thai language by the researcher prior to the pre-test activity.
- The interview schedule was tested and enumerator training was conducted at CMDEC on 2 July 2014.
- The interview schedule was revised following field-testing (**Appendix I**).

Methods and coverage in terms of content

The data collection used a structured interview schedule (**See Appendix I**). Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia (SocMon SEA) (Bunce and Pomeroy, 2003) was used as a guideline for development of the interview schedule, which included three sections: (1) General background information on the respondents; (2) Fishing activities, catch, income, and cost of trawl fishing in the last year; and (3) Respondent's perceptions of fisheries resources conditions, threats, laws and regulations and participation in decision making, and their thoughts on trawl fishing in the future. The interviews were conducted by the officers of CMDEC during August - November 2014. Descriptive statistics were used for data analysis to summarize household responses to the interview schedule. The statistical analysis was done using SPSS 13.0 software (SPSS Inc., Chicago, Illinois, U.S.A.).

Methods and coverage in terms of area

There are four main landing sites/fishing ports in Prachuap Khiri Khan and Chumphon Province (**see section 1.4.1**). The interviews with trawl fishers were conducted in three out of these four fishing ports. The three fishing ports were selected based on guidance from the fisheries officers of CMDEC.

Figure 1-1 (b) shows the location of Ao Noi Bay Fishing Port in Mueang Prachuap Khiri Khan District (No.1) in Prachuap Khiri Khan Province and **Figure 1-1 (c)** shows the locations of Pak Nam Fishing Port in Mueang Chumphon District (No.1) and Pak Nam Fishing Port in Lang Suan District (No.4) in Chumphon Province.

1.4 FINDINGS

1.4.1 Review of existing socio-economic data on trawl fisheries in Prachuap Khiri Khan and Chumphon Provinces, Thailand

Number of trawl fishers and numbers of fishing licences for trawl fishing gear in Prachuap Khiri Khan and Chumphon Provinces

The number of fishing vessels registered for trawling in Prachuap Khiri Khan and Chumphon during 1990-2011 were reviewed by Noranarttragoon (2014) in the

baseline report "Review of the Trawl Fisheries in Prachuap Khiri Khan and Chumphon Province, Thailand", REBYC-II CTI; GCP/RAS/269/GFF. The total number of registered trawl vessels has reduced from approximately 120 to 22 in Prachuap Khiri Khan and from 500 to 150 in Chumphon. Otter board trawlers (OBT) were the most common type of trawl vessels registered in the two provinces compared to other types of trawl boats (pair trawlers (PT) and beam trawlers (BT). In 2013, the Marine Fisheries Research and Development Bureau (MFRDB), DOF investigated the difference in the number of registered vessels and actual number of vessels operating. For example, the number of registered OBT in the Gulf of Thailand was recorded at 1 875 vessels while the number reported by MFRDB was 2 034 boats (MFRDB, 2013).

During the planning phase for the design of this socio-economic study (in 2014) the most recent records of fishing licences for trawl fishing gear including OBT and PT at the Fisheries Provincial Offices in Prachuap Khiri Khan Province and Chumphon Province for the fishing period between 1 April 2013 and 31 March 2014 showed 150 fishing licences for OBT (96.2 percent) and only 6 fishing licences for PT (3.8 percent). These OBT licences include OBT otter board with boom trawl (OBBT) and beam trawl (BT). The number of trawl fishers (or licensee or person who is granted a licence to conduct or operate trawl) for OBT and PT was 113 (97.4 percent) and 3 (2.6 percent) respectively. It is noted that the number of trawl fishers (licensees) described in **Table 1-1** is smaller than the number of fishing licences for trawl because some of trawl fishers were granted more than one fishing licence to operate trawls. The total number of licences for all types of trawl in Chumphon is much higher than in Prachuap Khiri Khan (133 compared to 23) (**Table 1-1**). See figures of different types of trawl fisheries in **Appendix II**.

TABLE 1-1
Numbers of trawl fishers and numbers of fishing licences for OBT and PT recorded at fisheries provincial offices in Phachuap Khiri Khan and Chumphon (1 April 2013 – 31 March 2014)

Fisheries Provincial Office	Types of trawl fishing gears licensed at Fisheries Provincial Offices					
	Otter board trawl (OBT)*		Pair trawl (PT)		Total (OBT & PT)	
	Number of trawl fishers	Number of fishing licences for OBT	Number of trawl fishers	Number of fishing licences for PT	Number of trawl fishers	Number of fishing licences
Prochuap Khiri Khan	16 (13.8%)	21 (13.5%)	1 (0.9%)	2 (1.3%)	17 (14.7%)	23 (14.7%)
Chumphon	97 (83.6%)	129 (82.7%)	2 (1.7%)	4 (2.6%)	99 (85.3%)	133 (85.3%)
Total	**113 (97.4%)**	**150 (96.2%)**	**3 (2.6%)**	**6 (3.8%)**	**116 (100.0%)**	**156 (100.0%)**

* including Otter Board Trawl (OBT), Otter Board with Boom Trawl (OBBT), and Beam Trawl (BT)
Source: Prachuap Khiri Khan and Chumphon Fisheries Provincial Offices, DOF, 2014.

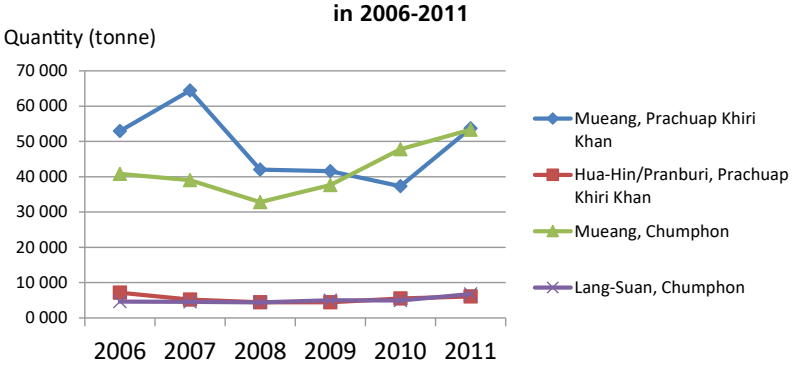
Landing sites in Prachuap Khiri Khan and Chumphon Provinces

There are four main landing sites in Prachuap Khiri Khan and Chumphon Provinces. The landing sites are Mueang – Prachuap Khiri Khan, Hua Hin/Pranburi – Prachuap Khiri Khan, Mueang – Chumphon, and Lang Suan – Chumphon. The total marine fish catch recorded by the landing sites in quantity (tonnes) and value (1 000 Thai Baht [THB][1]) in 2006-2011 are presented in **Figure 1-2** and **Figure 1-3** (DOF, 2013c). It is noted that the total quantity and value of marine fish catch were calculated from a variety of different types of fishing gears, including trawl, landed at the main landing sites. In the period between 2006 and 2011, the quantity and value of marine fish recorded at landing places in Mueang – Prachuap Khiri Khan and Mueang –

[1] Thai Baht or THB is the currency of Thailand. Annual average exchange rate between Thai Baht and US Dollar was 32.48 in 2014 (during the data collection period).

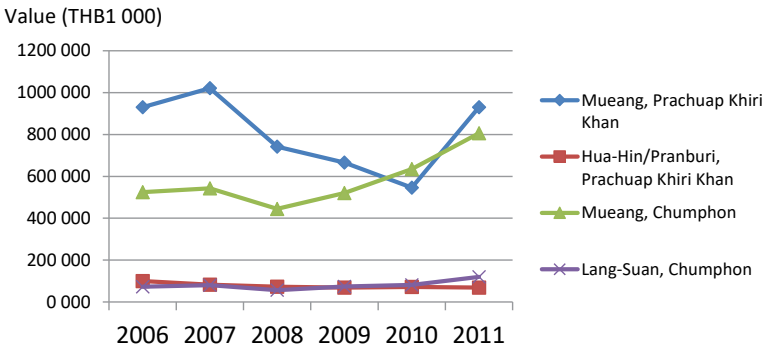
Chumphon were higher than the other two sites (approximately 30 000 - 64 000 tonnes, compared to less than 10 000 tonnes and THB 400 - 1 000 million, and less than THB 200 million) (for more details see **Appendix III**).

FIGURE 1-2
Total landing of marine fish by landing place in quantity (tonnes) in 2006-2011



Source: DOF. 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages.

FIGURE 1-3
Total landing of marine fish by landing place in value (THB 1 000) in 2006-2011



Source: DOF. 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages.

Fish prices

The price of marine fish at the landing sites for the years 2006 to 2011 are shown in **Table 1-2.** The average price of giant tiger prawn, banana shrimp, and green tiger prawn were higher than for other marine fish (THB 220-263 per kilogram). For fish such as tunas, snapper, and king mackerel the average prices were higher than for other fish (THB 88-188 per kilogram). The average price of crab was THB 73 per kg. The price of 'trash fish' ranged between THB 4.77 and 7.17 per kilogram – average price was THB 5.66 per kilogram. The 'trash fish' price has been increasing since 2006 (**Table 1-2**).

TABLE 1-2
Price of marine fish at landing place in 2006-2011 (THB per kg)

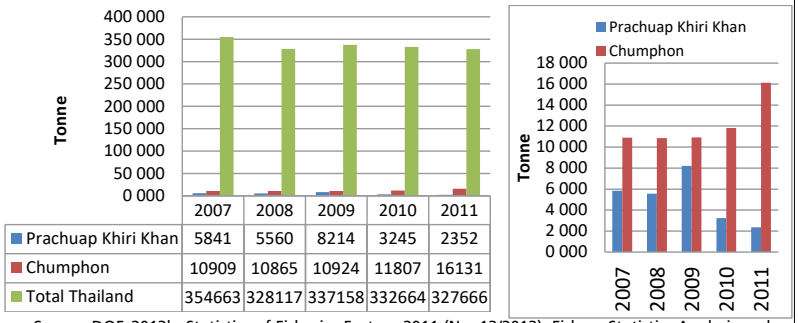
	2006	2007	2008	2009	2010	2011	Average**
Indo Pacific mackerel	30.21	30.51	32.87	32.44	36.29	38.65	33.50
Indian mackerel	26.18	26.07	25.56	27.71	31.20	36.31	28.84
King mackerel	86.53	87.44	87.90	83.62	88.01	92.56	87.68
Longtail tuna & Eastern little tuna	29.00	32.62	32.93	34.75	36.12	38.69	34.02
Round scads	18.51	20.88	19.11	19.39	22.60	31.28	21.96
Hardtail scads	18.72	18.28	18.80	20.15	21.32	22.45	19.95
Trrevallies	19.16	19.62	20.35	20.97	22.43	24.32	21.14
Sardines	9.35	9.50	11.02	11.24	12.25	14.58	11.32
Anchovies	6.66	7.23	8.32	9.05	10.76	10.35	8.73
Tunas*	-	-	192.81	192.53	190.20	174.32	187.47
Threadfin breams	23.06	23.21	24.00	25.62	26.99	27.42	25.05
Lizard fish	14.91	14.32	15.31	16.52	17.08	19.68	16.30
Snapper	91.56	88.62	88.75	95.54	100.35	105.53	95.06
Big-eyes	15.17	13.64	14.69	16.67	17.82	20.04	16.34
Other food fish	46.06	43.36	37.48	35.35	32.95	32.14	37.89
Trash fish	4.77	5.00	5.28	5.59	6.13	7.17	5.66
Banana shrimp	244.79	245.47	249.56	245.31	232.11	230.55	241.30
Giant tiger prawn	264.78	258.18	260.13	247.64	273.26	270.24	262.37
Green tiger prawn	240.86	238.26	226.59	220.23	200.30	209.93	222.70
School prawn	122.90	114.52	111.67	115.98	121.36	121.24	117.95
Other shrimp	59.53	63.91	64.56	67.76	63.61	71.12	65.08
Mantis shrimp & lobster	128.37	122.49	117.31	133.67	142.39	143.08	131.22
Crabs	62.36	57.47	70.47	75.17	86.65	88.52	73.44
Squid	68.11	66.93	63.68	60.11	65.51	76.58	66.82
Cuttlefish	65.04	60.48	60.62	57.19	64.51	72.63	63.41
Octopus	39.10	37.10	37.68	38.35	42.17	48.92	40.55
Bigfin reef squid	78.54	79.92	73.50	73.03	66.86	82.31	75.69
Shellfish	37.86	32.29	32.36	23.51	35.28	25.49	31.13

* Price of Tunas at Phuket landing place by Fish Marketing Organization.
** Average price was calculated from the prices recorded in 2006-2011.
Source: DOF. 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages.

Fishmeal

Figure 1-4 presents the production of fishmeal in Prachuap Khiri Khan, Chumphon and Thailand from 2007 to 2011. The production of fishmeal in the two provinces is very small contributing between 1.5-3.6 percent of the total fishmeal production in Thailand. Since 2007, the production of fishmeal in Prachuap Khiri Khan has

FIGURE 1-4
Production of fishmeal by province, 2007-2011



	2007	2008	2009	2010	2011
Prachuap Khiri Khan	5841	5560	8214	3245	2352
Chumphon	10909	10865	10924	11807	16131
Total Thailand	354663	328117	337158	332664	327666

Source: DOF. 2013b. Statistics of Fisheries Factory 2011 (No. 13/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 36 pages.

been lower than in Chumphon, where the production has been increasing, while in Prachuap Khiri Khan, fishmeal production has been decreasing since 2007. Overall, the production of fishmeal in Thailand has slightly decreased since 2007 (DOF, 2013b).

1.4.2 Survey on socio-economic status of trawl fishers in Prachuap Khiri Khan Province and Chumphon Province

The objective of the survey was to study the socio-economic status and perceptions of trawl fishers in Prachuap Khiri Khan Province and Chumphon Province for informing sustainable trawl fisheries management. Key findings of the survey are described and discussed below.

Respondents

Thirty respondents were interviewed at the three main fishing ports by the officers of Chumphon Coastal Research and Development Center between August and November 2014: 24 respondents were interviewed at fishing ports in Chumphon (80 percent) and the remaining respondents were interviewed in Prachuap Khiri Khan (20 percent) (**Table** 1-3). This is similar to the proportion of trawl fishers and trawl licences in Chumphon and Prachuap Khiri Khan, which is about 85:15 (**Table** 1-1).

TABLE 1-3
Number of respondents by fishing ports in study area

Fishing ports	OBT*	BT	PT	Total
Ao Noi Fishing Port, Mueang Prachuap Khiri Khan, Prachuap Khiri Khan	5 (16.7%)	0 (0%)	1 (3.3%)	6 (20%)
Pak Nam Fishing Port at Mueang Chumphon, Chumphon	14 (46.7%)	0 (0%)	4 (13.3%)	18 (60%)
Pak Nam Fishing Port at Lang Suan District, Chumphon	0 (0%)	6 (20.0%)	0 (0%)	6 (20%)
Total	**19 (63.3%)**	**6 (20.0%)**	**5 (16.7%)**	**30 (100%)**

* including Otter Board Trawl (OBT), Otter Board with Boom Trawl (OBBT)

General information on the respondents

The average age of trawl respondents was 50 years with a range of 30-82 years. This implied that young people may not be interested in trawl fishing or they may have other options for supporting their livelihood. The average number of family members was 4.6 (2.6 male and 2.0 female members) and the average number of family members who were involved in trawl fishing was 1.6 (1.2 male and 0.4 female members) (**Table 1-4**).

Most respondents in all groups were male (73.3 percent). All respondents in the PT group and the majority of respondents in OBT group (73.7 percent) were male. However, half of the respondents in BT group were female. All of the respondents were Buddhists. The majority of the respondents in all groups had education to elementary level (66.7 percent). In BT a third of the respondents (33 percent) had attained bachelor degree level. Overall the main occupation of the respondents was OBT and OBBT fishing (63.3 percent), followed by BT fishing (20 percent) and PT fishing (16.7 percent). The majority of respondents across the three groups had no second occupation (70 percent). All PT respondents, the majority of OBT respondents (68.4 percent), and half of BT respondents, had no secondary occupation. The majority of the respondents owned their boat (70 percent for overall), particularly in BT respondents (83.3 percent) and OBT respondents (73.7 percent), while the majority of PT respondents were hired as captains (60 percent). More than half of the respondents

or their family members (53.3 percent) were members of stakeholder organization such as Trawl Fisheries Association, Ruam Jai Fisheries Association, and Pak Nam Lang Suan Fisheries Association that participated in co-managing trawl fisheries (**Table 1-4**).

TABLE 1-4
General information on the respondents

Items	OBT (n=19)	BT (n=6)	PT n=5)	Overall (233)
	Mean (Min -Max)			
Age	50.6 (30-64)	52.2 (35-82)	49.4 (37-66)	50.8 (30-82)
Number of household members (including respondent)				
• Total	5.1 (3-9)	3.8 (1-7)	3.8 (2-5)	4.6 (1-9)
• Male	3.0 (2-5)	2.0 (0-5)	1.8 (0-5)	2.6 (0-5)
• Female	2.1 (1-4)	1.8 (1-3)	2.0 (1-3)	2.0 (1-4)
Number of household members involved in trawl fishing (including respondent)				
• Total	1.7 (1-6)	1.7 (1-3)	1.2 (1-2)	1.6 (1-6)
• Male	1.2 (1-3)	1.2 (0-3)	1.2 (1-2)	1.2 (0-3)
• Female	0.5 (0-3)	0.5 (0-1)	0.0 (0-0)	0.4 (0-3)
	In percentages			
Gender				
• Male	73.7	50.0	100.0	73.3
• Female	26.3	50.0	0.0	26.7
Religion				
• Buddhist	100.0	100.00	100.0	100.0
Education				
• Elementary	78.9	50.0	40.0	66.7
• Secondary school or equivalent	10.5	0.0	20.0	10.0
• High school or equivalent	5.3	16.7	40.0	13.3
• Bachelor degree	5.3	33.3	0.0	10.0
Main occupation (based on time spent)				
• OBT & otter board with boom trawling	100.0	0.0	0.0	63.3
• Beam trawling	0.0	100.0	0.0	20.0
• Pair trawling	0.0	0.0	100.0	16.7
Secondary occupation (based on time spent)				
• None	68.4	50.0	100.0	70.0
• Pair trawl fishing	5.3	0.0	0.0	3.3
• Others (sellers, restaurant owners)	26.3	50.0	0.0	26.7
Relation to the boat owners				
• Owners	73.7	83.3	40.0	70.0
• Family members or relatives of owners	10.5	16.7	0.0	10.0
• Captains	15.8	0.0	60.0	20.0
Membership of stakeholder organizations managing trawl fisheries				
• No	36.8	50.0	60.0	43.3
• Yes	57.9	50.0	40.0	53.3
• No answer	5.3	0.0	0.0	3.3

Fishing activities, catch, income, and cost of trawl fishing of the last year by types of trawl fishing

a) Boat length, codend mesh size, and fishing activities by types of trawl fishing

The average length of trawlers was 17.5 meters. Pair trawls were, on average, larger (22.1 m) than otter board (16.9 m) and beam trawlers (15.8 m). The average mesh size

of the codend was 2.8 cm (ranging from 2-4 cm). Average codend mesh sizes of PT and OBT were similar (2.4 and 2.5 cm) while the average codend mesh size of BT was larger (3.9 cm) (**Table 1-5**).

The average number of trips in a month was 3.3. On a monthly basis, BT were operated more often than the other two types (4.8 trips per month compared with 3 trips by OBT and 3.4 trips by PT) but had fewer days per trip (5.6 compared to 7.4 days for PTs and 9.6 days for OBT). PT had fewer hauls per trip (23.2 compared with 38.6 and 41) but a longer time spent per haul (6.6 hours per haul compared with 2 hours by BT and 5.8 hours by OBT) (**Table 1-5**).

The respondents operated their trawl fishing activities throughout the year with an average of 10.2 months. Almost all of the respondents who used BTs operated their trawls throughout the year. All of the thirty respondents operated their trawl fishing during the period between May and September (**Table 1-5** and **Table 1-6**).

TABLE 1-5
Boat length, codend mesh size, and fishing activities by types of trawl fishing (Mean (Min-Max))

Items	OBT (n=19)	BT (n=6)	PT (n=5)	Overall (n=30)
Boat length (Overall length)(m)	16.9 (15-22.5)	15.8 (15-18)	22.1 (21-23)	17.5 (15-23)
Codend mesh size (cm) (<4 cm = 87%, 4 cm = 13%)	2.5 (2-3)	3.9 (3.8-4)	2.4 (2-2.5)	2.8 (2-4)
Total number of months fishing undertaken by the trawl vessel (month/year)	9.4 (7-12)	11.8 (11-12)	11 (9-12)	10.2 (7-12)
Number of trips per month (trip/month)	3 (2-4)	4.8 (4-7)	3.4 (3-4)	3.3 (2-7)
Number of days per trip (day/trip)	9.6 (4-19)	5.6 (4-7)	7.4 (7-8)	8.8 (4-19)
Number of hauls per trip (haul/trip)	38.6 (20-70)	41 (30-60)	23.2 (21-25)	37.1 (20-70)
• Day time (haul/day)	2.0 (2-2)	3.8 (2-5)	2.0 (2-2)	2.3 (2-5)
• Night time (haul/day)	2.0 (2-2)	3.8 (3-5)	1.0 (1-1)	2.2 (1-5)
Number of hours per haul (hour/haul)	5.8 (5-6)	2 (2-2)	6.6 (5-8)	5.2 (2- 8)
• Day time (hour/haul)	5.8 (5-6)	2 (2-2)	5.6 (5-6)	5.0 (2- 6)
• Night time (hour/haul)	5.8 (5-6)	2 (2-2)	8.6 (8-10)	5.5 (2-10)

TABLE 1-6
Months fishing undertaken by each type of trawler

Months fishing undertaken by the trawl vessel	OBT (n=19)	BT (n=6)	PT (n=5)	Overall (n=30)
January	16 (84.2%)	6 (100%)	4 (80%)	26 (86.7%)
February	9 (47.4%)	5 (83.3%)	5 (100%)	19 (63.3%)
March	8 (42.1%)	6 (100%)	5 (100%)	19 (63.3%)
April	8 (42.1%)	6 (100%)	5 (100%)	19 (63.3%)
May	19 (100%)	6 (100%)	5 (100%)	30 (100%)
June	19 (100%)	6 (100%)	5 (100%)	30 (100%)
July	19 (100%)	6 (100%)	5 (100%)	30 (100%)
August	19 (100%)	6 (100%)	5 (100%)	30 (100%)
September	19 (100%)	6 (100%)	5 (100%)	30 (100%)
October	17 (89.5%)	6 (100%)	5 (100%)	28 (93.3%)
November	13 (68.4%)	6 (100%)	3 (60%)	22 (73.3%)
December	13 (68.4%)	6 (100%)	3 (60%)	22 (73.3%)

Shaded areas represent months when 100 percent of respondents of each fishing gear type were fishing.

b) Target species by types of trawl fishing

The median total catch of target species was 6 850 kg per trip. The total catch of target species caught by PT was larger than for the other two types of trawl (5 times compared to OBT and 23 times compared to BT). The minimum total catch amount of target species (kg/trip) were 550 kg in beam trawling and the maximum 54 600 kg in otter board trawling (**Table 1-7**). The target species of OBT and PT were threadfin breams, Indian mackerel and other food fish while the target species of BT were shrimps including banana shrimp and school prawn. Squid was caught more by PT and scallop was more likely to be caught by OBT than by the other types of trawl.

TABLE 1-7
Total catch amount of target species by types of trawl fishing (kg/trip)

Total catch amount of target species (kg/trip)	OBT (n=19)	BT (n=6)	PT (n=5)	Overall (n=30)
Median*	6 900	1 425	33 500	6 850
Mean	10 775	1 266	35 000	12 911
Min	3 750	550	19 000	550
Max	54 600	1 700	50 000	54 600
SD	12 934	447	11 897	15 443

*used median as the central value to represent the data

c) 'Trash fish' by types of trawl fishing

The average ''trash fish' catch by trawl fishing was 2 465 kg/trip. The overall percentage (by weight) of 'trash fish' in the total catch for each trawling trip was 42 percent. The percentage of 'trash fish' caught by pair trawling was higher than for other types of trawling (53 percent compared to 38 percent by otter board trawling and 14.5 percent by beam trawling) (**Table 1-8**). The average price of 'trash fish' was THB 5.5 per kg (Min=4.5 and Max=7). The 'trash fish' catch included juveniles of economic fish, such as threadfin breams and mackerel, as well as juveniles of shrimp.

TABLE 1-8
Percentage of trash fish catch and average trash fish catch amount (kg) by different types of trawl fishing

	OBT (n=19)	BT (n=6)	PT (n=5)	Overall (n=30)
Trash fish catch amount (% of total catch (by weight) from each trip)				
Median*	38	14.5	53	42
Mean	41.3	14.5	54.2	41.7
Min	22	6	43	6
Max	70	23	70	70
SD	14.4	12	10.8	16.2
Average trash fish catch amount (kg/trip)				
Median*	2 430	100	20 000	2 465
Mean	4 693	100	19 200	7 129
Min	1 200	100	10 000	100
Max	25 000	100	30 000	30 000
SD	6 419	0	7 981	8 801

*Used median as the central value to represent the data

Table 1-9 shows the main operating costs of trawling, which includes labor, fuel, and ice, and the average income per trip.

Pair trawling required the most labor for operating (18-20 persons per trip). Generally, for trawling, there were more foreign workers hired than Thai nationals and there were more permanent workers hired than temporary workers. The average salary for a captain and other workers were THB 25 000 and THB 8 000 per month,

respectively. A captain usually received approximately 6.3 percent (range from 5 to 10 percent) of the total amount of money received from selling fish caught per trip as an extra income.

All respondents perceived the cost of fuel as the highest single cost in trawl fishing operations (67 percent of the total cost). The average fuel cost was about THB 60 000 per trip. This was much higher for pair trawlers compared to the other two types (THB 350 000 per trip per boat compared to THB 60 000 and THB 65 875 for otter board trawlers and beam trawlers). The average cost of ice was THB 8 000 per trip and pair trawlers spent more on ice than other types of trawlers (THB 12 000 per trip compared with THB 4 000 by BT and THB 7 600 by OBT) (**Table 1-9**).

The average income of trawl fishing was THB 140 000 per trip. PT fishers received the highest income (THB 700 000/trip) compared with THB 140 000 for OBT fishers and THB 130 000 for BT fishers (**Table 1-9**).

TABLE 1-9
Main operating costs and income by types of trawl fishing (Mean (Min- Max))

Items	OBT (n=19)	BT (n=6)	PT (n=5)	Overall (n=30)
Total number of workers hired for trawl fishing (person/trip)	7.9 (5-20)	6.3 (5-7)	19.6 (18-20)	9.6 (5-20)
Nationality				
• Thai nationals (persons)	2.7 (1-7)	1.5 (1-2)	4.6 (2-6)	2.8 (1-7)
• Foreigners (persons)	5.3 (0-15)	4.8 (4-5)	15 (12-18)	6.8 (0-18)
Type of workers				
• Permanent (persons)	6.3 (1-20)	4 (1-7)	11.4 (5-20)	6.7 (1-20)
• Temporary (persons)	1.6(0-9)	2.3 (0-5)	8.2 (0-15)	2.9 (0-15)
Position				
• Captain (persons)	1.1(1-2)	1 (1-1)	1.8 (1-2)	1.2 (1-2)
• Others(persons)	6.9(4-18)	5.3 (4-6)	15.8 (8-19)	8.1 (4-19)
Salary of workers hired for trawl fishing				
• Salary for captain (THB/month/person)	23 333* (15 000-30 000)	18 000 (18 000-18 000)	30 000* (25 000-30 000)	25 000* (15 000-30 000)
• % of product for captain	6.5 (5-10)	5.6 (5-8)	6.3 (5-10)	6.33 (5-10)
• Salary of other workers (THB/month/person)	7 600* (7 000-8 500)	7 750* (6 500-9 000)	8 000* (8 000-8 500)	8 000* (6 500-9 000)
Fuel cost (THB/trip)	60 000* (31 500-400 000)	65 875* (27 300-96 000)	350 000* 245 000-367 500)	60 000* (27 300-400 000)
• Total quantity fuel used (Liter/trip)	2 500* (1 500-20 000)	3 000* (1 300-4 000)	15 000* (9 800-17 500)	3 000* (1 300-20 000)
• Fuel price (THB/Liter)	23.6 (20-26)	22.4 (20.5-24)	23.8 (20-25)	23.4 (20-26)
• % of the total cost	66.9 (60-70)	62.5 (50-80)	72 (70-75)	66.9 (50-80)
Ice cost (THB/trip)	7 600* (5 100-32 000)	4 000* (2 400- 8 000)	12 800* (12 000-20 000)	8 000* (2 400-32 000)
• Total quantity of ice used (kg/trip)	7 600* (4 800-32 000)	4 000* (1 600-8 000)	12 800* (12 000-20 000)	8 000* (2 400-32 000)
• Ice price (THB/kg)	1 (1-1.2)	1.1 (1-1.52)	1 (1-1)	1.04 (1-1.5)
Average income per trip (THB/trip) (income before deducting expense)	140 000* (100 000-800 000)	130 000* (80 000-200 000)	700 000* (700 000–800 000)	140 000* (80 000-800 000)

*Used median as the central value to represent the data.

Most of the respondents perceived that the costs and incomes from their trawl fishing were either equal or very similar (66.7 percent). Only two respondents, who operated otter board trawlers, reported that their income was less than the costs. However, 83.3 percent of respondents were satisfied with the benefits from trawling and only 16.7 percent were not satisfied. The level of satisfaction of most of respondents (53 percent) was slightly satisfied (**Table 1-10**).

TABLE 1-10
Comparison between income and cost and respondent's satisfaction on the benefit returned based on respondents' perceptions

Cost and income	OBT (n=19)	BT (n=6)	PT (n=5)	Overall (n=30)
Comparison between income and cost of respondent's trawl fishing in the past 12 months				
• Income more than cost	4 (21.1%)	3 (50.0%)	1 (20.0%)	8 (26.7%)
• Income equal/very similar to cost	13 (68.4%)	3 (50.0%)	4 (80.0%)	20 (66.7%)
• Income less than cost	2 (10.5%)	-	-	2 (6.7%)
Total	**19 (100%)**	**6 (100%)**	**5 (100%)**	**30 (100%)**
Level of satisfaction on the benefit returned from respondent's trawl fishing the past 12				
• Not satisfied	5 (26.3%)	-	-	5 (16.7%)
• Slightly satisfied	9 (47.4%)	3 (50.0%)	4 (80.0%)	16 (53.3%)
• Moderately satisfied	4 (21.1%)	2 (33.3%)	1 (20.0%)	7 (23.3%)
• Highly satisfied	1 (5.3%)	1 (16.7%)	-	2 (6.7%)
Total	**19 (100%)**	**6 (100%)**	**5 (100%)**	**30 (100%)**

Respondent's perceptions of fisheries resource conditions, threats, laws and regulations and participation in decision making, and their trawl fishing in the future

a) Perceived fisheries resource conditions

Most of the respondents from all trawl groups perceived that the conditions of resources of fish (83.3 percent), shrimp (70 percent) and cephalopod (76.6 percent) were 'bad' or 'not good & not bad' (scale 2-3). Crab (33.3 percent) and Acetes shrimp (16.7 percent) resources were perceived to be in a 'very bad' condition (scale 1). Only shellfish (particularly scallop) was perceived to be in a 'very good' condition (scale 5). The perceptions of trawl respondents in each group were similar for conditions of fish (scale 2-3, which were 'bad' to 'not good & not bad'). Most BT respondents were more optimistic about the conditions of fish, shrimp, Acetes shrimp and crab than the other two trawl groups. Cephalopod was perceived to be in better condition by PT respondents than the conditions perceived by other two groups (80 percent compared to 26.3 and 66.7 percent for medium condition). OBT and PT respondents (40-42 percent) perceived shell/clam was to be in 'good' to 'very good' condition (scale 4-5) while no one in BT respondents perceived that shell/clam was in good condition (**Table 1-11**).

b) Perceived threats to fisheries resources

An increase in number of fishers and fishing gears was perceived as the most severe threat to fisheries resources by most respondents in all groups (56.7 percent for overall, 80 percent in PT, 57.9 percent in OBT, and 33.3 percent in BT). Other threats that were perceived to be the severe threats included marine pollution (20 percent), illegal fishing (6.7 percent) and others (16.7 percent) (e.g. threats by some fishing activities such as anchovy surrounding nets with light and anchovy falling nets with light) (**Table 1-12**).

c) Perceived laws and regulations and participation in decision making

All trawl respondents perceived that they know about the regulations and laws related to trawl fishing in their main fishing ground. Most respondents in all groups thought that trawl fishers complied with trawl fisheries regulations and laws (66.6 percent – ranked 4-5). Most PT respondents (80 percent) thought that most fishers fully complied (ranked 5) with fisheries law, while the largest proportion of respondents in OBT (36.8 percent) and BT (50 percent) perceived that most fishers highly complied with

fisheries laws (ranked 4). The enforcement of the trawl fisheries laws was ranked 3-4 by most respondents in all groups (76.7 percent). This perceived level of enforcement (ranked 3-4) was the same for perceptions of most OBT (79 percent) and BT respondents (100 percent), but the majority of PT respondents (80 percent) perceived that the enforcement level was low to moderate (ranked 2-3) (**Table 1-13**).

Most respondents in all groups (80-89.5 percent) participated in decision making processes for trawl fisheries management such as participating in public hearings. A public hearing is one of the requirements when the decision makers plan to change or introduce a new fisheries law or regulation into the area. However, the level of participation in decision-making was perceived to be low (ranked 2-3) by most respondents (70 percent). This is similar for all three groups (66.7-80 percent). Most respondents in all groups had attended meetings or listened to information about trawl fisheries management (60 percent). Most of OBT (63.2 percent) and PT (80 percent) respondents had attended the meetings while most BT respondents (66.7 percent) had never attended such meetings (**Table 1-13**).

d) Perceived future of their trawl fishing activities

When talking to the respondents about the future of their trawl fishing activities, it was found that more than two-thirds of the respondents (76.7 percent) mentioned that they could be able to continue with their trawl fishing activities. However, 26.3 percent of OBT and 40 percent of PT respondents thought that they could not continue with their activities (**Table 1-13**).

TABLE 1-11
Perceived fisheries resource condition in the respondent's main fishing ground

Types of resources	Respondent group*	Fishery resource condition scale** (%)						
		1	2	3	4	5	No answer	Total
Fish	OBT	21.1	31.6	47.4	0	0	0	100
	BT	0	16.7	83.3	0	0	0	100
	PT	20.0	40.0	40.0	0	0	0	100
	Total	16.7	30.0	53.3	0	0	0	100
Shrimp	OBT	31.6	31.6	31.6	5.3	0	0	100
	BT	0	16.7	83.3	0	0	0	100
	PT	20	40	20	0	0	20	100
	Total	23.3	30.0	40.0	3.3	0	3.3	100
Acetes shrimp	OBT	21.1	5.3	5.3	0	0	68.4	100
	BT	0	0	33.3	0	0	66.7	100
	PT	20	20	20	0	0	40.0	100
	Total	16.7	6.7	13.3	0	0	63.3	100
Crab	OBT	36.8	42.1	10.5	0	0	10.5	100
	BT	16.7	16.7	66.7	0	0	0	100
	PT	40.0	40.0	20.0	0	0	0	100
	Total	33.3	36.7	23.3	0	0	6.7	100
Cephalopod	OBT	21.1	42.1	26.3	10.5	0	0	100
	BT	16.7	16.7	66.7	0	0	0	100
	PT	0	20.0	80.0	0	0	0	100
	Total	16.7	33.3	43.3	6.7	0	0	100
Shell/calm	OBT	15.8	15.8	0	15.8	26.3	26.3	100
	BT	0	16.7	33.3	0	0	50	100
	PT	0	40.0	20.0	0	40.0	0	100
	Total	**10.0**	**20.0**	**10.0**	**10.0**	**23.3**	**26.7**	**100**

*Respondent group: OBT=Otter Board Trawl (n=19), BT=Beam trawl (n=6), PT=Pair trawl (n=5) and Total (n=30)
**condition scale: 1=very bad, 2=bad, 3=not good & not bad, 4=good, 5=very good

TABLE 1-12
Ranking of perceived threats to fisheries resources

Types of perceived threats to fisheries resources	Ranking of perceived threats to fisheries resources (%)											
	First most severe				Second most severe				Third most severe			
	OBT	BT	PT	Total	OBT	BT	PT	Total	OBT	BT	PT	Total
Increase in number of fishers & fishing gears	57.9	33.3	80	56.7	10.5	33.3	20.0	16.7	26.3	16.7	0	20.0
Illegal fishing	0	33.3	0	6.7	31.6	16.7	40.0	30.0	36.8	33.3	20.0	33.3
Natural disaster	0	0	0	0	0	16.7	0	3.3	0	0	0	0
Marine pollution	26.3	16.7	0	20.0	47.4	33.3	20.0	40.0	21.1	16.7	40.0	23.3
Others	15.8	16.7	20	16.7	5.3	0	20.0	6.7	0	0	0	0
No answer	0	0	0	0	5.3	0	0	3.3	15.8	33.3	40.0	23.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Respondent group: OBT=Otter board trawl (n=19), BT=Beam trawl (n=6), PT=Pair trawl (n=5) and Total (n=30)

TABLE 1-13
Perceived laws and regulations and participation in decision making

	OBT (n=19)	BT (n=6)	PT (n=5)	Total (n=30)
Awareness of rules and regulations				
• No (Not aware/Don't know)	0	0	0	0
• Yes (Aware/Know)	100	100	100	100
Compliance on a scale of 1 to 5 (to what extent do most fishers comply with trawl fisheries regulations & laws?				
• 1 = No compliance	0	0	0	0
• 2 = Low compliance	5.3	16.7	0	6.7
• 3 = Moderate compliance	31.6	16.7	20.0	26.7
• 4 = High compliance	36.8	50.0	0	33.3
• 5 = Full compliance	26.3	16.7	80.0	33.3
Enforcement: on a scale of 1 to 5, to what extent are the trawl fisheries laws enforced?				
• 1 = No enforcement	5.3	0	0	3.3
• 2 = Low enforcement	10.5	0	40.0	13.3
• 3 = Moderate enforcement	47.4	66.7	40.0	50.0
• 4 = High enforcement	31.6	33.3	0	26.7
• 5 = Full enforcement	5.3	0	0.0	6.7
Participation in decision making: on a scale of 1 to 5, to what extent do you participate in trawl fisheries management decision-making?				
• 1 = No participation	10.5	16.7	20.0	13.3
• 2 = Low participation	15.8	50.0	40.0	26.7
• 3 = Moderate participation	52.6	16.7	40.0	43.3
• 4 = High participation	5.3	0	0	3.3
• 5 = Full participation	15.8	16.7	0	13.3
Participation in a meeting or listening to information related to fisheries management				
• No (Never participated)	36.8	66.7	20.0	40.0
• Yes (Have participated)	63.2	33.3	80.0	60.0
Do you think that you can continue with current fishing activities forever?				
• No (cannot continue)	26.3	0	40	23.3
• Yes (can continue)	73.7	100	60	76.7

1.5 Conclusions and recommendations

Based on the review of existing data and survey results, the following conclusions and recommendations can be formulated.

- In the survey about 70 percent of respondents were boat owners and 20 percent were captains. This may have positively contributed to the level of reliability of the data collected during the survey. The respondents were likely to have good knowledge of fishing activities in their province given their responsibilities.

- Most of the respondents (70 percent) had no second occupation (50 percent of BT, 68.4 percent of OBT and 100 percent of PT respondents). Therefore, when the government introduces any measure that could have an impact on trawl fishing-based livelihoods, the government should prepare some compensation or other mitigation steps that can reduce the socio-economic impacts of the proposed measures.
- The increase of trawl codend mesh size would help to reduce the share of juveniles and trash fish in the catches. According to the National Council for Peace and Order's (NCPO) Order No. 24/2558 (24/2015) for additional measures for combating illegal, unreported and unregulated (IUU) fishing issued by the NCPO and entered into force on 5 August 2015, the possession of a trawl net with codend mesh sizes less than 5 cm is prohibited, because it is considered a destructive fishing gear. Nonetheless, according to the Notification of DOF, promulgated in the Royal Thai Government Gazette on 30 December 2015, the minimum allowed codend mesh size was revised from 5 cm to 4 cm. In effect, the codend mesh size of the trawl-net of most respondents (87 percent) in this study was less than 4 cm (2-2.5 cm for PT, 2-3 cm for OBT and 3.8-4 cm for BT), around 2-4 cm in overall. As a consequence most of the fishers should increase their current codend mesh sizes to comply with the new law.
- According to existing DOF data, the increase in trash fish price in Thailand may be one of the major challenges for the DOF when implementing the proposed measure to enlarge trawl codend mesh size. Higher prices encourage the capture of trash fish. The survey results showed that the average price of trash fish per kg is THB 5.5. Therefore, the estimated income from selling trash fish catch of BT, OBT and PT were approximately THB 550, THB 13 365 and THB 110 000 per trip (average trash fish catch amount by BT, OBT and PT were recorded as 100, 2 430 and 20 000 kg per trip, respectively). The potential reduction of this income due to enlargement of trawl codend mesh size should be considered when implementing this measure in the country. Without some compensatory mechanisms the enforcement of larger mesh may turn out to be extremely difficult.
- The highest share of the operating cost in trawl fishing is from fuel (67 percent of total cost overall, 63 percent of total cost for BT, 67 percent of total cost for BT, and 72 percent of total cost for PT). Any measures that reduce this cost would therefore be of benefit to trawler operators, and might thereby help the introduction of a larger minimum mesh size.
- Considering the socio-economic benefits returned from trawl fishing in the study area, most respondents were satisfied (although more than half of the respondents only claimed to be slightly satisfied). This result is consistent with the final question about the future of trawling. Most of the respondents (76.7 percent) said that they could continue with their trawling activities. This suggests that trawl fishing activities in the study area still provide benefits to the local community.
- In general, the condition of fisheries resources was perceived to be not good and the main threats to these resources were mainly an increase in number of fishers and fishing gear (i.e., increasing overall fishing effort). In addition, illegal fishing and marine pollution were also perceived as threats to fisheries resources. Rehabilitation measures for fisheries resources in addition to measures that prevent the impacts of these threats should be considered, implemented or strengthened.
- Issues about law enforcement and participation in decision-making should be strengthened in order to sustain trawl fisheries in the study area, for the future.

PART II: SOCIO-ECONOMIC STATUS OF FISHERS IN TRAT PROVINCE, THAILAND

1.3 Overview of the project site

The REBYC-II CTI project's study area for demarcation zone for juvenile fish and breeding stocks is in Trat Province in the upper Gulf of Thailand (**Figure 2-1**). Twenty four provinces (out of 77 provinces in Thailand) are grouped into five coastal zones. Trat is in Coastal Zone No. 1 along with Chantaburi and Rayong. The length of the Trat coastline is 184 km (DMCR, 2014). Trat Province includes 7 districts (Mueang Trat, Klong Yai, Khao Saming, Bo Rai, Laem Ngop, Ko Kut and Koh Chang), 38 sub-districts and 261 villages. Six out of seven districts are located on the coast (the exception being Bo Rai District). The total population in 2012 was 222 855, which is equivalent to 0.35 percent of the total population of Thailand) (Trat Provincial Office Website, 2015). Trat Province has 66 islands including Koh Chang, which is the third largest island in Thailand. In Trat, the total area of mangrove forests, seagrass beds and coral reefs are approximately 9 916 ha, 737 ha and 2 822 ha, respectively (DMCR: Central Database System and Data Standard for Marine and Coastal Resources Website, 2015).

FIGURE 2-1
Study area of REBYC-II CTI in Trat Province, Thailand

2.2 Objectives of the study

This study was carried out to investigate the "Socio-Economic Status of fishers in Trat Province, Thailand". The specific objectives of this study are:

1) To review existing socio-economic data of small-scale and commercial fishers in Trat Province, Thailand
2) To analyse the data from the questionnaire survey on socio-economic status of fishers (small-scale and commercial scale) in Trat province

2.3 Methodology

2.3.1 Review of existing socio-economic data of small-scale and commercial fisheries in Trat Province, Thailand

Existing socio-economic data on small-scale and commercial fishers in Trat Province was collected and collated from the Thai Department of Fisheries (DOF), at central and local offices, statistical records and from other relevant agencies. Socio-economic data included the number of fishers and fishing boats, landing sites, fish prices and related socio-economic data.

2.3.2 Survey on socio-economic status of fishers in Trat Province

Activities undertaken prior to the survey:

The following activities were undertaken prior to the start of the study:

- REBYC-II CTI Advisory Board Meeting on 18 October 2013. In the meeting an overview and background of the project were presented. This enabled the researcher to develop a deeper understanding of the project and its goals.

- REBYC-II CTI Stakeholder Consultation Meeting in Trat Province on 29 October 2013. During the meeting, the researcher had the opportunity to meet with key stakeholders, e.g. officers of the Trat Fisheries Provincial Office and EMDEC, to discuss and introduce the objectives and scope of the study.
- Data on the number of small-scale and commercial fishing households recorded at village level in Trat were collected from the Community Development Department (CDD) website (CDD, 2013). This was considered to be the most recent information, providing greater detail about fishers in Trat and was used for planning the sampling design. Another source of data on number of fishery household was from the '2000 Inter-censal Survey of Marine Fishery' by Office of the Prime Minister, National Statistical Office (NSO, 2000), although this was not used in the sampling design for this study as the data were considered to be out of date.
- According to the definitions of CDD (2013), small-scale fishery households are households whose fishing boats are not longer than 10 meters. Medium to large-scale fishery households are households that have fishing boats longer than 10 meters. In this study, the total number of fishery households in Trat in 2013 was 2 333. The sample size or the number of target household respondent in Trat (which was 219) was calculated by using an online sample size calculator based on the 95 percent Confidence level and Confidence interval of 6.31 (www.surveysystem.com Accessed on 8 September 2014). The target household respondent number of medium to large-scale fishery households was set as 35 to get sufficient data about the medium to large-scale fishery households. The remainder of the target respondents was 184 small-scale fishery households. These two fishery household groups were in different districts and stratified sampling was used to select the number of households in each district separately for each group. This sampling plan was provided to the EMDEC staff who conducted the data collection. The final number of fishery household respondents in this study was 233, including 193 small-scale fishery households and 40 medium to large-scale fishing households (Confidence level = 95 percent and Confidence interval = 6.09) (**Table 2-1**).
- The interview schedule was developed based on the study objectives and the aims of REBYC-II CTI Project.
- The details of the interview schedule that was translated into Thai by the researcher were discussed with EMDEC staff at DOF office in Bangkok in September 2014. The interview schedule is presented in **Appendix IV**. The expert evaluation was used as a method for pre-test of this interview schedule. The subject matter experts included National Technical Officer (NTO) and EMDEC staff (who conducted and led the interviews).

TABLE 2-1
Number of fishery households and number of respondents by district

District	Small-scale fishery households			Medium-Large-scale fishery households			Total in Trat		
	N*	n_1**	n_2***	N*	n_1**	n_2***	N*	n_1**	n_2***
Mueang Trat	911	76	70	120	32	33	1 031	108	103
Klong Yai	587	49	51	0	0	4	587	49	55
Khao Saming	198	17	19	0	0	0	198	17	19
Laem Ngop	250	21	28	11	3	2	261	24	30
Ko Kut	88	7	10	0	0	1	88	7	11
Ko Chang	168	14	15	0	0	0	168	14	15
Total	**2 202**	**184**	**193**	**131**	**35**	**40**	**2 333**	**219**	**233**

*N = Recorded fishery households by CDD (2013)
**n_1 = Target household respondent number
***n_2 = Household respondent number

Methods and coverage in terms of content

A structured interview schedule was used for data collection (see **Appendix IV**). Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia (SocMon SEA) (Bunce and Pomeroy, 2003) was used as a guideline for interview schedule development. The interview schedule included four sections: (1) general background information on the respondents; (2) fishing activities, catch, income and cost of fishing in the previous year; (3) respondent's perceptions of fisheries resources conditions, threats, laws and regulations and participation in decision making and their thoughts on fishing in the future; and (4) measures and options for fisheries management in Trat. The interviews were conducted by officers of EMDEC during September to October 2014. Descriptive statistics were used for the majority of the data analysis to summarize household responses to the interview schedule. Ordinal logistic regression analysis was used to identify the differences in respondents' perceptions on measures and options for fisheries management in Trat Province (significance level set as $\alpha = 0.05$ and 0.01). The statistical analysis was done using SPSS 13.0 software (SPSS Inc., Chicago, Illinois, U.S.A.).

2.4 Findings

2.4.1 Review of existing socio-economic data of fisheries in Trat Province, Thailand

Number of fishery households in Trat Province

The numbers of small-scale and medium to large-scale fishing households are presented in **Table 2-2**. The total number of fishery households in Trat, reported by CDD (2013), was 2 333, including 2 202 small-scale fishery households and 131 medium to large-

TABLE 2-2
Number of fishery households in Trat Province (CDD, 2013)

	District	Sub-district	Small-scale households		Medium to Large-scale households	
			Number	% (n=2 202)	Number	% (n=131)
1	**Mueang Trat**	Nhong Samet	42	1.91	0	-
		Nhong Sano	7	0.32	0	-
		Nhong Khansong	130	5.90	0	-
		Houng Nam Khao	140	6.36	0	-
		Ao Yai	310	14.08	0	-
		Wang Kra Jae	99	4.50	120	91.60
		Ta Kang	28	1.27	0	-
		Cham Rak	8	0.36	0	-
		Laem Klad	147	6.68	0	-
	Total		**911**	**41.37**	**120**	**91.60**
2	**Klong Yai**	Klong Yai	284	12.90	0	-
		Mai Root	303	13.76	0	-
	Total		**587**	**26.66**	**0**	**-**
3	**Khao Saming**	Saen Toong	59	2.68	0	-
		Tha Some	139	6.31	0	-
	Total		**198**	**8.99**	**0**	**-**
4	**Laem Ngop**	Laem Ngop	38	1.73	1	0.76
		Bang Pid	142	6.45	3	2.29
		Klong Yai	70	3.18	7	5.34
	Total		**250**	**11.35**	**11**	**8.40**
5	**Ko Kut**	Ko Mak	28	1.27	0	-
		Ko Kut	60	2.72	0	-
	Total		**88**	**4.00**	**0**	**-**
6	**Ko Chang**	Koh Chang	59	2.68	0	-
		Koh Chang Tai	109	4.95	0	-
	Total		**168**	**7.63**	**0**	**-**
Total	**6 Districts**	**20 Sub-districts**	**2 202**	**100.00**	**131**	**100.00**

scale fishing households. The number of small-scale fishing households was higher in Mueang Trat District compared to the other districts (41 percent for small-scale fishing households and 92 percent for medium-large-scale fishing households).

There are five coastal zones in Thailand. Trat is in Coastal Zone 1 along with Chantaburi and Rayong. The 2000 Inter-censal Survey of Marine Fishery, reported by the Fisheries Statistics of Thailand 2011 (DOF, 2013a), recorded the number of fishery households, fishing boats and fishermen as presented in **Table 2-3**. There were 6 389 fishers (during peak season) (3.8 percent of total number of fishers in Thailand) in Trat. Nearly 3 000 fishery households were recorded in Trat in 2000 (5 percent of fishery households in Thailand and 47 percent of fishing households in Coastal zone 1) (**Table 2-3**). The number of fishing households decreased by about 21.16 percent between 2000 and 2013 (from 2 959 (DOF, 2013a) to 2 333 (CDD, 2013), possibly as a result in decline in the productivity of the fishery.

Fishing gears in Trat

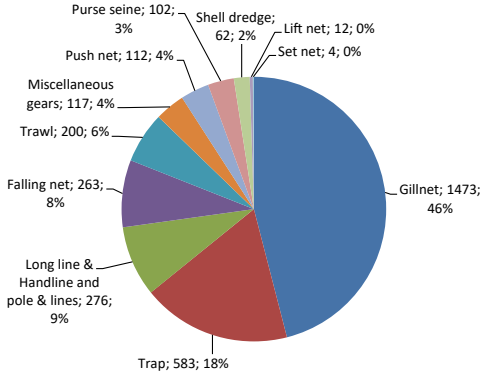
In 2000, there were 2 729 fishing boats in Trat (4.7 percent of total number of fishing boats in Thailand) (**Table 2-3**). The DOF recorded the number of fishing boats in Trat in 2011 and published the number on the 2011 Fishing Boat Survey Website managed by MFRBD (2016); this data is presented in **Figure 2-2**. The total number of fishing boats in Trat in 2011 was 3 204, which can be grouped into 11 types of fishing boats. Gillnetters were the most common type of fishing boat (1 473 boats corresponding to 46 percent of total number of fishing boats in Trat), followed by those using fish trap (583 boats or 18 percent), and longline & handline gears (276 boats or 9 percent). There were 200 trawlers (6 percent) and 112 push netters (4 percent). The number of fishing boats increased by about 17.4 percent between 2000 and 2011 (from 2 729 (DOF, 2013a) to 3 204 (MFRBD, 2016), despite the decline in the number of households involved in fishing (see **Table 2-2**).

TABLE 2-3
Excerpts of the 2000 Inter-censal Survey of Marine Fishery by NSO: Number of fishery households, fishing boats and fishermen during peak season in Trat, Coastal Zone 1, and Thailand

		Trat	Coastal Zone 1	Total for Thailand
No. of fishery households		2 959	6 351	57 801
No. of fishing boats	Total	2 729	6 200	58 119
	Non-powered boat	12	60	2 639
	Outboard powered boat	1 377	3 296	42 217
	Inboard powered boat	1 340	2 844	13 263
No. of fishers during peak season	Total	6 389	14 267	168 140
	Family member	3 842	8 402	80 857
	Employee	2 547	5 865	87 283

Source: DOF. 2013a. Fisheries Statistics of Thailand 2011: No. 11/2013. Information Technology Center, Department of Fisheries, Ministry of Agriculture and Cooperatives. 91 pages.

FIGURE 2-2
Types of fishing boats in Trat Province in 2011

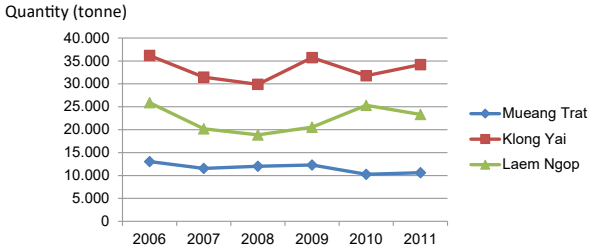


MFRBD website (2016) <http://www.platalay.com/boatsurvey2554/prvsearch.php>, Accessed on 20 Feb 2016.

Landing sites in Trat Province

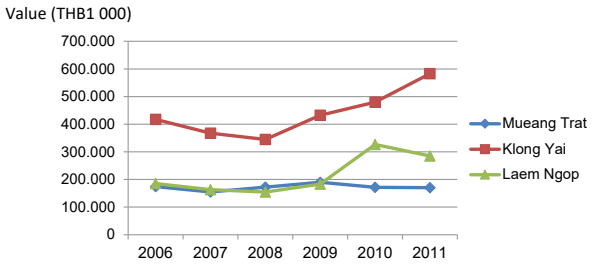
There were three main landing sites in Trat: Mueang Trat, Klong Yai and Laem Ngop. The total marine fish catch recorded by landing sites in quantity (tonne) and value (THB 1 000) between 2006 and 2011 are presented in **Figure 2-3** and **Figure 2-4**. Data on total quantity and value of marine fish from a variety of fishing gears landed at the main landing sites were collected by DOF. However the marine fish sent directly to freezing or processing plants was not recorded at the landing site by DOF. In the period between 2006 and 2011, the quantity and value of marine fish recorded at the landing site in Klong Yai was higher than the other two sites (31 460–36 180 tonnes in Klong Yai compared to 10 263–25 894 tonnes at the other two sites and THB 345–583 million in Klong Yai compared to THB 155–327 million) at the other two sites (For more details see **Appendix V**). It is noted that Klong Yai had higher quantity of marine fish landed (**Figure 2-3)** but had fewer fishery households than Mueang Trat (**Table 2-2**). The data of marine fish landed at main landing sites recorded by DOF in the period between 2006 and 2011 was collected from both Thai fishing vessels and foreign fishing vessels. Klong Yai is located closer to the border between Thailand and Cambodia than the other districts. The imported marine fish from Cambodian fishing vessels landing at Klong Yai could be an explanation for the higher quantity of marine fish landed at Klong Yai compared to Mueang Trat District.

FIGURE 2-3
Total landing of marine fish by landing place in quantity (tonne) in Trat in 2006-2011



Source: DOF 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages

FIGURE 2-4
Total value (THB 1 000) of marine fish landings by place in Trat in 2006-2011



Source: DOF 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages

2.4.2 Survey on socio-economic status of fishers in Trat Province

The objective of the survey was to study the socio-economic status and perceptions of fishers in Trat Province for demarcating a fishery conservation zone for juvenile fish and breeding stocks and for sustainable fisheries management. Key findings from the survey are described and discussed below.

Respondents

The total number of respondents was 233 including 193 from small-scale fishery households and 40 from medium to large-scale fishery households. Most of the

TABLE 2-4
Number of respondents by sub-district and district

District	Sub-district	Small-scale fishery households	Medium to Large scale fishery households	Total (n)	%
1. Mueang Trat District		**70**	**33**	**103**	**44.2**
	Nhong Samet	4	0	4	1.7
	Nhong Sano	0	5	5	2.1
	Nhong Khansong	9	11	20	8.6
	Houng Nam Khao	11	2	13	5.6
	Ao Yai	25	3	28	12.0
	Wang Kra Jae	2	1	3	1.3
	Cham Rak	2	0	2	0.9
	Laem Klad	13	10	23	9.9
	Nern Sai	2	0	2	0.9
	Tha Prik	2	1	3	1.3
2. Klong Yai District		**51**	**4**	**55**	**23.6**
	Klong Yai	20	2	22	9.4
	Mai Root	26	2	28	12.0
	Had Lek	5	0	5	2.1
3. Khao Saming District		**19**	**0**	**19**	**8.2**
	Saen Tung	8	0	8	3.4
	Tha Som	11	0	11	4.7
4. Laem Ngop		**28**	**2**	**30**	**12.9**
	Laem Ngop	3	1	4	1.7
	Bang Pid	12	0	12	5.2
	Klong Yai	13	1	14	6.0
5. Ko Kut		**10**	**1**	**11**	**4.7**
	Ko Kut	10	1	11	4.7
6. Ko Chang		**15**	**0**	**15**	**6.4**
	Ko Chang	6	0	6	2.6
	Ko Chang Tai	9	0	9	3.9
Total		**193**	**40**	**233**	**100**
%		**82.8**	**17.2**	**100**	

respondents lived in Mueang Trat District (44.2 percent), followed by Klong Yai District (23.6 percent), and Laem Ngop District (12.9 percent), respectively. The interviews were conducted by EMDEC staff between September and October 2014 (**Table 2-1** and **Table 2-4**).

General information on the respondents

Most respondents were male (92.3 percent) and the average age of respondents was 47 years with a range of 19 and 83 years. The majority of respondents were Buddhists (98.3 percent). Most respondents only had elementary level education (78.1 percent). The average number of family members was 4.5 (2.3 male and 2.2 female members) and the average number of family members who were involved in fisheries work was 1.6 (1.3 male and 0.2 female members) (**Table 2-5**).

Fisheries work was the main occupation of 93 percent of the households surveyed. Most of the respondents had only one occupation (67.8 percent) but about one-third (28.8 percent) had two occupations. The majority of the respondents owned their fishing boat (86.3 percent) and 11 percent of respondents were captains. More than half of the respondents or their family members (59.4 percent) were members of stakeholder organizations involved in co-managing fisheries **(Table 2-5).**

Fishing activities, catch, income, and cost of fishing of the last year

a) Main fishing gears operated by households of respondents

The main fishing gears operated by small-scale and medium to large-scale groups varied between respondents. The three main fishing gears for small-scale respondents were shrimp trammel nets (25.9 percent of total number of small-scale respondents); crab gillnets (25.4 percent); and crab traps (20.2 percent). The three main fishing gears for medium to large-scale respondents were push nets (32.5 percent of total number of medium to large-scale respondents), OBTs (22.5 percent), and purse seines (10 percent) (**Table 2-6**).

b) Secondary fishing gears operated by households of respondents

The most common fishing gears used as secondary fishing gears for small-scale respondents were shrimp trammel nets (36.6 percent of total number of small-scale respondents), crab gillnets and fish gillnets (22.6 percent each). For medium to large-scale respondents, short-necked clam dredge (33.3 percent of total number of medium to large-scale respondents), crab gillnets, fish gillnets, crab traps, and push nets (16.7 percent each) were mentioned as secondary fishing gears (**Table 2-7**).

c) Main fishing areas in different zones in Trat (proposed zones for discussion in stakeholder meeting)

During the first stakeholder meeting organized by REBYC-II CTI project in Trat in October 2013, there was a discussion about the proposed zones for fishery conservation and fisheries management activities around Trat. There were 141 participants including representatives from fishers, local fishery authorities, local fishery associations, fishery experts, DOF and DMCR who attended the stakeholder meeting. The five zones (zone 1-5) were drafted by DOF prior to the meeting and they were agreed by the participants for further discussion about the fishery conservation and management measures in Trat. Zone 6 and zone 7 were subsequently added by the researcher and included in the interview schedule for the questions regarding the fishing areas of the respondents (**Figure 2-5**). The main fishing areas of the small-scale respondents in order of responses were: zone 4 (29 percent), zone 1 (19.7 percent), zone 3 (17.1 percent), and zone 5 (16.1 percent), while the main fishing areas of medium to large-scale respondents were in zone 7 (40 percent) and zone 6 (27.5 percent) (**Figure 2-6**).

TABLE 2-5
General information of the respondents

Items	Small-scale fishery households (n=193)	Medium to Large-scale fishery households (n=40)	Total (n=233)
	Mean (Min -Max)		
Age	46.2	46.98	46.71 (19-83)
No. of household members (including respondent)			
• Total	4.46	4.68	4.50 (1-12)
• Male	2.31	2.32	2.31 (0-8)
• Female	2.15	2.41	2.19 (0-6)
No. of household members involved in fishing (including respondent)			
• Total	1.58	1.55	1.58 (1-6)
• Male	1.30	1.37	1.31 (0-6)
• Female	0.25	0.18	0.24 (0-3)
	In percentages		
Gender			
• Male	93.8	85.0	92.3
• Female	6.2	15.0	7.7
Religion			
• Buddhist	98.4	97.5	98.3
• Islamic	1.6	2.5	1.7
Education			
• No formal education	9.3	5.0	8.6
• Elementary	78.2	77.5	78.1
• Secondary school or equivalent	7.8	10.0	8.2
• High school or equivalent	4.1	5.0	4.3
• Bachelor degree	0.5	2.5	0.9
Main occupation (based on time spent)			
• Fisheries	92.2	97.5	93.1
• Business	3.1	2.5	3.0
• Wage earner	2.1	-	1.7
• Others (Orchard garden, rubber planting, etc)	2.6	-	2.1
Numbers of occupations			
• One	66.8	72.5	67.8
• Two	29.5	25.0	28.8
• Three - Four	3.6	2.5	3.4
Relation to the boat owners			
• Owners	91.7	60.0	86.3
• Family members/owner's relatives	7.3	27.5	10.7
• Captains	0.5	12.5	2.6
Membership of stakeholder organizations managing fisheries			
• No	61.6	48.7	59.4
• Yes	38.4	51.3	40.6

TABLE 2-6
Main fishing gears of respondents' households (in percentages)

Fishing gears	Small-scale fishery households (n=193)	Medium to Large-scale fishery households (n=40)	Total (n=233)
Shrimp trammel net	25.9	2.5	21.9
Crab gillnet	25.4	2.5	21.5
Fish gillnet	14.5	2.5	12.4
Crab trap	20.2	7.5	18.0
Squid trap	2.6	5.0	3.0
Push net	4.7	32.5	9.4
Otter board trawl	0.0	22.5	3.9
Beam trawl	0.0	5.0	0.9
Pair trawl	0.0	2.5	0.4
Purse seine	0.5	10.0	2.1
Light luring squid	1.0	0.0	0.9
Short-necked clam dredge	0.0	7.5	1.3
Handline	3.6	0.0	3.0
Long line	0.5	0.0	0.4
Others	1.0	0.0	0.9
Total	**100.0**	**100.0**	**100.0**

TABLE 2-7
Secondary fishing gears of respondents' households (in percentages)

Fishing gears	Small-scale fishery households (n=193)	Medium to Large-scale fishery households (n=40)	Total (n=233)
Shrimp trammel net	36.6	-	34.3
Crab gillnet	22.6	16.7	22.2
Fish gillnet	22.6	16.7	22.2
Crab trap	4.3	16.7	5.1
Squid trap	3.2	-	3.0
Fish trap	1.1	-	1.0
Push net	-	16.7	1.0
Otter board trawl	1.1	-	1.0
Short-necked clam dredge	3.2	33.3	5.1
Handline	5.4	-	5.1
Total	**100.0**	**100.0**	**100.0**

The fishing activities were prohibited in the Strait of Chang Island for the whole year in Zone 4 and in the June to November period every year in Zone 5. These two zones were conserved to protect larvae of aquatic animals of economic value and the eggs of such animals from being caught or destroyed in an excessive amount to ensure such resources were sustainable. This excessive fishing would have a negative effect on marine resources and marine environment. The survey responses showed that 29 percent of small-scale fishery and 5 percent of medium to large-scale fishery respondents used Zone 4 as their main fishing areas, and 16 percent of small-scale and 10 percent of medium to large-scale fishery respondents used Zone 5. The issue with compliance to the law should be improved, and education on fisheries law and law enforcement should be strengthened (**Figure 2-6**).

d) Fishing days and month

The number of fishing days per month of the respondents ranged from 2 to 30 (average 19). The number of fishing days per month for small-scale fishing households was slightly lower than for medium and large-scale fishing households (18.8 and 20.8

respectively). The respondents carried out their fishing activities between 2 and 12 months of the year with an average of 10.9 months per year (**Table 2-8**).

e) Income and cost from fishing activities

The median household income of respondents for all types of fishing gears by all household members was THB 1 000 per day before accounting for fishing costs. Medium to large-scale fishery households had a much higher income than small-scale fishery households (THB 7 000 compared to THB 1 000 per day). The household income of small-scale households were between THB 130-5 520 per day, while household income of medium to large-scale fishing households ranged from THB 850-20 000 per day (**Table 2-9**). When considering income per person per day, it is estimated that small-scale fishers earned THB 500 while medium to large-scale fishers earned THB 3 500. This estimation is based on the average number of household members involved in fishing, which was about 1.6 for both groups or about 2 persons per household (see **Table 2-5**). In 2014, the national poverty line of Thailand was THB 2 647 per month per person (approximately THB 88 per day) (NESDB, 2015) and the minimum wage in Thailand was THB 300 per day in 2014. The household incomes of both groups of respondents were higher than the national poverty line as well as the minimum wage in Thailand.

All medium- to large-scale fishery household respondents considered the cost of fuel as the single highest cost of financing their fishing operations, while two-thirds of small-scale fishery household respondents also considered the cost of fuel as the highest cost. These results were based on the respondents' perceptions about the highest costs associated with fishing. The cost of fishing gear was considered by 24.1 percent of small-scale fishing household respondents to be the highest cost for their fishing activity. Most of the respondents said that costs and incomes from their fishing were either equal or very similar (69.5 percent). However, 30 percent of respondents claimed to have incomes greater than the costs of their fishing operation (42.5 percent of medium to large-scale and 27.5 percent for small-scale fishing households). Approximately 90 percent of respondents were satisfied with the benefits from their fishing. The level of satisfaction of most of respondents (59 percent) was moderate (**Table 2-10**).

FIGURE 2- 5
Fishing zones

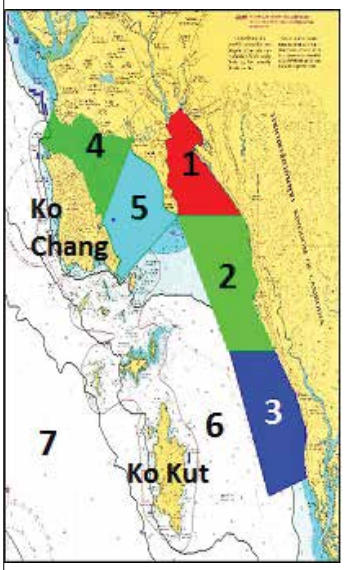


FIGURE 2- 6
Main fishing areas of respondents

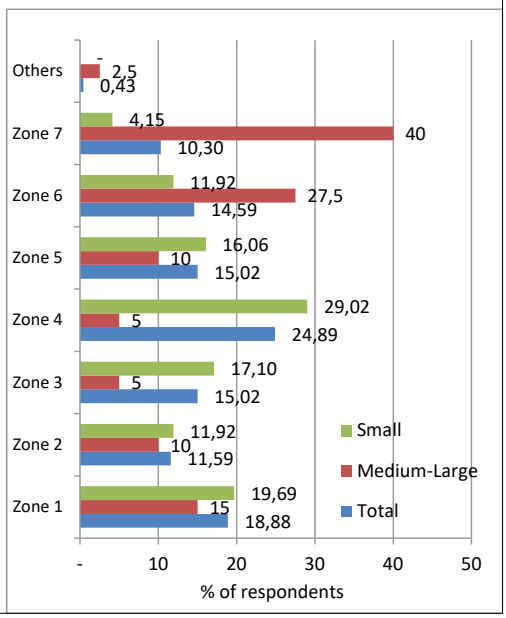


TABLE 2-8
Fishing days and month

	Small-scale fishery households (n=193)	Medium to Large-scale fishery households (n=40)	Total (n=233)
Number of fishing days per month			
• Average	18.8	20.8	19.1
• Minimum	3	15	3
• Maximum	30	25	30
Number of fishing month per year			
• Average	10.8	11.2	10.9
• Minimum	2	5	2
• Maximum	12	12	12

TABLE 2-9
Household income per day from fishing activities (before deducting the cost)

Household Income (THB per day)	Small-scale fishery households (n=193)	Medium to large-scale fishery households (n=40)	Total (n=233)
Median*	1 000	7 000	1 000
Mean	1 167	7 457	2 112
SD	950.3	4 630	2 995
Min	130	850	130
Max	5 520	20 000	20 000

*used median as the central value to represent the data

TABLE 2-10
Main fishing cost and comparison between income and cost and respondent's satisfaction on the benefit returned, based on respondents' perceptions

Cost and income	Small-scale fishery households (n=193)	Medium to large-scale fishery households (n=40)	Total (n=233)
Main fishing cost	%	%	%
• Fuel	66.8	100	72.6
• Labour	4.3	0.0	3.5
• Baits	2.1	0.0	1.8
• Fishing gears	24.1	0.0	19.9
• Boat & maintenance cost	2.7	0.0	2.2
Comparison between income and cost of fishing in the past 12 months			
• Income more than cost	27.5	42.5	30.0
• Income equal/very similar to cost	72.0	57.5	69.5
• Income less than cost	0.5	0.0	0.4
Level of satisfaction on the benefit returned from fishing in the past 12			
• Not satisfied	8.3	20.5	10.3
• Slightly satisfied	21.8	10.3	19.8
• Moderately satisfied	58.0	64.1	59.1
• Highly satisfied	11.9	5.1	10.8

Respondent's perceptions of fisheries resource conditions, threats, laws and regulations and participation in decision making, and their fishing in the future

a) Perceived fisheries resource conditions

In general, most of respondents perceived the conditions of fishery resources as being between 'bad' and 'not so good & not so bad' (42-61 percent) except for Acetes shrimp, which was perceived to be in a 'very bad' or 'bad' condition (44.6 percent).

The perceptions on the condition of fisheries resources were similar for the two groups (**Table 2-11**).

b) Perceived threats to fisheries resources

An increase in number of fishers and fishing gears as well as illegal fishing were perceived as the first two most severe threats to fisheries resources. Other threats included marine pollution, natural disasters and other factors such as too much freshwater from rivers, climate change, and increase of jelly fish. Most respondents in two groups perceived that increase in number of fishers and fishing gears was the first most severe threat to fishery resources (37.7 percent of small-scale fishery households and 50 percent of medium to large-scale fishery households). Nearly 30 percent of small-scale fishery households and only about 10 percent of medium-large scale fishery households perceived illegal fishing as the second most severe threat to fishery resource (**Table 2-12**).

TABLE 2-11
Perceived fisheries resource condition in the respondent's main fishing ground

Types of resources	Fishery household group*	Fishery resource condition scale** (%)						
		1	2	3	4	5	No answer	Total
Fish	S	15.7	24.6	30.9	13.1	2.6	13.1	**100**
	M-L	2.4	35.7	31.0	28.6	0.0	2.4	**100**
	Total	13.3	26.6	30.9	15.9	2.1	11.2	**100**
Shrimp	S	16.8	20.4	31.4	11.0	2.1	18.3	**100**
	M-L	4.8	38.1	33.3	21.4	0.0	2.4	**100**
	Total	14.6	23.6	31.8	12.9	1.7	15.5	**100**
Acetes shrimp	S	22.5	22.0	17.8	9.4	1.0	27.2	**100**
	M-L	31.0	14.3	14.3	19.0	2.4	19.0	**100**
	Total	24.0	20.6	17.2	11.2	1.3	25.8	**100**
Crab	S	15.2	28.3	34.0	12.6	1.6	8.4	**100**
	M-L	9.5	31.0	23.8	21.4	0.0	14.3	**100**
	Total	14.2	28.8	32.2	14.2	1.3	9.4	**100**
Cephalopod	S	15.7	26.2	23.0	11.0	0.5	23.6	**100**
	M-L	0.0	38.1	28.6	23.8	0.0	9.5	**100**
	Total	12.9	28.3	24.0	13.3	0.4	21.0	**100**
Shell/calm	S	18.8	22.0	19.4	14.1	2.6	23.0	**100**
	M-L	16.7	23.8	21.4	21.4	2.4	14.3	**100**
	Total	**18.5**	**22.3**	**19.7**	**15.5**	**2.6**	**21.5**	**100**

*Fishery household group: S=Small-scale fishery households (n=193), M-L=Medium to large-scale fishery households (n=40) and Total (n=233)
**condition scale: 1=very bad, 2=bad, 3=not good & not bad, 4=good, 5=very good

TABLE 2-12
Ranking of perceived threats to fisheries resources

Types of perceived threats to fisheries resources	Ranking of perceived threats to fisheries resources(%, n=233)								
	First most severe			Second most severe			Third most severe		
	S	M-L	Total	S	M-L	Total	S	M-L	Total
Increase in number of fishers & fishing gears	37.7	50.0	39.9	30.4	31.0	30.5	10.5	9.5	10.3
Illegal fishing	29.8	9.5	26.2	29.8	23.8	28.8	15.7	19.0	16.3
Natural disaster	8.9	9.5	9.0	14.7	16.7	15.0	26.7	23.8	26.2
Marine pollution	12.0	16.7	12.9	11.5	11.9	11.6	12.6	11.9	12.4
Others	8.4	14.3	9.4	2.1	2.4	2.1	5.2	0	4.3
No answer	3.1	0	2.6	11.5	14.3	12.0	29.3	35.7	30.5
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

*Fishery household group: S=Small-scale fishery households (n=193), M-L=Medium to large-scale fishery households (n=40) and Total (n=233).

c) Perceived laws and regulations and participation in decision making

Most respondents (81 percent) perceived that they were aware of, or knew about the regulations and laws related to fisheries in their fishing grounds. However, one-fifth of small-scale respondents (21 percent) was unaware of, or did not know about the fishery laws (**Table 2-13**).

Most respondents (55.3 percent) perceived that fishers generally complied with fisheries regulations and laws at level 2 or 3, which is low to moderate compliance. Most small-scale and medium to large-scale respondents perceived that fishers complied with fisheries laws at level 1 (low compliance) or level 2 (moderate compliance), respectively (**Table 2-13**).

The enforcement of the fisheries regulations and laws was given a ranking of 2 by most respondents (40.8 percent) corresponding to low enforcement (**Table 2-13**).

Approximately 60 percent of respondents reported that they have participated in decision-making processes for fisheries management in Trat such as participating in public hearings. A public hearing is one of the requirements when the decision makers plan to make changes or introduce a new fisheries law or regulation into the area. A breakdown of the 40 percent who had not been involved, showed that 43.5 percent of small-scale respondents and 27.5 percent of medium to large-scale respondents had

TABLE 2-13
Perceived laws and regulations and participation in decision making

	Small-scale fishery households (n=193)	Medium to large-scale fishery households (n=40)	Total (n=233)
Awareness of rules and regulations (know or don't know)			
• No (Not aware/Don't know)	21.2	7.5	18.9
• Yes (Aware/Know)	78.8	92.5	81.1
Compliance on a scale of 1 to 5 (to what extent do most fishers comply with fisheries regulations and laws?			
• 1 = No compliance	13.0	0	10.7
• 2 = Low compliance	34.7	22.5	32.6
• 3 = Moderate compliance	18.7	42.5	22.7
• 4 = High compliance	29.0	32.5	29.6
• 5 = Full compliance	4.7	2.5	4.3
Enforcement: on a scale of 1 to 5, to what extent are the fisheries regulations and laws enforced?			
• 1 = No enforcement	8.3	2.5	7.3
• 2 = Low enforcement	46.1	15.0	40.8
• 3 = Moderate enforcement	26.4	45.0	29.6
• 4 = High enforcement	16.6	32.5	19.3
• 5 = Full enforcement	2.6	5.0	3.0
Participation in decision making: on a scale of 1 to 5, to what extent do you participate in fisheries management decision-making?			
• 1 = No participation	43.5	27.5	40.7
• 2 = Low participation	22.0	22.5	22.1
• 3 = Moderate participation	23.6	27.5	24.2
• 4 = High participation	9.4	15.0	10.4
• 5 = Full participation	1.6	7.5	2.6
Participation in a meeting or listening to information related to fisheries management in Trat.			
• No (Never participated)	37.3	15.0	33.5
• Yes (Have participated)	62.7	85.0	66.5
Do you think that you can continue with current fishing activities forever?			
• No (cannot continue)	14.2	25	16.1
• Yes (can continue)	85.8	75	83.9

not participated in decision making processes. This is consistent with the question about attending meetings or listening to information regarding fisheries management. About 34 percent of respondents had never attended or participated in such meetings (37.3 percent of the small-scale respondents) (**Table 2-13**).

d) Perceived future of their fishing

Most respondents (84 percent) thought that they could continue their fishing activities indefinitely. However, 14 percent of small-scale respondents and 25 percent of medium to large-scale respondents thought that they could not continue fishing, given the current fisheries trends (**Table 2-13**).

Respondent's perceptions of measures and options for fisheries management in Trat

During the first stakeholder meeting organized by REBYC-II CTI project in Trat Province, the fishers including small-scale, medium and large-scale who attended the meeting supported fishery management options no. 2 – 14 presented in **Table 2-14**. Option no. 1 was added by the researcher to observe the responses. These options were included in the interview schedule used in this study to understand the respondent's opinions and agreements on these options on a scale of 1-5 (1=strongly disagree, 2=disagree, 3=neither agrees nor disagree, 4= agree, 5=strongly agree) (**See Figure 2-5** for the zone map).

An ordinal logistic regression was used to investigate differences in responses for the small-scale fishers and medium to large-scale fishers for each of the 14 options and there were five options where there were statistically significant differences between the responses of the two groups. The small-scale fishery households were more likely to agree or strongly agree with option 5 (no use of some fishing gears in zone 2 and zone 3 during May-October); option 6 (No fishing in spawning season in zone 3 during February-May); option 7 (No use of any fishing gears having net mesh size smaller than 4.5 cm); option 9 (Publicity campaign for no take fish larvae); and option 12 (Promote more and maintain crab bank project), than medium to large-scale fishery households. The differences in the mean for the two household groups were more than 0.5 for options 5, 6, and 7. The mean of options 9 and 12 for the two groups differed by less than 0.3 (**Table 2-14**).

The majority of small-scale fishery households were in agreement with options 4–14 (47.2–93.7 percent of the respondents). The most popular options were option 8 (dolphin watching tourism), option 9 (no take fish larvae publicity campaign), and option 12 (crab bank project). The small-scale fishery respondents disagreed or strongly disagreed with options 1–3 (50.7–84.3 percent of the respondents). Option 1 (no fishing in zone 1-3 permanently) and option 3 (no fishing in zone 1 and 2 permanently) were disagreed or strongly disagreed by most respondents (**Table 2-14**).

The majority of medium to large-scale fishery households agreed or strongly agreed with options 5, 6, and 8–14 (50.0–80.9 percent of the respondents). Option 12 (crab bank project) was the most popular option for the respondents followed by option 8 (dolphin watching tourism), option 9 (no take fish larvae publicity campaign), and option 13 (squid egg hatching bank). The medium to large-scale fishery households also disagreed or strongly disagreed with options 1–4 (57.2–76.2 percent). Options 1 and 3 were disagreed or strongly disagreed by most respondents. This outcome is similar to the responses of the small-scale fishery households (**Table 2-14**).

TABLE 2-14
Respondents' perception on measures and options for fisheries management in Trat Province

Measures/options for fisheries management in Trat (see map of fishing zone above)	Fishery household group[1]	Disagreement/ Agreement Level[2] (percentage of group)					Mean level[3]	Ordered Logit Estimates (p < 0.05)* (p < 0.01)**
		1	2	3	4	5		
1. No fishing in zone 1, 2, and 3 permanently	S	61.8	22.5	5.2	5.8	4.7	1.6	- 0.027^{ns}
	M-L	59.5	16.7	9.5	11.9	2.4	1.7	
	Total	61.4	21.5	6.0	6.9	4.3	1.6	
2. No fishing in zone 1, 2, and 3 in some seasons	S	27.7	23.0	4.2	31.9	13.1	2.8	0.241^{ns}
	M-L	31.0	26.2	2.4	33.3	7.1	2.6	
	Total	28.3	23.6	3.9	32.2	12.0	2.8	
3. No fishing in zone 1 & 2 permanently to conserve *Rastreliger brachysoma*, endangered species (dolphin & mangroves)	S	38.7	26.2	7.9	20.4	6.8	2.2	- 0.190^{ns}
	M-L	31.0	31.0	9.5	23.8	4.8	2.3	
	Total	37.3	27.0	8.2	21.0	6.4	2.3	
4. No fishing in zone 1 and 2 in some seasons (Alternate with opened-closed seasons between zone 1 and zone 2)	S	20.4	21.5	11.0	39.3	7.9	2.9	0.631^{ns}
	M-L	28.6	31.0	9.5	26.2	4.8	2.4	
	Total	21.9	23.2	10.7	36.9	7.3	2.8	
5. No use of some fishing gears in zone 2 and zone 3 in May - Oct to conserve *Rastreliger brachysoma,* swimming crab, and short necked clam	S	4.7	14.1	8.4	48.2	24.6	3.8	1.181**
	M-L	21.4	19.0	9.5	38.1	11.9	3.0	
	Total	7.7	15.0	8.6	46.4	22.3	3.6	
6. *Rastreliger brachysoma:* No fishing in spawning season in zone 3 in Feb-May to conserve *Rastreliger brachysoma*	S	4.2	8.9	13.6	44.5	28.8	4.0	0.978**
	M-L	16.7	11.9	14.3	40.5	16.7	3.0	
	Total	6.4	9.4	13.7	43.8	26.6	3.9	
7. *Rastreliger brachysoma:* No use of any fishing gears having net mesh size smaller than 4.5 cm. in Mar-May to conserve *Rastreliger brachysoma*	S	6.8	11.5	11.0	37.7	33.0	3.9	1.262**
	M-L	16.7	14.3	33.3	26.2	9.5	3.0	
	Total	8.6	12.0	15.0	35.6	28.8	3.8	
8. Dolphin: Promotion of dolphin watching tourism in Trat	S	0.5	1.6	4.2	34.0	59.7	4.6	0.256^{ns}
	M-L	0.0	9.5	11.9	26.2	52.4	4.4	
	Total	0.4	3.0	5.6	32.6	58.4	4.5	
9. Fish larvae: Publicity campaign for no take fish larvae	S	0.5	3.1	5.2	39.8	51.3	4.5	0.825*
	M-L	2.4	11.9	14.3	38.1	33.3	4.3	
	Total	0.9	4.7	6.9	39.5	48.1	4.4	
10. Sea turtle: reserved feeding and spawning area for sea turtle	S	2.1	1.0	18.8	41.9	36.1	4.3	0.192^{ns}
	M-L	0.0	0.0	35.7	40.5	23.8	4.4	
	Total	1.7	0.9	21.9	41.6	33.9	4.4	
11. Sea grass: Reserve existing area and new planting for suitable species	S	1.6	1.0	20.9	40.8	35.6	4.4	0.343^{ns}
	M-L	0.0	4.8	38.1	33.3	23.8	4.2	
	Total	1.3	1.7	24.0	39.5	33.5	4.3	
12. Promote more and maintain crab bank project	S	0.0	1.6	4.7	31.4	62.3	4.6	1.016**
	M-L	0.0	2.4	16.7	47.6	33.3	4.3	
	Total	0.0	1.7	6.9	34.3	57.1	4.6	
13. Squid eggs: Promote squid egg hatching bank by training fishery community and establish squid egg bank	S	0.0	3.1	17.3	39.8	39.8	4.4	-0.022^{ns}
	M-L	0.0	2.4	26.2	35.7	35.7	4.4	
	Total	0.0	3.0	18.9	39.1	39.1	4.4	
14. Mussel: Increase area for mussel culture in allowed areas, and placed artificial reef in the areas not allow	S	8.4	9.4	18.3	42.9	20.9	3.7	-0.112^{ns}
	M-L	2.4	9.5	31.0	40.5	16.7	3.9	
	Total	7.3	9.4	20.6	42.5	20.2	3.7	

[1] Fishery household group: S=Small-scale fishery households, M-L= Medium to Large-scale fishery households
[2] Disagreement/ agreement level: 1=strongly disagree, 2=disagree, 3=neither agrees nor disagree, 4= agree, 5=strongly agree
[3] Scale of 3 for neither disagree nor agree was not used for calculating the mean level of disagreement or agreement as it was considered as a neutral response.

1.4 Conclusions and recommendations

Based on the review of existing data and survey results, the following conclusions and recommendations are made:

- The number of fishery households decreased in 2000-2013 from 2 959 (DOF, 2013a) to 2 333 (CDD, 2013) while the number of fishing boats increased from 2 729 in 2000 (DOF, 2013a) to 3 204 in 2011 (MFRBD, 2016). Despite a reduction in the number of fishery households fishery resources are still under high pressure because an increasing number of fishing boats.
- The respondents represented the fishers in 21 sub-districts of the 6 coastal districts in Trat. Most of them were from Mueang Trat District (44 percent) and Klong Yai District (23.6 percent). Because 86 percent of respondents were boat owners and 11 percent were captains, the reliability of the data used for analysis in this study is relatively good. The respondents were likely to have good knowledge of fishing activities in their province given their responsibilities.
- In general, most of respondents were men, Buddhist, and had finished primary school. The average age of respondents was 47. The government should use this demographic information of fishermen in Trat as a criterion for designing projects for additional employment for fishing communities in Trat. The study considered differences in fishing activities, income, and cost, and other major differences between small-scale fishery households and medium to large-scale fishing households. Main fishing gear used, main fishing zones, and household incomes (before deducting cost) were different for the two groups of respondents. The main fishing gear used by small-scale households were shrimp trammel nets, crab gillnets, and crab traps while for medium to large-scale households, push nets, trawls, and purse seines were more common. The fishing grounds of small-scale households were close to the shore (zones 4, 1, 3, and 5, respectively) while medium to large-scale households had their fishing grounds further from the shore (zones 7 and 6, respectively). Household incomes before deducting the cost of fishing were about seven times higher for medium to large-scale households than for small-scale fishers (THB 7 000 vs THB 1 000 per day). To demarcate fishery conservation zone, there is a need to consider these fishing grounds. Banning fishing gears, in particular the main fishing gears used by the two groups, should be considered carefully and the socio-economic impacts should be evaluated and understood. Loss of income during ban period or closed season would result in negative impacts to livelihoods and households.
- The levels of fishing activities of small-scale and medium to large-scale households were similar, around 19 days per month and 11 months per year. Most of the respondents had a single occupation which was fishing (68 percent of all respondents, 66.8 percent of small-scale respondent and 72.5 percent of medium to large-scale respondents). When the government introduces measures that might impact on fishing activities, they should prepare alternative livelihoods, compensation or any mitigation measures that can reduce the impacts of proposed measures on local communities.
- Nearly 60 percent of the respondents were moderately satisfied with the benefits from fishing in the study area. These responses are consistent with the question about the future of their fishing. Most of the respondents (84 percent) said that they could continue with their current fishing activities. These perceptions were similar for the two groups. About 58 percent of small-scale and 64 percent of medium to large-scale fishery respondents were moderately satisfied with the benefits from fishing. Most respondents in each group were also optimistic about future fishing (86 percent of small-scale fishery respondents and 75 percent of medium to large-scale fishery respondents). This suggests that fishing in the study area still provides benefits to the local community.
- Fishers, however, in general perceived the condition of local fisheries resources to be not good with the main threats being an increase in the number of fishers and fishing gears, and illegal fishing. Small-scale and medium to large-scale

fishery households had similar perceptions on the threats to fishery resources. It is considered important to demarcate conservation zones (e.g. for juvenile fish) in addition to other measures that would mitigate the impacts of these threats, and all these measures should be integrated, implemented and strengthened.

- Fishers should be provided with better knowledge and awareness about fisheries laws and regulations. Some of the fishers are not at all aware of or do not know about the fishery laws and regulations (21 percent of small-scale respondents and 8 percent of medium to large-scale fishing respondents).
- Fishing activities were prohibited in the Strait of Chang Island for the whole year in Zone 4 and in the June to November period every year in Zone 5. In our survey there were 29 percent of small-scale and 5 percent of medium to large-scale fishery respondents who used Zone 4 as their main fishing areas and 16 percent of small-scale and 10 percent of medium to large-scale fishery respondents used Zone 5. Clearly, compliance with the laws and regulations should be improved, and education on fisheries law and law enforcement should be strengthened. In addition, participation of small-scale fishery households in decision-making processes should be improved in order to have sustainable management of fisheries in Trat.
- Awareness-raising campaigns should be undertaken to encourage fishers to join fisheries management groups. Membership will provide benefits in receiving and exchanging fisheries information among the members and between the government agencies. About 62 percent of small-scale respondents do not participate in any groups at present.
- There were similar responses between the small-scale fishery households and medium to large-scale fishery households for fishery management options no. 1-4, 8, 10, 11, 13 and 14. However, it could be challenging to implement options 5-7, 9 and 12 because of differences in perceptions of the two groups, which could lead to a conflict between small-scale fishery households and medium to large-scale fishery households. Option no. 1 (no fishing in zone 1-3 permanently) and option no. 3 (no fishing in zone 1 and 2 permanently) were disagreed or strongly disagreed by most respondents of the two groups. The implementation of these two management options is likely to be difficult for DOF. The participation of the local community is highly recommended in this case to avoid confrontation and ensure community engagement.

PART III: LESSONS LEARNED AND RECOMMENDATIONS FOR FUTURE SOCIO-ECONOMIC STUDIES

- Understanding the socio-economic context is essential for assessing and managing fisheries. Even without any complicated statistical analysis of the data, the socio-economic information itself is still useful for planning. The data from socio-economic surveys can be used to investigate the current socio-economic conditions as well as the socio-economic trends.
- The findings from the trawl fisheries study in Prachuap Khiri Khan and Chumphon Provinces were presented at three meetings: (1) 2nd REBYC-II CTI Stakeholder Consultation Meeting in Chumphon on 23 September 2014; (2) REBYC-II CTI Advisory Board Meeting in Bangkok on 25 September 2014; and (3) REBYC-II CTI Advisory Board Meeting in Bangkok on 23 July 2015. The findings from fisheries in Trat Province were also presented at two meetings: (1) 2nd REBYC-II CTI Stakeholder Consultation Meeting in Trat on 30 November 2015; and (2) REBYC-II CTI Advisory Board Meeting in Bangkok on 29 January 2016. Presentations to the stakeholders provided a useful platform for disseminating the findings, to discuss and verify the findings, and to make conclusions that can be used to support the measures proposed

by the Project. At present, according to the Notification of DOF, Thailand promulgated a prohibition of the possession of trawl net with codend mesh size less than 4 cm in the Royal Thai Government Gazette on 30 December 2015, as it was considered a destructive fishing gear. In the case of Trat, the Trat Provincial Fishery Committee, which was newly formulated under the Royal Ordinance on Fisheries B.E. 2558 (2015), has been working on the fishery conservation areas and fishery management measures in the Trat region.

- Enumerators who conduct socio-economic interviews should have a good knowledge of fisheries. In this study, all interviews were carried out face-to-face by the officers of CMDEC and EMDEC. These officers have good background knowledge about the fishing in the study area. This subject matter experience contributes to the reliability of the interview data that were collected. However, the selection of enumerators depends on the situation of the fisheries in each site or country. In some countries, the government officers may not be appropriate as the respondents may be unwilling to voice their perceptions or provide accurate data. In this case, university staff or students can be considered as alternatives for the data collection tasks.
- To strengthen the results and conclusions of the trawl fisheries study and to support statistical analysis of the data, additional samples of trawlers should be collected to increase the size of the data set.
- Recently, Thailand has significantly improved the system of registering fishing boats and fishing licences for both small-scale and commercial-scale fisheries. These improvements should provide reliable data for the sampling design and help to facilitate future socio-economic studies within Thailand.
- The study represents the socio-economic situation of fishers in the project sites in Thailand before the Royal Ordinance on Fisheries B.E. 2558 (2015) was fully implemented. This new fishery law is one of the crucial steps to combat illegal, unreported and unregulated (IUU) fishing, which is currently considered as the most serious problem related to fishery industry and resources in Thailand. To compare the situations and examine the impacts of the new fisheries law on fishers in the project sites, it is recommended that a similar study be conducted at a later period, using the current data as a baseline.

REFERENCES

Bunce, L. & Pomeroy, B. 2003. *Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia: SOCMON SEA.* World Commission on Protected Areas and Australian Institute of Marine Science, Townsville, Australia. 85 pages.

DMCR. 2014. *Bible of Marine Coastal Resources Thailand.* Office of Marine and Coastal Resources Conservation, Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment. Bangkok. 110 pages. (in Thai)

DMCR: Central Database System and Data Standard for Marine and Coastal Resources Website. 2015. <http://marinegiscenter.dmcr.go.th/km/#.VhTXpqXovIU> Accessed on 7 October 2015

DOF. 2013a. *Fisheries Statistics of Thailand 2011: No. 11/2013.* Information Technology Center, Department of Fisheries, Ministry of Agriculture and Cooperatives. 91 pages.

DOF. 2013b. *Statistics of Fisheries Factory 2011 (No. 13/2013).* Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 36 pages.

DOF. 2013c. *Statistics of Marine Fish at Landing Place 2011 (No. 12/2013).* Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages.

MFRDB. 2013. *Marine fishing boat in Thai waters, 2011.* Bangkok: MFRDB, DOF.

NESDB: Office of National Economic and Social Development Board Website. 2015. http://social.nesdb.go.th/SocialStat/StatReport_Final.aspx?reportid=854&template=2R1C&yeartype=M&subcatid=59

Noranarttragoon, P. 2014. *Review of the Trawl Fisheries in Prachuap Khiri Khan and Chumphon Province, Thailand.* REBYC-II CTI; GCP/RAS/269/GFF. 23 pages.

NSO. 2000. *The 2000 Intercensal Survey of Marine Fishery.* Office of the Prime Minister, National Statistical Office (NSO) <http://service.nso.go.th/nso/nso_center/project/search_center/23project-th.htm>, Accessed 10 January 2014

Trat Provincial Office Website. 2015. www.trat.go.th. Accessed on 7 October 2015

www.mkh.in.th/index.php/2010-03-22-18-06-15, Accessed on 20 October 2015.

Appendix I – Interview schedule: Socio-economic status of trawl fishers in Prachuap Khiri Khan Province and Chumphon Province, Thailand

Questionnaire ID: _____

Sample group ( ) 1. Otter board trawl ( ) 2. Otter board with boom trawl
( ) 3. Pair trawl ( ) 4. Beam trawl

Registered at province ( ) 1. Prachuap Khiri Khan ( ) 2. Chumphon

Name of respondent:_____	Name of interviewer: _____
Telephone number of respondent_____ Address of respondent: Number _____ Village Name _____Village No._____ Sub-district _____ District_____ Province_____	Date of interview: _____

General respondent information (Q1-Q10)

Q1. Sex: ( ) 1. Male ( ) 2. Female

Q2. Age: _____years

Q3. Religion: ( ) 1. Buddhist ( ) 2. Islam ( ) 3. Others (Specify) _____

Q4. Education:
( ) 1.No formal education ( ) 2. Primary school
( ) 3 Secondary school or equivalent ( ) 4. High school or equivalent
( ) 5.Bachelor degree ( ) 6. Other (Specify) _____

Q5. Number of household members (includingd respondent):

Total number: _____ (Male:_____ Female:_____)

Q6. Number of household members involved in fisheries (including respondent)

Total number: _____ (Male:_____ Female:_____)

Q7. What is your main occupation? (main occupation refers to the occupation that takes up a longer time compared to other occupations, in case you have more than one occupation)
( ) 1. Otter board trawl ( ) 2. Otter board with boom trawl
( ) 3. Pair trawl ( ) 4. Beam trawl
( ) 5. Others (Specify) _____

Q8. What is your secondary occupation?
( ) 0. None
( ) 1. Otter board trawl ( ) 2. Otter board with boom trawl
( ) 3. Pair trawl ( ) 4. Beam trawl
( ) 5. Others (Specify) _____

Q9. Relation to the boat owner
( ) 1. Owner ( ) 2. Family members or relatives of boat owner
( ) 3. Employee (on board work) ( ) 4. Captain
( ) 5. Others (Specify) _____

Q10. Have you ever participated in a meeting or listening to information related to mesh size codend enlargement of trawl net?
( ) 0. No ( ) 1. Yes

Part one: Trawl fisheries activities, catch, revenue, and cost in the past 12 months (Q11-Q36) (In case you have more than one boat, please select only one boat as the representative)

Q11. Boat length (Overall length) _____meter

Q12. Gross-tonnage_____

Q13. Codend mesh size _____ centimeter

Q14. Main fishing ground (Specify district, province, country) _____
Secondary fishing ground (Specify district, province, country) _____

Q15. What was your technique to determine or choose your fishing ground?
_____
_____

Q16. Total number of months fishing undertaken by the trawl vessel____(month/year)

Q16.1 Specify the months undertaken by the trawl vessel _____
_____

Q16.2 Why don't you undertake trawl fishing in some months? (In case you did not do trawl fishing whole year round) _____
_____

Q16.3 What activities did you do in those months when you did not do trawl fishing? (In case you did not do trawl fishing whole year round)
_____

Q17. Number of trips per month _____trip/month

Q18. Number of days per trip _____day/trip

Q19. Number of hauls per trip _____haul/trip
Day time, number of hauls per day _____ haul/day
Night time, number of hauls per night _____haul/day

Q20. Number of hours per haul _____hour/haul
Day time, number of hours per haul _____ hour/haul
Night time, number of hours per haul_____hour/haul

Q21. Total catchamount per trip_____ kilogram/trip

Q22. Total catch amount of target species (3 main species most caught), catch proportion, and selling price

Target species	% of total catch amount in each trip	Average catch amount (kg/trip)	Average selling price (THB/kg)
1.			
2.			
3.			

Q23. Total catch amount of trash fish (3 main species most frequently caught), catch proportion, and selling priceor utilization

Trash fish species	% of total catch amount in each trip	Average catch amount (kg/trip)	Average selling price or utilization (THB/kg)
1.			
2.			
3.			

Q24. After hauling, how did you handle and preserve your product during transportation, landing or selling at fishing pier? _____
_____
_____
_____
_____

Q25. Where did you sell your trawl catches (please enter a "1", "2", or "3", where "1" is the place where the catch is most frequently sold catch to)
____1. Landing place/fishing pier
Name_____Subdistrict_____District_____Province_____

Landing place/fishing pier
Name_____Subdistrict_____District_____Province_____

___ 2. Selling by yourself at market name_____Subdistrict_____
District_____Province_____

____ 3. Others (Specify) _____

Q26. What were the purposes of the buyers who bought your catches? (please enter a "1", "2", "3", or "4" where "1" is the most frequent purpose of the catch)
____ 1.Send to cold storage factory
____ 2. Send to processing plant (select multiple, if applicable)
( ) 1. Fish meal plant
( ) 2. Canned fish factory
( ) 3. Fish sauce plant
( ) 4. Others specify) _____
____ 3. Making processing product by yourself (specify) _____
____ 4. Others (specify): _____

Q27. Number of workers hired for trawl fisheries (on board working): Total number of workers _____person/trip. Comprising of

Q27.1 Sex: Male_____ persons and Female_____ persons
Q27.2 Nationality: Thai_____ persons and Foreigner _____persons
Q27.3 Type of worker: Permanent: _____persons and Temporary _____persons
Q27.4 Numbers of captain:_____ persons and Other workers _____persons

Q28. Salary of workers hired for trawl fisheries (on board working)

Q28.1 Salary for captain _____THB/month and percent from selling product ____ percent
Q28.2 Salary (average) for other workers working on board _THB/month / person

Q29. Number of workers hired for trawl fisheries (working on land): Total number of workers _____person/trip (excluded workers on board in Q27). Comprising of

Q29.1 Sex: Male_____ persons and Female_____ persons
Q29.2 Nationality: Thai_____ persons and Foreigner _____persons
Q29.3 Type of worker: Permanent: _____persons and Temporary _____persons

Q30. Salary of workers hired for trawl fisheries (working on land) _____THB/month/person

Q31. Fuel cost (in total) _____THB/trip
Estimated from: Total quantity fuel used_ liter/trip and the fuel price_ THB /liter

Q32. Ice cost _____THB/trip
Estimated from: Total quantity of ice used _____kg/trip, Ice price_____ THB/kg
Note: one buck of ice is about 80 kg, or 1 ton of ice equal to 1 000 kg.

Q33. What was the highest cost of your trawl fisheries? _____
This cost was estimated as how many percent of the total cost _____

Q34. Average income per trip from trawl fisheries _____THB/trip (income before deducting expense)

Q35. In the past 12 months, please compare between income and cost of your trawl fisheries.

( ) 1. Income more than cost
( ) 2. Income equal to cost (not much different)
( ) 3. Income less than cost

Q36. In the past 12 months, please indicate your level of satisfaction on the benefit returned from your trawl fisheries

( ) 0. Not satisfied ( ) 1.Slightly satisfied
( ) 2. Moderately satisfied ( ) 3. Highly satisfied

Part 2 Perception and attitude of the respondent (Q37-Q51)

Q37. Perception on fisheries resource condition:

How would you describe current fisheries resource condition in your main fishing ground?
(Condition scale*: 1=to very bad, 2=bad, 3=not good not bad, 4=good, 5= very good)

Type of resources	Resource condition scale* (1-5)	Explanation for condition specified
Fish		
Shrimp		
Acetes shrimp		
Crab		
Cephalopod		
Shell/clam		
Others: specify		

Q38. Perceived threats to fisheries resource
What are the top 3 major threats to the health of fisheries resources (negative impact) in your main fishing ground? Please enter a "1", "2", and "3" in front of the perceived threats
____ 1. Marine pollution
____ 2. Increase in number of fishers /fishing gear increase
____ 3. Illegal fishing
____ 4. Natural disaster (specify) _____
____ 5. Other (specify) _____

Q39 Awareness of regulations and laws related to trawl fisheries:
Do you know about any regulations and laws related to trawl fisheries in your main fishing ground?
( ) 0. No ( ) 1. Yes

Q40. Compliance:
On a scale of 1 to 5 (1=no compliance, 5=full compliance), to what extent do most trawl fishers comply with trawl fisheries regulations and laws?
Scale: _____ reason for specified scale:_____

Q41. Enforcement
On a scale of 1 to 5 (1=no enforcement, 5=full enforcement), to what extent are the trawl fisheries regulations and laws enforced?
Scale: _____ reason for specified scale:_____

Q42. Participation in decision making:
On a scale of 1 to 5 (1=no participation, 5=full active participation), to what extent do you participate in trawl fisheries management decision-making?
Scale: _____ reason for specified scale:_____

Q43. Membership of stakeholder organizations managing trawl fisheries:
Is someone from your household a member of stakeholder organization managing trawl fisheries?
( ) 0. No ( ) 1. Yes, specify organization: _____

Q44. Perceived trawl fisheries management problems:
In the past, what do you see as the two major problems facing trawl fisheries management?
1._____; 2._____

Q45. Perceived trawl fisheries management solutions:
What do you see as solutions to the problems indicated in Q44?
1._____; 2._____

Q46. Success in trawl fisheries management:
In the past, what two things do you think have worked well and provided benefits to trawl fisheries management?
1._____; 2._____

Q47. Challenges in trawl fisheries management:
In the future, what are the two challenges in trawl fisheries management that have to be conducted for sustainable management?
1._____; 2._____

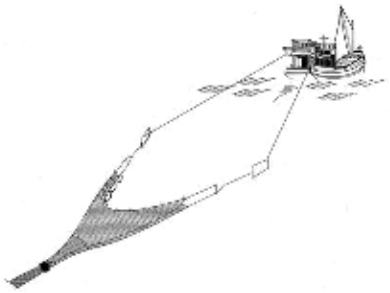
Q48. Based on the conceptual idea, which is "the enlargement of the codend mesh size of trawl will help to conserve fisheries resources and to sustain trawl fisheries management", do you agree with the measure of enlargement of codend mesh size of trawl net measures? (write √ representing your opinion and specify the reason) (select only 1 choice)
( ) 1 = Strongly disagreed: Why? _____
( ) 2 = Disagreed: Why? _____
( ) 3 = No idea: Why? _____
( ) 4 = Agreed: Why?_____
( ) 5 = Strongly agreed: Why?_____

Q49. If you agree with the conceptual idea in Q48 (selected choice number 4 or 5 in Q48), what is the suitable mesh size of the codend of trawl net (cm)?
Suitable mesh size of the codend of trawl net _____cm.

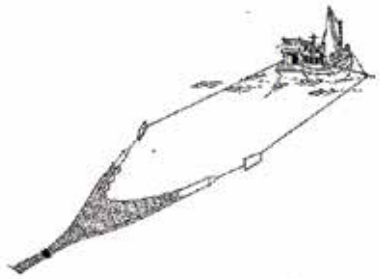
Q50. Do you think that you can continue with current trawl fishing activities forever?
( ) 0. No Why?._____
If you could not continue trawl fishing, what alternative job will you do? (specify alternative job)_____
( ) 1. Yes, Why?_____

Q51. Other comments and recommendations for trawl fisheries management
_____
_____
_____
_____

Appendix II – **Types of trawl fisheries**

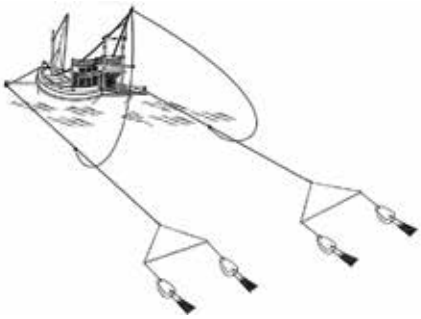


Otter board trawl (OBT)



Otter board with boom trawl (OBBT)

Pair trawl (PT)



Beam trawl (BT)

Appendix III – **Total landing of marine fish by landing place in quantity (tonnes) and value (1 000 THB) in year 2006 – 2011**

		Prachuap Khiri Khan		Chumphon	
		Mueang	Hua-Hin/ Pranburi	Mueang	Lang-Suan
2006	Quantity	52 922	7 156	40 800	4 624
	Value	930 153	99 972	524 847	73 266
2007	Quantity	64 417	5 219	39 009	4 551
	Value	1 021 192	82 750	542 882	80 432
2008	Quantity	41 996	4 436	32 814	4 407
	Value	741 429	73 130	444 832	56 299
2009	Quantity	41 571	4 456	37 667	5 024
	Value	666 357	68 940	520 785	74 082
2010	Quantity	37 310	5 512	47 800	4 975
	Value	546 265	71 606	634 482	81 732
2011	Quantity	53 684	6 085	53 339	6 766
	Value	930 514	68 782	805 913	119 772

Source: DOF. 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages

Appendix IV – **Interview schedule: Socio-economic status of fishers in Trat Province, Thailand**

Questionnaire ID: _____

( ) 1. Small-scale fishery household: using fishing boat of not more than 10 m. in length

( ) 2. Medium to large-scale fishery household: using fishing boat of more than 10 m. in length

Name of respondent:	**Name of interviewer:**
Tel. no. of respondent (if applicable):	Date of interview:
Address of respondent:	

Section 1: Household demographics (Q1-Q10)

Q1. Gender: ( ) 1. Male ( ) 2. Female

Q2. Age: _____ years

Q3. Religion:

( ) 1. Buddhism ( ) 2. Islam ( ) 3. Others, specify_____

Q4. Education:

( ) 1. None ( ) 2. Primary school
( ) 3. Secondary school (1-3) ( ) 4. Secondary school (4-6)
( ) 5. University ( ) 6. Others:_____

Q5. Family members (including respondent):

Total: _____ persons (Male:_____; Female:_____)

Q6. Family members who engaged in fishing activities (including respondent):

Total: _____ persons (Male:_____; Female:_____)

Q7. Occupations of household members (more than one answer if applicable)

( ) 1. Fisheries (specify fishing gears used, more than one answer if applicable, no.1 is fishing gears used more often

1) _____ 2)_____3) _____
4) _____ 5)_____6) _____

( ) 2. Aquaculture, specify main species cultured:_____
( ) 3. Business, specify: _____
( ) 4. Wage earner, specify: _____
( ) 5. Others, specify: _____

Q8. From Q7, what occupation did your household spend most time on it?_____

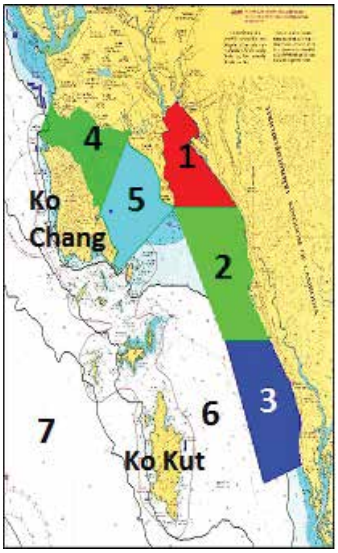
Q9. Relation to the boat owner
( ) 1. Owner ( ) 2. Family members or relatives of boat owner
( ) 3. Employee (on board work) ( ) 4. Captain
( ) 5. Others (Specify) _____

Q10. Have you or your household members ever participated in a meeting or listening to information related to fishery management measure in Trat?
( ) 0. No ( ) 1. Yes

<u>Section 2: Fishing activities, catch amount, income and cost of fishing activities in the last year (Q11-Q29)</u>

Q11. What types of fishing gears did your household use? When did your household use them and in which zones (see fishing zones in map below), please write the number of fishing zone in the calendar below in the appropriate month

Fishing gears	Fishing periods in which fishing zone, specify the number of zone (See map below, 8=other zones)												Months/ year
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
e.g., mullet gillnet	8 Chantaburi	8	8	4,5	4	4	4			1,2	1,2	1,2	10
1.													
2.													
3.													
4.													
5.													



Q11.1. For other zones, please write no. 8 and specify the name of area e.g., district, province, country (e.g., 8 = Laemsing District, Chantaburi)
Other zones
Other zone No. 8: _____
_____
_____
_____
_____

Q12. From Q11, please specify your main fishing area, secondary fishing area of your household
Main fishing area (specify fishing zone no. 1-8, multiple answers if applicable):___

Secondary fishing area (specify fishing zone no. 1-8, multiple answers if applicable):_____

Q13. How did your family select the fishing area (any techniques?)

_____

_____

Q14. From Q11, Total number of months fishing undertaken by your household____ (month/year)

Q14.1 Why don't you do fishing in some months? (see calendar)

_____

Q14.2 What did you do in those months when you did not do fishing? (see calendar)

_____

Q15. Numbers of fishing days of your household in average_____ days/month

Q16-23: Three types of fishing gears, number of fishing gear used per trip, fishing effort, species caught by each fishing gear, total catch amount, household consumption , income by each fishing gear, Market orientation

Q16. Three types of fishing gears mainly used	Q17. No. of fishing gears used per trip	Q18. Fishing effort (by each type fishing gear)			Q19. Species caught by each fishing gear (specify % of total caught a day and sell price of each species (THB)	Q20. Total catch amount by each type of fishing gear (kg/ day)	Q21. Household consumption (% of total amount caught a day)	Q22. Average income by each fishing gear (THB/day)	Q23. Market orientation 1= Sale at fishing port, specify:_____ 2= Sale at market, specify:___ 3= Sale at house/village to middleman, 4= Sale to other sources, specify:___
		(hours/ trip)	(trips/ day)	(days/ month)					
					1st: _____ (__ %) (_____ THB/kg) 2nd : _____ (__ %) (_____ THB/kg) 3rd : _____ (__ %) (_____ THB/kg) Other species: _____				
					1st: _____ (__ %) (_____ THB/kg) 2nd : _____ (__ %) (_____ THB/kg) 3rd : _____ (__ %) (_____ THB/kg) Other species: _____				
					1st: _____ (__ %) (_____ THB/kg) 2nd : _____ (__ %) (_____ THB/kg) 3rd : _____ (__ %) (_____ THB/kg) Other species: _____ _____				

Q24. How much is your household's income (in average from all types of fishing gears before deducting the cost) ? _____THB/day

Q25 Fixed cost

Items	Size (m. or hw)	Amount (units)	Price per unit (THB)	Useful life (years)	Cost of repair: (THB/year)
Q25.1 Boat:					
Boat type:_____	……m.				
Boat engine:_____	…….HP				
Boat type:_____	……m.				
Boat engine:_____	…….HP				
Q25.2 Three types of fishing gears mainly used:					
1)_____ Licence cost:_____ (THB/year)	W*L*H ……m.				
2)_____ Licence cost:_____ (THB/year)	W*L*H ……m.				
3)_____ Licence cost:_____ (THB/year)	W*L*H ……m.				

Q26. Operational cost

Items	Amount (units/day)	Price per unit (THB/unit)	Total cost (THB/year) (if applicable)
Q26.1 Type of fishing gears: 1) _____			
Petrol for boat	_____(Liter/day)	_____(THB/L)	
Labor (hh members)	_____(person/day)		
Labor cost	_____(person/day)	_____(THB/person/day)	
…….Bait:_____	_____(Kg/day)	_____(THB/kg)	
Ice	_____(Kg/day)	_____(THB/kg)	
…….Other costs:___	_____(THB/day)		
Q26.2 Type of fishing gears: 2) _____			
Petrol for boat	_____(Liter/day)	_____(THB/L)	
Labor (hh members)	_____(person/day)		
Labor cost	_____(person/day)	_____(THB/person/day)	
…….Bait:_____	_____(Kg/day)	_____(THB/kg)	
Ice	_____(Kg/day)	_____(THB/kg)	
…….Other costs:___	_____(THB/day)		
Q26.3 Type of fishing gears: 3) _____			
Petrol for boat	_____(Liter/day)	_____(THB/L)	
Labor (hh members)	_____(person/day)		
Labor cost	_____(person/day)	_____(THB/person/day)	
…….Bait:_____	_____(Kg/day)	_____(THB/kg)	
Ice	_____(Kg/day)	_____(THB/kg)	
…….Other costs:___	_____(THB/day)		

Q27. What was the highest cost of your household's fisheries? _____
This cost was estimated as how many percent of the total cost _____

Q28. In the past 12 months, please compare between income and cost of your household's fisheries.
( ) 1. Income more than cost ( ) 2. Income equal to cost (not much different)
( ) 3. Income less than cost

Q29. In the past 12 months, please indicate your level of satisfaction on the benefit returned from your household's fisheries
( ) 0. Not satisfied ( ) 1.Slightly satisfied
( ) 2. Moderately satisfied ( ) 3. Highly satisfied

Section 3. Attitudes and perceptions (Q30-Q44)

Q30. Perceptions of fisheries resource conditions:

How would you describe current fisheries resource conditions in Trat?
(Condition scale*: 1=to very bad, 2=bad, 3=not good not bad, 4=good,) 5= very good)

Types of resources	Resource condition scale* (1-5)	More specific info:
Fish		
Shrimp		
Acetes shrimp		
Crab		
Cephalopod		
Shell		
Others: specify_____		

Q31. Perceived threats to fisheries resource

What are the top 3 major threats to the health of fisheries resources (negative impact) in your main fishing ground? Please enter a "1", "2", and "3" in front of the perceived threats

____ 1. Marine pollution
____ 2. Increase in number of fishers /fishing gear increase
____ 3. Illegal fishing
____ 4. Natural disaster (specify) _____
____ 5. Other (specify) _____

Q32 Awareness of regulations and laws related to fisheries in Trat:

Do you know about any regulations and laws related to fisheries in your main fishing ground? ( ) 0. No ( ) 1. Yes

Q33. Compliance:

On a scale of 1 to 5, to what extent do most fishers comply with fisheries regulations and laws in Trat?

( ) 1. No compliance ( ) 2. Low compliance
( ) 3. Moderate compliance ( ) 4. High compliance
( ) 5. Full compliance
Reasons: _____

Q34. Enforcement:

On a scale of 1 to 5, to what extent are the rules and regulations enforced in Trat?

( ) 1. No enforcement ( ) 2. Low enforcement
( ) 3. Moderate enforcement ( ) 4. High enforcement
( ) 5. Full enforcement
Reasons: _____

Q35. Participation in decision making:

On a scale of 1 to 5, to what extent do you participate in fisheries management decision-making in Trat?

( ) 1. No participation ( ) 2. Low participation
( ) 3. Moderate participation ( ) 4. High participation
( ) 5. Fullparticipation
Reasons: _____

Q36. Membership in stakeholder organizations:
Are you or someone from your household a member of stakeholder organization?
( ) 0. No ( ) 1. Yes, which organization?: _____

Q37. Perceived fisheries management problems:
Aside from threats, what do you see as the two major problems facing fisheries management in Trat?
1._____; 2._____

Q38. Perceived fisheries management solutions:
From Q37, what do you see as solutions to these problems?
1._____; 2._____

Q39. Success in fisheries management:
What two things do you think have worked well for fisheries management Trat?
1._____; 2._____

Q40. Challenges in fisheries management:
What two things do you think have not worked well for fisheries management in Trat?
1._____; 2._____

Q41. Fishery management options in Trat:
Indicate degree of agreement with the following fishery management options (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree)

Measures/options for fisheries management in Trat* (see map of fishing zone above)	Disagreement/Agreement Level					Reasons
	1	2	3	4	5	
1. No fishing in zone 1, 2, and 3 permanently						
2. No fishing in zone 1, 2, and 3 in some seasons						
3. No fishing in zone 1 and 2 permanently to conserve *Rastreliger brachysoma*, endangered species e.g., dolphin, and mangroves						
4. No fishing in zone 1 and 2 in some seasons (Alternate with opened-closed seasons between zone 1 and zone 2)						
5. No use of some fishing gears in zone 2 and zone 3 in May - Oct to conserve *Rastreliger brachysoma*, swimming crab, and short-necked clam						
6. *Rastreliger brachysoma*: No fishing in spawning season in zone 3 in Feb-May to conserve *Rastreliger brachysoma*						
7. *Rastreliger brachysoma*: No use of any fishing gears having net mesh size smaller than 4.5 cm. in Mar-May to conserve *Rastreliger brachysoma*						
8. Dolphin: Promote of dolphin watching tourism in Trat						
9. Fish larvae: Publicity campaign for no take fish larvae						
10. Sea turtle: reserved feeding and spawning area for sea turtle						
11. Sea grass: Reserve existing area and new planting for suitable species						
12. Promote more and maintain crab bank project						
13. Squid eggs: Promote squid egg hatching bank by training fishery community and establish squid egg bank						
14. Mussel: Increase area for mussel culture in allowed areas, and placed artificial reef in the areas not allow						

*Option 2-14 was proposed by fishers during the first stakeholder meeting organized by Rebyc II-CTI Project on 29 Oct 2013. Option 1 was proposed by the researcher to observe the responses.

Q42. Apart from the fishery management options in Trat in Q41, do you have any management options to propose?

( ) 0. No.

( ) 1. Yes, specify: _____

_____

Q43.Do you think that you can continue with current fishing activities in Trat forever?

( ) 0. No Why?._____

If you could not continue fishing, what alternative job will you do? (specify alternative job)_____

( ) 1. Yes, Why?_____

Q44. Other comments and recommendations for fisheries management in Trat

_____

_____

_____

_____

Thank you for your cooperation

Appendix V – **Total landing of marine fish by landing place in quantity (tonnes) and value (THB 1 000) in Trat Province in year 2006 – 2011**

		Mueang Trat	Klong Yai	Laem Ngop
2006	Quantity	13 040	36 180	25 894
	Value	174 092	417 525	185 125
2007	Quantity	11 566	31 462	20 193
	Value	154 787	367 557	163 086
2008	Quantity	12 011	29 885	18 864
	Value	171 918	344 698	154 519
2009	Quantity	12 285	35 713	20 559
	Value	189 909	432 139	183 527
2010	Quantity	10 263	31 790	25 325
	Value	171 591	479 656	326 630
2011	Quantity	10 625	34 208	23 317
	Value	170 331	582 629	284 919

Source: DOF 2013c. Statistics of Marine Fish at Landing Place 2011 (No. 12/2013). Fishery Statistics Analysis and Research Group, Information Technology Center, DOF, Bangkok, Thailand. 32 pages.

Study on trawl fishery socio-economics and supply chains in Kien Giang, Viet Nam

Thong Ba Nguyen
Consultant

ABSTRACT

This study on the socio-economics and supply chain of trawl fisheries in Kien Giang province, Viet Nam, was conducted during November and December 2015, and focused on otter trawler fleets, shrimp trawlers, anchovy pair trawlers and mixed pair trawlers in Rach Gia city, Chau Thanh district and Ha Tien Township. Questionnaires were designed to interview and get feedback and relevant information from fishers, vessel owners, middlemen, seafood/fishmeal processors and traders, associations and fisheries managers. The main objectives of the study are to identify: (1) the key issues related to socio-economics of the trawl fishery in Kien Giang including catch and catch composition, catch volume and value, role of main fish production in the fishery concerned; (2) issues related to fishing operation and post-harvest handling practices; (3) importance of the trawl fishery in terms of food security, livelihoods and incomes of stakeholders who may be directly or indirectly impacted by the fishery and; (4) issues related to management of the fishery.

The study focused on social aspects such as the number of fishermen and associated labourers in the fishery; and the incomes and livelihoods of major groups (fishers, vessel owners, fish porters, fish pickers, workers in the fishmeal processing plants, seafood processing factories). Analysis of trends in catch landings of the important fishing fleets in recent years and rough estimations of some other indicators for the fishing fleets concerned (e.g. trip revenue, trip operational cost and net benefit) was performed based on the data and information collected. Assessments of the key supply chains for the major products caught by trawlers such as pig fish/fertilizer fish,[1] dried squid, octopus and cuttlefish, shrimp, were carried out.

The trawl fishery plays an important role in terms of socio-economic development in the province, and annually contributes about 85 percent of the total landing volume, as well as providing work for about 27 500 fishers, as well as a larger number of labourers involved in fishmeal processing, seafood processing and sun-drying shrimp, and fish porters at the landing sites and fishing ports. Additionally, the fishery supplies important sources of raw materials for the fishmeal industry in the Province as well as throughout South Viet Nam. In 2015, about 110 000 tonnes of fishmeal was produced in the province which is important ingredient of the aquaculture feed for shrimp and other fish species farmed in the country and a part was used for export.

However, the fishery is faced with issues that may impact on its sustainability and these challenges and difficulties must be addressed to ensure a long-term sustainable fishery. Such issues currently include: weak management of fishing labourers, increasing conflicts with other fishing fleets, poor fishing and handling practices, and weak monitoring, control and surveillance (MCS). The increasing demand on raw materials for fishmeal industry and seafood for human consumption create more challenges to the sustainability of the fishery.

This study also emphasized current fisheries management bodies at the local level and management policies and strategies at both the central and local levels. The central government has recognized that trawl fishing capacity should be reduced and have developed a roadmap to decrease the number of trawlers in the coming years. This also involves a freeze on the quantity of small trawlers (below 90 HP). Additionally, the study shows that it is difficult to persuade trawler operators to change to other gears, because trawl fishers are still able to stay in business with positive benefits.

[1] Pig fish and fertilizer fish are translations into English of the Vietnamese terms that refer to fish that are used for feeding pigs, or in the past, used as fertilizer in agriculture. Pig fish or fertilizer fish is normally comprised of low value species mainly threadfin porgy, flat head fish, cardinal fish, goatfish, and partly of juveniles of economically important species, including lizard fish, goat fish, red bigeye, and croaker. In the literature, pig fish and fertilizer fish may be referred to as low value fish or "trash fish". In this paper, there are instances when the term "trash fish" is used, and this refers to what is locally termed as pig fish/fertilizer fish.

There is a need to improve the trawl fishery in Kien Giang towards sustainability to ensure security for the large number of beneficiaries who have either direct or indirect benefits from the fishing operations. Collective efforts should be made among relevant stakeholders and actors along the key supply chains of the products sourced by this important fishery.

While the information collected from the study is informative and valuable, the limitations of the study duration and coverage should be taken into consideration when using the results. An in-depth study on the socio-economics of trawl fishery and other gear types should be performed to fulfill the gaps and to keep track of the trends. Nevertheless, the outputs of the study are useful as baseline for later comparison and valuable for reference purposes.

ACKNOWLEDGEMENTS

On behalf of the consultancy team, I would like to express our thanks to the donor, the Global Environment Facility (GEF) and its Executive Partner, Food and Agriculture Organization of the United Nations (FAO) and representatives in the Asia-Pacific region (FAORAP) as well as in Viet Nam (FAOVN) for offering us the chance to implement these studies, and to provide the financial and technical support to carry out our work.

Our special thanks go to Mr. Rick Gregory, Mr. Petri Suuronen, Dr. Susana Siar and the REBYC-II CTI project national facilitation unit in Viet Nam for their kind help in preparation of the consultancy work and studies at the field, as well as their invaluable comments, advices and recommendations related to the finalization of this report. Additionally, I would like to express my special acknowledgement to Mr. Nguyen Xuan Trung, Vice Director of Fisheries Department in Kien Giang, Mr. Le Anh Dung, leader of the Anchovy Pair Trawl Cooperative in Ha Tien, Mr. Nguyen Van Du, member of the Rach Gia Fisheries Association, and Mr. Nguyen Van Tinh, Director of Tac Cau Fishing Port for their helpful contributions to these studies.

This study would not have been completed without the collaboration of local staff under the Division of Ha Tien Socio-economics, Kien Giang Provincial Department of Agriculture and Rural Development (DARD), the Provincial Division of Fisheries (former Sub-DECAFIREP), Fisheries Associations (FA), leaders of local fisheries cooperatives, seafood enterprises, fishmeal industries, Ha Tien Fishmeal, Phuc Ngoc Fishmeal, Skretting Viet Nam, CP Viet Nam, Huy Nam seafoods, and Tac Cau Fishing Port Authority, all of whom provided very good cooperation in exchanging information and participating in discussions on the relevant issues.

Last but not least, we like to send our thanks to the local fishers, seafood workers, middlemen, seafood traders/brokers and other stakeholders who have kindly gave us their time and provided invaluable inputs into our study.

Once again, thank you all very much!

ABBREVIATIONS

ASC	Aquaculture Stewardship Council
BAC	Boat Active Coefficient
BRD	bycatch reduction device
CP Vietnam	CP Vietnam Joint Stocks Company
CPUE	Catch per Unit of Effort
CSR	Corporate Social Responsibility
CTI	Coral Triangle Initiative
DARD	Provincial Department of Agriculture and Rural Development
DFISH	Directorate of Fisheries
DOF	Department of Fishery
DPI	Department of Planning and Investment
EEZ	exclusive economic zone
FA	fisheries association
FAO	Food and Agriculture Organization of the United Nations
FAORAP	FAO Regional Office for Asia and the Pacific
GDP	Gross Domestic Product
GEF	Global Environment Facility
HCMC	Ho Chi Minh City
hp	horsepower
IFFO	International Fishmeal and Fish oil Organization
MARD	Ministry of Agriculture and Rural Development
PPC	Provincial People's Committee
RIMF	Research Institute for Marine Fisheries
SEAFDEC	Southeast Asian Fisheries Development Center
TC	total cost
TR	total revenue
UNEP	United Nations Environment Programme
VND	Viet Nam Dong (Viet Nam Currency); 1USD is equivalent to 22,470 VND

INTRODUCTION

Increasing fisheries sustainability concerns, particularly in relation to trawl fishing, are being paid more attention globally. Approaches relating to social aspects, environmental impacts and the promotion of the ecosystem approach to fisheries management are being applied by a range of organizations to try to improve the sustainability of trawl fisheries. Trawlers are dominant in Thailand, Viet Nam and many other Southeast Asian nations and are important in providing raw materials for fishmeal processing industries and seafood for human consumption. However, trawlers are largely non-selective in their operation and may have negative impacts on fisheries resources and the environment by damaging critical habitats such as nursery grounds, spawning grounds, seaweed meadows and coral reefs. Poorly managed tropical trawl sector in Asia is leading to depletion of fish stocks in nearshore waters (FAO, 2014) and dramatically decreased landing volumes and catch per unit effort (CPUE) in some countries in the Region (Saikliang, 2013, Ramiscal and Dickson, 2009).

Asian countries are currently among the biggest aquaculture producers and Viet Nam is considered as one of the top five aquaculture producers in the world. This means that the demand for fishmeal is rapidly growing and huge volumes of fishmeal and fish oil are needed to produce the aqua feeds upon which the industry depends. This demand means that fishers are able to retain all the fish caught and the 'bycatch" and discard definition/concepts cannot be applied to the Region. In Viet Nam, bycatch reduction devices (BRDs) are not being used by trawlers and small mesh-size codends are the norm. A large number of households have livelihoods and incomes that are heavily dependent on the trawl fishery. In Viet Nam, materials to replace fishmeal as an aquafeed ingredient have not yet been developed. This leads to the requirement for harmonized solutions to fisheries management that ensure the sustainability of the trawl fishery, while negative impacts to the environment and livelihoods, are reduced, but which still match the demands from the aquaculture sector.

Some international organizations are updating, amending and developing new standards for aquaculture feed production through certification and labeling, e.g. Aquaculture Stewardship Council (ASC) and The International Fishmeal and Fish Oil Organization (IFFO). Thus higher standards for social and environmental impacts and the concept of corporate social responsibility (CSR) in the fishery industry are also being developed and are starting to be applied in many fisheries. These demands add pressure on the aquaculture industry to improve and promote sustainable fisheries management. The sustainability of the trawl fishery is a vital issue not only for people directly involved in trawl fishing operations but also for the large number of people indirectly engaged in the fishery and other stakeholders who are using or trading fish products unloaded by the trawlers.

There are presently about 3 192 units of pair trawlers and 560 otter trawlers operating in Kien Giang province. Officially, there are no "anchovy pair trawlers" in the Registry licensing system used in the province. However, there are significant differences between the fleets of anchovy pair trawlers and "mixed pair trawlers" in terms of fishing gear used, the fishing grounds trawled and the main target species. There are 350 pairs of anchovy pair trawlers in the province, and mixed pair trawlers which use two types of trawl fishing gears, and can fish both daytime and nighttime. Otter trawlers are normally small in size and engine capacity, targeting mainly shrimp, squid and cuttlefish, and mixed fish.

There are around 30 seafood and 12 fishmeal processing companies operating in the Province (not including fish sauce industry). Annually, the local fishmeal processing plants provide thousands of tonnes of fishmeal as an input material for aqua feeds or livestock feed processing industries in Viet Nam, and a part is used for export. The importance of the trawl fishery can be seen through these linkages. Nevertheless few

studies have been done to obtain more comprehensive knowledge and information about the fishery. To date, in-depth studies on the socio-economics of trawl fishery are very limited, either in Kien Giang or anywhere else in Viet Nam.

In the current context, there are insufficient human and other essential resources to ensure good management of the fishery. Landing data collection is not part of the routine work done by the local authorities. There is an absence of data on fish landings, fish stock assessment or other fisheries economic information. Thus it is challenging to do a rapid assessment of the economic aspects, including fish landing value, contributions to livelihoods, incomes of the relevant actors) and social aspects (labour, gender issues, conflicts, work generation, raw material dependence etc.). Studies relating to the socio-economics of the trawl fishery in Kien Giang are rare and no specific research on socio-economics of the trawl fleet has been done so far. In 2014, an assessment against Responsible Supply of Fish Meal and Fish Oil standard (IFFO RS standards)[2] concluded that fishery compliance is low (IFFO, 2014).

In order to have a more detailed and comprehensive understanding of the trawl fishery and to better understand its importance, the REBYC-II CTI Project designated an activity namely "Study on trawl fishery socio-economics and supply chains in Kien Giang, Viet Nam". This study focuses on the Kien Giang trawl fishery and some important related supply chains. Data for the study were collected between October and December 2015.

The study aimed to find answers to the following concerns:

- The major socio-economic characteristics of the trawl fishing community;
- Importance of trawl fishery in food security, livelihoods, incomes and resource users dependent on this fishery;
- Key issues related to fishing operations and fisheries management; and
- Connections between capture fishery (trawl fishery) and aquaculture as well as industries dependent on raw materials sourced from trawl fishery in Kien Giang.

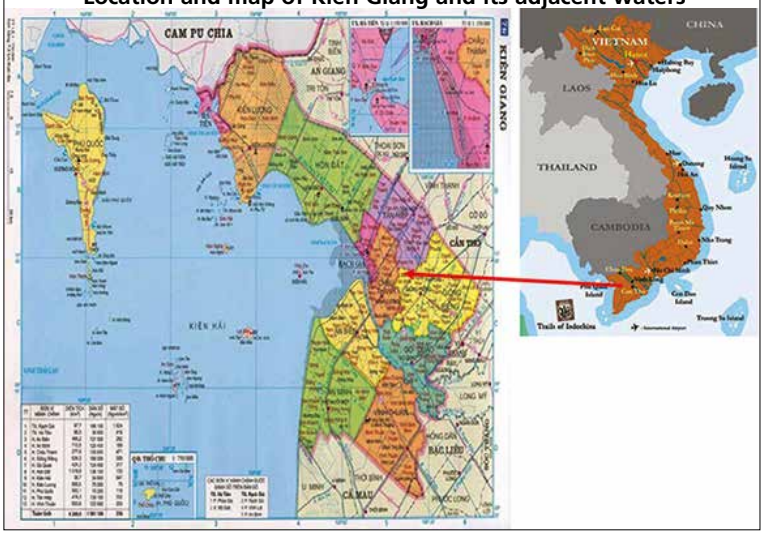
This report presents key findings from the study, particularly with regards to the supply chain of some key products from the trawl fishery in Kien Giang. The supply chain approach provides information on the linkages between actors and identifies who are getting benefits, and whose incomes/livelihoods are most dependent on the trawl fishery.

2. OVERVIEW OF KIEN GIANG TRAWL FISHERY

Located in the southwest area of Viet Nam, Kien Giang is a relatively large province and the fisheries sector is important to the local socio-economy. There are 15 administrative districts having marine capture fishing vessels. However, the vessels are most dominant in Phu Quoc, Rach Gia City, Kien Hai, Kien Luong, and Ha Tien township and Hon Dat districts. Accordingly, Kien Giang is the most important fishing province in Viet Nam. Kien Giang marine waters belong to the eastern part of the Gulf of Thailand which border with Ca Mau province and Cambodian waters (Figure 1).

[2] The International Fishmeal and Fish Oil Organization (IFFO) has developed a Global Standard and Certification Programme for the Responsible Supply of Fishmeal and Fish Oil (IFFO RS). IFFO recognizes the importance of responsible sourcing, responsible production and responsible supply practices. The standard covers criteria related to state of fisheries resource concern, existing and operating of the fisheries management in place (management framework), management approaches and measures and management performance, responsible traceability and manufacturing practices.

FIGURE 1
Location and map of Kien Giang and its adjacent waters



The province has the largest number of fishing vessels (10 275 units). The trawl fleet in Kien Giang is also the largest compared to the other provinces. There are many different fishing gear types used in the province, including trawls, gillnets, purse seines and hook & lines (Table 1). There are also several thousand small fishing boats catching fish by other gears such as pots and traps (for crab, squid and cuttlefish, octopus), push nets and lift nets.

TABLE 1
Structure of fishing fleets by gear types and horsepower groups in Kien Giang

Gear type	HP group							Sub-total
	< 20	20 - < 45	45 - < 90	90 - < 150	150 - < 250	250 - < 400	>= 400	
Anchovy purse seine	0	2	3	8	47	138	44	**242**
Mackerel purse seine	0	0	1	1	6	98	4	**110**
Purse seine with light	0	0	0	0	0	0	0	**0**
Bottom gillnet	103	101	34	4	7	88	3	**340**
Gillnet	0	3	8	1	3	87	9	**111**
Shrimp gillnet	78	55	5	3	3	0	0	**144**
Small size trammel net	0	4	0	0	0	0	0	**4**
Sardine gillnet	99	40	1	0	0	0	0	**140**
Crab trammel net	1 329	1 043	317	17	75	18	4	**2 803**
Otter trawl	1	69	72	41	181	125	71	**560**
Pair trawl	0	0	1	10	56	406	2 159	**2 632**
Squid hooks and lines	743	620	72	23	39	11	2	**1 510**
Bottom long line	92	91	27	8	25	32	1	**276**
Crab trap	0	0	3	0	0	0	0	**3**
Cuttlefish trap	107	107	10	6	31	10	0	**271**
Set net	7	41	0	0	0	0	0	**48**
Logistic services	19	16	3	6	24	148	57	**273**
Others	112	359	161	73	89	14	0	**808**
Sub-total	**2 690**	**2 551**	**718**	**201**	**586**	**1 175**	**2 354**	**10 275**

Source of data: Kien Giang Department of Fishery, 2015.

Official statistics state that the agriculture and fishery sectors account for 30 percent of gross domestic product (GDP) of the Province. The annual fish landing of the province is estimated at more than 500 000 tonnes. In the first six months of 2015, the total landing volume of the marine capture fishery was about 238 900 tonnes (Kien Giang PPC, 2015). Trawlers yearly contribute about 440 000 tonnes. The biggest fishing port in Kien Giang is Tac Cau, which is located in Chau Thanh district and the port is large, compared to others in Viet Nam. The port has developed a number of facilities, including clean water supply, fuel stations, sorting places, quays for unloading fish, anchoring places, stores for foods and beverages and other necessary support for crews. There are smaller fishing ports in other districts e.g. Xeo Nhau fishing port (An Bien district), Ba Hon fishing port (Kien Luong district), An Thoi fishing port (Phu Quoc island), Nam Du fishing port (Kien Hai district) and Linh Huynh fishing port (Hon Dat district) and about six landing sites located in the coastal districts of the province. However, most of the port facilities are old and poorly planned and managed. The environment in and around the ports is not clean and little attention is paid to collecting and treating waste materials. Most landing sites are under-invested and have few facilities available for providing the necessary services for fishing operations. Typically, landing sites are difficult to approach, transport fish to, and it can be difficult to purchase ice and fuel.

Under this study, the trawlers in Kien Giang can be categorized into several types as below:

Anchovy pair trawlers operate during the nighttime and use larger gear compared to that of other trawlers. The anchovy trawl normally has a header and footer rope of about 150 m and the length of the gear is about 140 m. The length of the codend is around 8 m and the mesh size at the wings can be 8 m (stretched full mesh size) and is then gradually decreasing downward to the belly. Usually the codend mesh size is 3–4 cm, although some gears may have smaller mesh size. The opening width of the gear can be in range of 70–80 m and opening height 30–40 m. Anchovy trawling fleets mainly catch anchovies and other small pelagic fish species; however, they also catch squid, cuttlefish and octopus. Usually, anchovy and economically important species are dominant in the catches. Anchovy pair trawlers are abundant in Ha Tien, Hon Dat and Ba Hon districts.

Mixed pair trawlers targeting mixed species are dominant in terms of the number of trawlers in the province. This fleet uses two types of trawl gears that are used during the daytime or nighttime. Squid is the most important commercial catch of this fleet in terms of landing value or trip revenue. The majority of squid caught is sun dried onboard and kept in milled ice for transporting to the shore. Catches comprise of commercially valuable species and what is called in Vietnamese as “pig fish” (fish for feeding pigs) or “fertilizer fish” (in the past this sort of fishes was used as fertilizer in agriculture/cultivation). Pig fish or fertilizer fish is normally comprised of low value species mainly threadfin porgy, flat head fish, cardinal fish, goatfish, and partly juveniles of economically important species, including lizard fish, goat fish, red bigeye, and croaker. Mixed-species pair trawlers come mainly from Rach Gia, Kien Luong, Kien Hai districts.

Shrimp trawlers use otter trawls (i.e. have trawl doors that are dragged along the seabed to spread the trawl) and are usually smaller compared to other trawlers. The total number of shrimp trawlers is about 1 000 units in the whole Province with the majority concentrated in Ha Tien, Ba Hon and Hon Dat districts. The engine capacity of the vessels varies from 50 to 350 hp, with the most common range being 70–250 hp. The fishing grounds of the shrimp trawl fleet are around the islands of Phu Quoc, Tho Chu, Nam Du and close to Ca Mau Cape, with some operating in Ba Ria Vung Tau waters. The key target species of these fleets are shrimp, squid, cuttlefish, and octopus.

Pig fish/fertilizer fish also contributes a proportion of the catch of the shrimp fleet and are retained in their catches.

All types of trawlers in the province operate all year round and are active on average for 10–11 months per year. However, the important season is the southwest monsoon (May–September). During this season, sea conditions are favourable for trawl fishing operations. During northeast monsoon season (November–March), fishing vessels have smaller catches compared to the southwest monsoon season. During this season the sea is rougher which is disadvantageous for conducting trawl-fishing activities. In addition, some fish species also have seasonal migration behaviour.

The agriculture and fishery sectors account for 49 percent of the labour in Kien Giang (Kien Giang DPI, 2015). It is estimated that 82 000–90 000 fishers are working in the capture fishery sector of the province. Crews and labour are important matters for the fishing vessel owners in Kien Giang. In 2014, during the northeast monsoon, about 500 trawlers were not able to carry out fishing operations due to lack of crew members (Kien Giang Fisheries Association, 2014). Two fisher associations were established in 2012 and 2014. The first fisher syndication has 91 members and the second one has 25 members. The fisher associations were formed at the provincial level (Kien Giang Fisheries Association) and at the district level, e.g. Rach Gia City Fisheries Association. However, these associations have limited operations and do not have a strong impact on fishers and other members. Fishers have formed themselves into informal cooperatives based on relations or friendships. Normally, users of the same fishing gear or the same fleet, may gather together to establish cooperatives. A typical cooperative of shrimp trawlers is about 30–40 vessels and for anchovy pair-trawlers, 20–30 pairs.

Middlemen play an important role in providing capital for vessel owners to cover fishing operational costs and play a lead role in the market distribution of landed catches. Fishers have close connections with middlemen in the fishing sector or in the supply chains for seafood and fishmeal originating from the trawl fishery. It is difficult for seafood producers to buy fish directly from fishers, and they usually have to buy fish through middlemen. There are about 30 seafood processing companies (excluding fish sauce industries) and 12 fishmeal processing companies located in Kien Giang. This industry creates jobs and livelihoods for thousands of workers in the Province.

Ice blocks are kept on board all types of trawlers for preservation of the catches. Shrimp trawlers also bring salt for boiling shrimp at sea. Most trawlers bring their catches to Tac Cau fishing port. Anchovy pair trawlers usually come to Muong Dao landing site in Ha Tien Township for unloading purposes. Anchovy and pig fish/fertilizer fish are mainly purchased by local fishmeal processing plants. However, a certain part is transported to other provinces e.g. Dong Thap and An Giang provinces, for either homemade aquafeed production or fishmeal processing purposes. Some pair trawlers unload their catches in other provinces that are closer to their fishing grounds, such as Ba Ria-Vung Tau, Ca Mau and Bac Lieu. Then, their catches are transported to Kien Giang by trans-shipment boats. There are now no trans-shipments boats servicing shrimp trawlers in Kien Giang. A representative from each cooperative alternately comes to the homeport or landing site and brings the catches of the others. This kind of activity is performed daily by the cooperatives.

Several studies done by Research Institute for Marine Fisheries (RIMF) show that the fishing effort in southeast and southwest Viet Nam is showing signs of overcapacity (Bui Van Tung *et al*., 2013; Do Van Thanh &, Pham Van Tuyen, 2014). The catch rates of fleets fishing for demersal and bottom fishes have declined while the pig fish/fertilizer fish proportion has increased in trawl landings; the average CPUE declined from approximately 0.30 tonnes per hp per year in 2003 to approximately 0.25 tonnes per hp per year in 2014 (Dang Van Thi & Nguyen Ba Thong, 2008; Do Van Thanh & Pham Van Tuyen, 2014). Post-harvest loss is another issue affecting trawl fishing.

It is estimated that 35–48 percent of the landings from trawlers is lost due to the loss of quality resulting from poor handling practices applied while fishing and preserving catches at sea (Nguyen Xuan Thi *et al.*, 2014).

3. METHODOLOGY

A. Scope of the study

Time frame

This study was carried out during November 2015 to December 2015. The survey, fieldwork and consultation with stakeholders were mainly conducted during November 2015. Secondary data, information and previous study results were also gathered and collected as inputs for the study.

Area of the study

The survey was conducted in Ha Tien Township, Rach Gia City and Chau Thanh District in Kien Giang province. These study sites are highlighted in red circles in Figure 2. The focus of the study was on single trawlers (otter trawlers) and pair trawlers. Studies on the supply chain were also performed in Ho Chi Minh City to gather information related to seafood trading companies.

FIGURE 2

Study sites of the socio-economics survey for trawl fishery in Kien Giang in 2015

Study fields

The study focused on social and economic aspects of the trawl fishery in Kien Giang province. Study indicators and parameters included: the structure of the trawl fishing fleets; catch per unit effort (CPUE), catch composition by main commercial groups; total revenue; total cost of fishing trip; fishing grounds and seasons; numbers of labourers, social issues related to fishing operations; and supply chain actors for pig fish/fertilizer fish, squid and shrimp. Some specific social impacts of the fishery were examined at the data collection sites and included work generation, livelihoods, gender aspects, working conditions, civil society organizations and conflicts.

B. Data collection

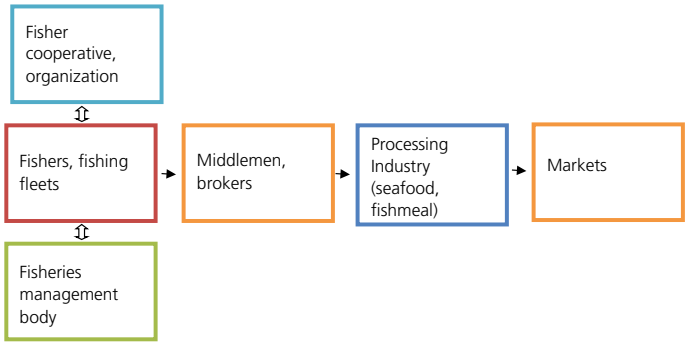
Secondary data

Secondary data and information were collected from relevant sources e.g. Provincial Department of Agriculture and Rural Development (DARD), Department of Fisheries Management, Research Institute for Marine Fisheries (RIMF), Tac Cau fishing port authority, Ha Tien Socio-economic Division, and from available published papers and scientific articles. The desk review was performed to compile data and information for analytical purposes.

Socio-economic study design

The survey was designed to include representation from the two main types of pair trawlers operating in Kien Giang: anchovy pair-trawlers (mainly in Ha Tien township and Ba Hon and Hon Dat districts) and mixed pair trawlers operating both day and night time. These fleets target all types of fish species; however the main revenue comes from squid, followed by the commercially valuable species. The other trawler types surveyed during the study were shrimp trawlers. This fleet mainly occurred in Ha Tien and Ba Hon districts. For each fleet, the survey was designed to cover the key actors (Figure 3) involved in the supply chains of its key products, i.e. "supply chain approach".

FIGURE 3
Key stakeholders in the socio-economic study of the Kien Giang trawl fishery



Middlemen in Ha Tien, Rach Gia and Chau Thanh were interviewed and relevant information related to their businesses (annual catches, production traded, prices, costs associated to the business) collected. However, due to the strong competition in this sort of business, some important information was considered as "sensitive" and was not easy to obtain from the interviewees. The processing industry can be categorized into two major types: fishmeal processing and seafood processing. Important fishmeal processing plants in Ha Tien and Chau Thanh were visited and operators interviewed to acquire relevant information. Some seafood processing, cephalopod processing and exporting companies located in Chau Thanh district were also surveyed. Specific questionnaires were designed to collect information from fishers, fishing vessel owners, middlemen/brokers and processing industry. The questionnaires used in this survey can be found in the appendices.

Consultation with relevant stakeholders

Consultations with stakeholders including fisheries managers, fisheries management experts, middlemen, fishmeal and seafood processors, crews, vessel owners, and fisheries associations were performed to acquire a basic understanding of the trends in fisheries resource availability, landings, fish quality and associated issues. Consultations were either done by individual meetings or at group meetings. However, stakeholders

were segregated by actors along the supply chain, to ensure that no conflicts of interests occured during the consultation process. Talks included broad and focused comments, disscussions and suggestions from all relevant stakeholders. Issues frequently repeated by stakeholders were considered as core issues.

Sample size

The category and number of respondents are described in Table 2. Questionnaires were designed to explore gaps in existing information. Some relevant information was retrieved from available studies already carried out under either REBYC II-CTI Project or other projects related to trawl fisheries in Kien Giang, e.g. landing data collection survey done by RIMF, IFFO–RS standards assessment of Kien Giang trawl fishery (IFFO, 2014).

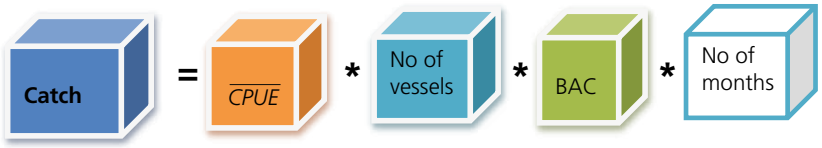
TABLE 2
Respondents for the socio-economic survey of the trawl fishery in Kien Giang

Category of respondents	Number of samples
Shrimp trawlers	30
Shrimp sundried processing	15
Anchovy pair trawlers	20
Mixed pair trawlers	20
Middlemen	3
Fish porter	6
Fishmeal processing	3
Seafood processing	1
Total	**98**

c) Data analysis

Total catches of the fleet

An estimation of the catch from the fishing fleet was done in line with suggestions from Stamatopoulos (2002). The calculation of the total catch of a fishing fleet concerned is calculated by the mean catch rate (catch per unit effort or CPUE), quantity of the vessels, the proportion of vessels operating, Boat Active Coefficient (BAC), and the given time period (month, quarter or year).

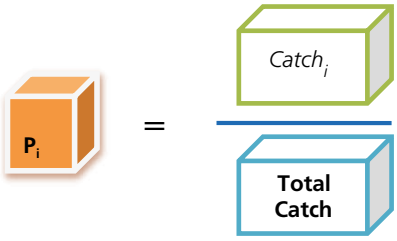


The Boat Active Coefficient (BAC) reflects the level of intensity of fishing fleet effort assumed during a certain time period. If 100 percent of vessels are operating, the BAC is 1.0. In bad weather conditions (typhoon, storm, rough sea etc.) no fishing vessel can operate, meaning that the BAC of the fleet at that time is 0. In a simple way, the BAC can reflect the percentage of the total fishing effort of the fleet. In other words, the higher the BAC, the more fishing effort is being used for fishing activity.

The BAC is referred from previous studies conducted for the Kien Giang trawl fishery and in consultation with local fishers, fishing vessel owners and managers. The BAC is estimated to be 0.65 to 0.70, meaning that on average, 65–70 percent of the fishing effort is involved in fishing operations at any one time.

Catch composition by commercial groups

The catch composition or proportion of each commercial group or even single species can be calculated by the following equation:



Where: P_i is proportion of group i^{th}
$Catch_i$ is total catch in the trip of the group or species i^{th}

Total Catch is the total weight of all species, groups caught in the trip.

Total cost

Table 3 identifies the costs associated with fishing operations.

TABLE 3
List of some associated costs to be included in the fishing operations of the fleet

Type of cost associated with fishing operation	Covering	Remarks
Fuel consumption	Oil, gas, lubricant	
Materials for fish handling	Ice block, salt	
Plastic bag, baskets	Bags for packing fish onboard	
Food and fresh water	Food, drinking waters for crew onboard	
Gear reparations	Cover gear repaired	
Home port fee	Fee paid according to current regulations	
Fish unloading service charge	Fish porters rent at landing site	
Fees for broker to recruit/find fishers		
Opportunity costs	Compensation for the capital invested in fishing operation	The opportunity cost may be estimated relative to the commercial bank interest rates
Fixed costs	Capital invested in buying/building vessel, gear and fishing equipment, maritime devices	

Operational costs: The total operational cost for each fishing trip is a sum of the costs covering fuel, ice block, food, water, fees of finding fishers (if any), plastic bags, and small reparation cost, fees associated with unloading fish, and staying at the port. The calculation used is as follows:

$$TC = \sum_{i=1}^{n} C_i$$

Where: TC is the total operational cost of the trip, C_i is the cost of item i^{th}.

Investment costs (fixed costs): The total investment cost of the vessel is the sum of the money put into building, buying the vessel, cost of maritime equipment, fishing devices, (e.g. echo-sounders), gears, etc. This is normally a large investment and depreciation should be taken into account.

Opportunity costs: Opportunity costs are the capital invested in building vessels or investment in fishing operation that could have been invested in another enterprise or a bank account (for interest). In this study, the opportunity cost of fishing vessel is

based on the popular interest rate of the commercial bank, about 6.5 percent per year. The opportunity cost of the fishing vessel is estimated from the amount of money put into the fishery, if the fisher had not invested money in his fishing operation.

$$OC = Q^{*}r$$

Where: OC is the opportunity cost, Q is amount of money invested in the fishery by the vessel owner and r is commercial rate of the bank.

Lending rate: Most vessel owners have to borrow money from a bank to invest in fishing. Normally they can borrow up to half of the value of the vessel building cost. Thereafter, the vessel owner has to pay monthly interest on the money borrowed.

$$LR = Q^{*}r$$

Where: LR is the lending rate, Q is amount of money borrowed from the bank and r is commercial rate of money borrowed.

Total revenue

The total revenue (TR) of the fishing trip is estimated by applying the following equation:

$$TR = \sum_{i}^{n} Catch_i * p_i$$

Where: TR is total trip revenue, $Catch_i$ is the catch of commercial group i^{th} and p_i is corresponding market price of that group.

Fleet benefit

The benefit of the fishery is estimated for each trip or for one month. The net benefit is the difference between total revenue (TR) and total costs (TC).

Number of crews

For each fleet, the total number of fleet crew working onboard may be estimated using the below formula:

$$FC = N^{*}C$$

Where: FC is the number of crews of the given fleet (for instance, shrimp trawlers or anchovy pair trawlers), N is total number of vessels, and C is average number of crews on every vessel. Then the total number of crews working in trawl fishery in the province is estimated as follows:

$$NC = \sum_{i=1}^{n} FC_i$$

Where: NC is number of crew in the fishery interested, FC_i is the number of crews of the fleet i^{th} and i is the number of stratum or fleet.

Middlemen benefit

Benefits to the middlemen can be estimated based on capital invested, daily or monthly catch volume traded, market prices, and costs of operation. Normally, financial investments or information related to benefits are considered as sensitive, therefore the

benefits and other related information were estimated through calculating the mean values of catches bought (volume, prices), and operational costs (labourers, other fees, taxes, transportation etc.).

Fishmeal production

Fishmeal production from a fishmeal processing plant can be either based on the daily or monthly intake of raw materials. According to the information provided by local fishmeal processors, the average ratio between raw material (wet) and final production (dry) in fishmeal industry is in the range of 3.2–3.4:1. This depends on the quality of the raw material used as well as type of pig fish/fertilizer fish used. Annual reports from the fishmeal industry were also used for reference purposes. Additionally, fishmeal production can be calculated from information generated from the middlemen who supply raw materials to the processing plants and from their yearly estimated landings of pig fish/fertilizer fish.

4. RESULTS AND DISCUSSION

This study was conducted in a short period and we were not able to cover all districts of Kien Giang province. Therefore, the results may not reflect the complete status of the fishery. Additionally, secondary data and information on landings, and socio-economics related to the trawl fisheries in the Province are very limited or absent. However, the study can still be considered as a deep investigation about the socio-economic aspects of trawl fleets operating in Kien Giang, and the outputs of the study may be useful for reference purposes. In-depth research studies of a longer duration or regular surveys should be planned for a more evidence-based policy decision-making process.

a. Fishing effort and operations

a) Otter trawl fishery *(Shrimp trawlers)*

Based on the current statistics reports of the Kien Giang DARD (2015), there are 560 otter trawlers, targeting shrimp and prawn in the provincial waters and adjacent areas such as Ca Mau and Vung Tau provinces. About 75 percent of the total number of shrimp trawlers is above 90 hp (Table 4). The shrimp trawlers mainly concentrate around Ha Tien Township, Hon Dat and Kien Luong districts. The main fishing grounds are in Kien Giang (around Phu Quoc, Hon Thom, Nam Du, Ba Ria Vung Tau islands) but in the northeast monsoon, they tend to trawl the nearshore areas in Ca Mau province. A fishing trip of 5–6 days usually comprises of 3–4 hauls per night with an average towing duration for each haul of around 3–4 hours.

TABLE 4
Number of shrimp trawlers (unit) by engine capacity groups and administrative districts in Kien Giang

District	<90 HP		>90HP		Total	
	Number	Percent	Number	Percent	Number	Percent
An Bien	2	1	26	6	28	5
An Minh	1	1	17	4	18	3
Chau Thanh		0	31	7	31	6
Ha Tien	64	45	30	7	94	17
Hon Dat		0	62	15	62	11
Kien Hai	61	43	37	9	98	18
Kien Luong	8	6	113	27	121	22
Phu Quoc		0	4	1	4	1
Rach Gia	6	4	93	22	99	18
Tan Hiep		0	3	1	3	1
Giang Thanh		0	2	0	2	0
Sub-Total	**142**	**100**	**418**	**100**	**560**	**100**

Source: Kien Giang Provincial Department of Fisheries (DOF), 2015.

FIGURE 4
Some pictures of vessels, landing site, facility for dried shrimp of the trawl fishery in Kien Giang Province

Usually, shrimp trawlers voluntarily organize cooperatives, which are based on kinship relations and/or friendships. Typically, a group of 30–40 trawlers organizes a cooperative. The cooperatives are not registered with any management body or fulfilled any administrative procedures needed; they are completely voluntary and "free" organizations. This is to ensure that after several days, one member vessel of the cooperative will be available to trans-ship the catches of the others to the shore for unloading. Transporting of the catches of the cooperative is alternately done by all members. There are no specialized trans-shipment vessels now because it is not economically efficient. Figure 4 shows some images of the shrimp trawl fishery in Kien Giang Province.

b) Pair trawl fishery

Pair trawlers in Kien Giang are dominant in terms of the quantity of vessels, total engine capacity, as well as landing value. Pair trawlers in Rach Gia city account for approximately 50 percent of the total number of trawlers. Pair trawlers are also found in large numbers in Hon Dat, Kien Hai and Ha Tien districts. However, most pair trawlers in these districts are focusing on catching anchovies and other small pelagic fish. The rest of the trawlers in Kien Giang have mixed gear types: regular trawling nets for daytime fishing and high-opening trawl nets for nighttime operations. Accordingly, there are about 350 pairs of anchovy pair trawlers operating in the province. Detailed information on the number of trawlers by fleet sizes (horsepower) and administrative district are presented in Table 5.

TABLE 5
Number of pair trawlers by engine capacity and districts of Kien Giang in 2015

District	<250 hp		250– 400 hp		≥ 400 hp		Total	
	Number (unit)	%	Number (unit)	%	Number (unit)	%	Number (unit)	%
An Bien			3	0.7	45	2.1	48	2
An Minh			6	1.5	31	1.4	37	1
Chau Thanh			13	3.2	272	12.6	285	11
Giong Rieng			2	0.5			2	0
Go Qao			3	0.7	1	0.0	4	0
Ha Tien	31	46.3	95	23.4	85	3.9	211	8
Hon Dat	27	40.3	111	27.3	301	13.9	439	17
Kien Hai			1	0.2	150	6.9	151	6
Kien Luong	6	9.0	93	22.9	46	2.1	145	6
Phu Quoc	1	1.5	1	0.2	8	0.4	10	0
Rach Gia	1	1.5	67	16.5	1 201	55.6	1 269	48
Tan Hiep			1	0.2	10	0.5	11	0
U Minh Thuong	1	1.5					1	0
Giang Thanh			10	2.5	9	0.4	19	1
Sub-Total	**67**	**100**	**406**	**100**	**2 159**	**100**	**2 632**	**100**

Source: Kien Giang Provincial Department of Fisheries (DOF), 2015.

FIGURE 5
Anchovy pair trawlers unloading their catches at a landing site in Ha Tien district, Kien Giang province

Anchovy pair trawlers (Figure 5) are dominant in Ha Tien and Hon Dat districts while mixed pair trawlers are more concentrated in Rach Gia, Kien Hai and Kien Luong. These mainly target cephalopods (squid, octopus, and cuttlefish), mixed fish (economically valuable fish, including threadfin bream, croakers, lizard fishes, scads, snappers, groupers, etc.) and pig fish/fertilizer fish (threadfin porgy, lizard fish). A few mixed pair trawlers in the province also fish for anchovy during the night. Normally, the mixed pair trawlers operate for 24 hours per day and the number of hauls per day is about 3–4 with each tow being of 6–8 hours duration. As their fishing grounds tend to be more offshore, these trawlers need more crew numbers (20–24 crew members), compared to anchovy pair trawlers (Table 6).

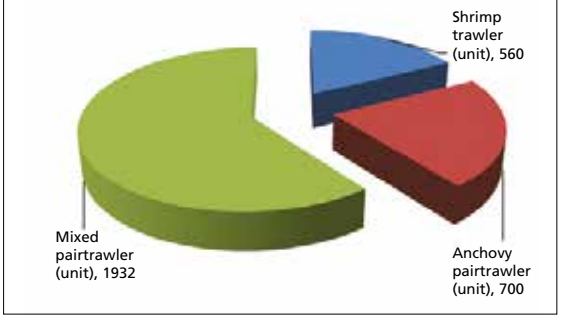
TABLE 6
Information on the fishing operations by gear types of the trawl fishery in Kien Giang

Fisheries	Trip duration (day)	No of crew (person)	Fishing time	No of haul per day (unit)	Haul towing duration (hour)	Fishing time per year (month)	Fishing ground
Shrimp trawler	4–5	4–5	Night	3	3	10–11	Kien Giang, Ca Mau, Vung Tau
Anchovy pair trawlers	15–20	9–11	Night	2	5–6	10–11	Kien Giang
Mixed pair trawlers	25–30	20–24	Day and Night	3–4	6–8	10–11	Kien Giang, Vung Tau

Source: Survey data (November–December 2015).

Anchovy pair trawlers are important suppliers of raw materials for fishmeal processing companies located in Ha Tien and Rach Gia (Tac Cau industrial zone). In addition, a volume of anchovy and pig fish/fertilizer fish landed are transported to neighboring provinces for either fishmeal processing or for processing into aquafeeds for tilapia, snakehead fish or catfish farming. These fleets operate all year, around Phu Quoc Island, in the southwest waters of Viet Nam. Structure of trawling fleets by gear types can be graphically presented as in Figure 6. The two most dominant fleets are mixed pair trawlers and anchovy pair trawlers.

FIGURE 6
Structure of trawl fishery in Kien Giang in 2015



The mixed-species pair trawler fleets in Rach Gia, Kien Luong, Kien Hai frequently fish in offshore waters close to the neighboring countries. Fishing operations take place 24 hours a day. They use both types of trawls: large mesh size trawls and small mesh size fish trawls. The main targeted species are economically valuable fish and cephalopods (squid, cuttlefish and octopus). There are 1 932 mixed pair trawlers, which can set up 966 pair trawler operations. The large mesh size trawls operate during the nighttime. Currently, the mixed pair trawl (Figure 7) fleet is providing the largest contribution to the provincial annual landing volume.

FIGURE 7
The mixed pair trawlers are unloading their catches at the Tac Cau fishing port in Chau Thanh district, Kien Giang Province

b. Catches and landings

Shrimp trawlers have an average catch of around 6 000 kg per month. The most important component in terms of catch value are shrimp, accounting for 64 percent of the catch value, followed by cuttlefish and squid (19 percent), mixed fish for human consumption (13 percent) and pig fish/fertilizer fish accounting for about 3 percent (Table 7). Pig fish/fertilizer fish from shrimp trawlers obtain lower prices compared to pig fish/fertilizer fish from anchovy pair trawlers. The reason for this is that pig fish/fertilizer fish from shrimp trawlers are made up of a number of low value species (threadfin porgy, cardinal fish, puffer fish, flat head fish, goat fish, flounders, leather jacket fish) with a smaller part being made up of juveniles of more economically important fish species, while the "trash fish" in anchovy pair trawlers are mainly anchovies which are preferred for fishmeal processing due to the better quality fishmeal produced and the unique quality of associated fishmeal products.

TABLE 7
Average estimates of monthly economic indicators of the shrimp trawlers (otter trawlers) in Kien Giang based on the survey conducted in November 2015

Commercial Group	Catch per day (kg)	Catch per month (kg)	Catch Value (1000 VND)	Percentage of revenue (%)
Shrimp	120	3 600	90 000	64.4
Mixed fish	30	900	18 000	12.9
Squid, cuttlefish	15	450	27 000	19.3
pig fish/fertilizer fish	40	1 200	4 800	3.4
Total	**205**	**6 150**	**139 800**	**100**

Estimates of economic indicators for anchovy pair trawlers and the mixed pair trawlers in the province are presented in Table 8 and Table 9. The anchovy group is dominant in terms of both catch volume and value for anchovy pair trawl fleets, while squid is the major contributor to trip revenue for the mixed pair trawl fleet.

TABLE 8
Average estimates of monthly economic indicators of the anchovy pair trawlers in Kien Giang based on survey conducted in November 2015

Commercial group	Catch per day (tonnes)	Catch per month (tonnes)	Catch value (1000 VND)	Percentage of revenue (%)
Anchovy	2.56	43.5	348 000	64
Mixed fish	0.14	2.3	46 000	8
Squid, cuttlefish	0.09	1.5	150 000	28
Total	**2.79**	**47.3**	**544 000**	**100**

TABLE 9
Average estimates of monthly economic indicators of the mixed pair trawlers in Kien Giang based on survey conducted in November 2015

Commercial group	Catch per day (tonnes)	Catch per month (tonnes)	Catch value (1000 VND)	Percentage of revenue (%)
Pig fish/fertilizer fish	0.8	20	82 000	7
Mixed fish	1.0	22	270 000	23
Cuttlefish, octopus	0.02	0.4	24 000	2
Squid	0.3	8	800 000	68
Total	**2.1**	**50.4**	**1 176 000**	**100**

The total annual landing volume by trawl fleets of Kien Giang in 2015 were estimated at about 446 000 tonnes. This was made up of 25 000 tonnes from shrimp trawlers, 107 000 tonnes from anchovy pair trawlers and 314 000 tonnes from mixed

pair trawlers. The result is very similar to the published outputs made by the Research Institute for Marine Fisheries (RIMF) in 2014, which estimated the annual catch as 444 000 tonnes (Table 10, Table 11).

TABLE 10

Annual landing estimated by gear types in trawl fishery in Kien Giang in 2015 based on the survey conducted in November 2015

Gear types	Average monthly landing (tonnes)	No of months operated (month)	BAC	Quantity	Unit	Annual landing (tonnes)
Shrimp trawler	6	10	0.75	560	vessel	25 200
Anchovy pair trawlers	47	10	0.65	350	pair	106 925
Mixed pair trawlers	50	10	0.65	966	pair	313 950
Total						**446 075**

Note: The Boat Active Coefficient (BAC) was estimated from the fishers' point of view. The study on BAC of trawl fishery in south Viet Nam suggested the average BAC was 0.65 (Cao Van Hung, 2013).

TABLE 11

Estimates of the annual landing of trawlers in Kien Giang conducted by the Research Institute for Marine Fisheries, 2014

Fishing fleet	Total catch (tonnes)	Proportion (%)
Pair trawler	422 130	95.04
<45 hp	-	0.00
45 – <90 hp	79	0.02
90 – <150 hp	786	0.18
150 – <250 hp	6 312	1.42
250 – 400 hp	86 293	19.43
>400 hp	328 660	73.99
Otter trawlers	22 047	4.96
<45 hp	1 284	0.29
45 – < 90 hp	3 679	0.83
90 – <150 hp	1 946	0.44
150 – <250 hp	4 917	1.11
250 – 400 hp	7 049	1.59
>400 hp	3 172	0.71
Total	**444 177**	**100**

Source: RIMF, 2014.

c. Catch composition

In the estimated landings in Kien Giang in 2014 (RIMF, 2015), pig fish/fertilizer fish accounted for approximately 40 percent of the catch from otter trawlers and 56 percent of the catch from pair trawlers. However, the study did not categorize the pair trawlers into anchovy and mixed pair trawlers. This is important because the anchovy pair trawlers are different from mixed pair trawlers in terms of fishing grounds, target species and fishing operations. The term "trash fish" used by anchovy pair trawlers refers to anchovies (about 80–90 percent catch volume).

A study of the catch composition from shrimp trawlers in Kien Giang shows that shrimp and prawn account for an average of 58.5 percent of the landing volume (Table 12). There are several shrimp and prawn species caught and most are boiled with brine onboard and brought to the shore for sun drying and peeling (Figure 8). Pig fish/fertilizer fish from shrimp trawlers is comprised of low value species such as threadfin porgy, leather jacket fish, pufferfish, flathead fish and goatfish, and accounts for around 19.5 percent of the total catch volume, followed by mixed fish (economically valuable species e.g. croakers, scads, lizardfish, snappers) accounting for 14.6 percent

of the catch volume. The final group accounting for 7.3 percent of catch volume is the cephalopod group comprising of squid, cuttlefish and a small number of octopus. There are no discards at sea; fishers manage to utilize all the catches taken onboard.

TABLE 12
Average estimates of monthly catch composition by main commercial groups of the shrimp trawlers in Kien Giang, based on the survey conducted in November 2015

Commercial group	Catch (tonnes)	Proportion (%)
Shrimp, prawn	3.60	58.5
Mixed fish	0.90	14.6
Squid, cuttlefish	0.45	7.3
Pig fish/fertilizer fish	1.20	19.5
Total	**6.15**	**100**

FIGURE 8
Some important commercial groups in the catches of trawlers in Kien Giang province

Anchovy pair trawlers in Kien Giang catch mainly anchovy and so-called "pig fish/fertilizer fish", which account for about 92 percent of the fleet landing, followed by mixed fish (5 percent) and cephalopods (squid, cuttelfish, octopus) at 3 percent of the total landings (Table 13). There are no discards. Anchovies fished by these fleets are comprised of several species which school together and are caught during the nighttime.

All the fish captured are packed in plastic bags and kept in crashed ice (Figure 8). Groups of mixed fish and pig fish/fertilizer fish are the two biggest contributors in terms of landing volumes of the mixed pair trawl fleets, accounting for approximately 44 percent and 40 percent respectively (Table 14). Cephalopods account for a small part of the landing but make an important contribution to the economic value of the catch. Some estimates for annual landing by important commercial groups in trawling fleets in the province in 2014 was conducted by RIMF and detailed information is described in Table 15.

TABLE 13
Average estimates of monthly catch composition by main commercial groups of the anchovy pair trawlers in Kien Giang based on survey data in November 2015

Commercial group	Catch (tonnes)	Proportion (%)
Mixed fish	2.3	5
Squid, cuttlefish	1.5	3
Anchovy and pig fish/fertilizer fish	43.5	92
Total	47.3	100

TABLE 14
Average estimates of monthly catch composition by main commercial groups of the mixed pair trawlers in Kien Giang based on survey data in November 2015

Commercial group	Catch (tonnes)	Proportion (%)
Mixed fish	22	43.6
Pig fish/fertilizer fish	20	39.7
Squid	8	15.9
Cuttlefish, octopus	0.4	0.79
Total	**50.4**	**100**

TABLE 15
Annual landing volume estimated by the trawlers in Kien Giang in 2014 based on research done by the Research Institute for Marine Fisheries

Commercial group	Otter trawlers		Pair Trawlers		Total	
	Catch (tonnes)	%	Catch (tonnes)	%	Catch (tonnes)	%
"Trash fish"	8 733	39.6%	237 576	56.3%	246 309	55.5%
Mixed fish	3 953	17.9%	78 286	18.5%	82 239	18.5%
Croaker		0.0%	8 994	2.1%	8 994	2.0%
Rays	526	2.4%			526	0.1%
Threadfin breams			14 845	3.5%	14 845	3.3%
Lizard			7 544	1.8%	7 544	1.7%
Goatfishes	508	2.3%			508	0.1%
Bigeyes		0.0%	6 269	1.5%	6 269	1.4%
Cuttlefish	257	1.2%	5 055	1.2%	5 312	1.2%
Squids			31 857	7.5%	31 857	7.2%
Mixed cephalopods	793	3.6%	26 896	6.4%	27 689	6.2%
Mixed shrimp	6 139	27.8%			6 139	1.4%
Green tiger prawn	649	2.9%			649	0.1%
Others	488	2.2%	4 809	1.1%	5 297	1.2%
Total	**22 046**	**100%**	**422 131**	**100%**	**444 177**	**100%**

Source: RIMF, 2014. "Trash fish" indicated by RIMF (2014) was comprised of 93 fish species in which species Shorthead anchovy *(Encrasicholina heteroloba)* accounted for 32.5 percent landing volume. Anchovies are considered as "trash fish" in anchovy pair trawlers.

d. Catch preservation

All vessel owners interviewed are using milled ice to preserve their catches onboard and during transportation to the shore (Figures 9 and 10). Ice blocks are kept onboard for longer trips. Before use, the ice blocks are broken up and then mixed with fish at a proportion of 1:1 (by weight) respectively. On average, smaller trawlers use 200–300 ice blocks per month, with each block weighing around 40 kg. A large anchovy pair trawler may use 1 000–1 200 blocks per trip of 20–25 days and mixed pair trawlers use even more ice: 2 000–3 000 ice blocks (equal to 80–120 tonnes) per trip of 25–35 days.

Ice blocks are normally bought at the landing sites or fishing ports. Currently, the price of a single ice block is about 13 500 VND (in Ha Tien) and about 10 000 VND in Chau Thanh (Tac Cau fishing port). Some vessel owners with more than 10 vessels build their own trans-shipment vessels to transport fish and ice, food, fuel. Normally, mixed pair trawlers may stay at sea for 50–60 days before coming to port for unloading and conducting repairs and preparation for the next trip. After 20–30 days, their catches are trans-shipped to shore and the vessels may stay for an additional 20–30 days to reduce transporting time, fuel consumption and to keep fishermen employed. So, although mixed pair trawl trips are in the range of 25–30 days, they may combine two trips at sea to mitigate costs and reduce future recruitment risks.

FIGURE 9
Fish preservation onboard, at landing places and transporting means of trawl fishery in Kien Giang province

FIGURE 10
Preservation of fish onboard and at the landing sites, fishing port of the trawl fleets in Kien Giang province

Fish, pig fish/fertilizer fish and squid are also preserved on ice after unloading from the vessels and during transportation to seafood, fishmeal–processing plants and to domestic markets. Cold storage trucks are often used for transporting fresh fish or fish mixed with ice. Shrimp caught by otter trawlers are usually boiled with brine onboard and then preserved with ice, before being sent to shore every 1–2 days.

For fleets of mixed pair trawlers, one of the most economically important commercial groups is squid. Ordinarily, squid is sun dried onboard and then stored on ice. Other catch groups are also maintained in ice, packed in plastic bags or retained in plastic baskets.

e. Fleet economics

Investment in trawl fishing is much greater than with most other fishing gears, especially for pair trawlers. A pair trawl vessel operator needs at least two vessels of a similar size and engine capacity. Additionally, the costs of buying gears and fishing equipment, (e.g. echo sounders, communication devices), add to the fishing costs. Table 16 describes the average level of capital investment in the three different kinds of trawlers in Kien Giang.

TABLE 16
Average investment capital estimated in trawl fishery in Kien Giang by gear types based on survey data collected in November 2015

Fisheries	Vessel cost (1000 VND)	Gear (1000 VND)	Communication devices (1000 VND)	Capital source	Remarks
Shrimp trawler	500 000–1 500 000	10 000–20 000	5 000–10 000	Loan, own capital	Per vessel
Anchovy pair trawler	8 000 000–12 000 000	270 000–300 000	30 000–40 000	Loan, own capital	Per pair
Fish pair trawler	10 000 000– 16 000 000	270 000–300 000	40 000–60 000	Loan, own capital	Per pair

Shrimp trawlers (otter trawlers) are mostly smaller vessels, below 20 m length with an engine capacity of below 250 hp. Therefore, the capital for investing in this fishery is significantly less than for anchovy pair trawlers or mixed fish pair trawlers.

A number of vessel owners buy secondhand vessels and engines and even some new vessels are equipped with secondhand engines to reduce initial investment costs. More than 90 percent of vessel owners have received loans from commercial banks. For instance, the cost of building one set of pair trawlers is about 12 000 million VND, of which the owner could borrow 6 000 million VND from the bank at an interest rate of 10 percent per year; the monthly repayment rate being around 50 million VND.

The cost of buying a new gear for a pair trawler is in the range of 90–120 million VND per set, depending on the engine capacity of the vessel used, with bigger vessels needing larger gears. Shrimp trawlers have smaller gears costing about 20 million VND per set. Normally, every trawler has 1 or 2 spare sets of gear onboard.

Investment in comunication devices (tele-radio, radio communication) for shrimp trawlers and anchovy pair trawlers varies from 5 million VND to 15 million VND. The average investment in communication devices per pair of the mixed pair trawlers is about 30 million VND.

In Kien Giang, it is typical that vessel owners and their crews have revenue shares or net benefit shares, with different rates between these methods. The owners invest in vessels and equipment, fuel and other operational costs. Crew members are responsible for fishing operations and get paid at the end of the trip, when they are free to decide when they want to get their shares. There are no salary or wage mechanisms existing in the fishery. Shares will be based on trip revenue; the crews will take 50 percent of the net benefit, the difference between total revenue and total operational cost. The remainder is for vessel owner. In case the benefit is negative, the vessel owners have to ensure to pay at least 200 000 VND per crew per day.

Average incomes from mixed pair trawlers, at about 380 million VND per month, are highest among the trawlers in Kien Giang. The average income from one pair of mixed trawlers is around 240 million VND per month. Average incomes from shrimp trawlers and anchovy pair trawlers are typically around 30–60 million VND per month. Table 17 shows some key investments in trawl fishery by fleets. Total revenue from anchovy pair trawlers, whose catches are destined for the fishmeal industry, is low compared to mixed pair trawlers who have their main income from dried squid and economically valuable species. However, the investment capital for mixed pair trawlers are higher compared to other trawlers as they need to fish offshore and use big vessels with high engine capacities, and need more crew members working onboard, making this type of investment more risky in terms of financial return and safety at sea. The operational cost of an anchovy pair trawler is around half of that of a mixed pair trawler with the same engine capacity.

TABLE 17
Average investment costs of the trawlers in Kien Giang based on survey data collected in November 2015, in million VND

Fleet	Vessel cost	Gear cost	Communication devices	Depreciation cost per month	Bank interest cost per month
SHT	1 000	30	10–15	4	5
APT	10 000	300	30–40	40	41
MPT	16 000	300	40–60	67	80

Note: SHT–shrimp trawlers; APT–anchovy pair trawlers; MPT–mixed pair trawlers

The benefit of the fishing operation may be less as opportunity cost is taken into account. This cost should be considered prior to investment in fishing vessel or fishing operation. Therefore, vessel owners and fisheries managers are advised to pay attention to this cost in development of their business plan as well as fisheries management plans

and policy decision making. Table 18 describes some estimates of main investments and fixed costs related to trawl fishery by fleets in which opportunity costs are taken into account.

TABLE 18
Average investment costs of the trawlers taking into account the opportunity costs in Kien Giang based on survey data collected in November 2015, in million VND

Fleet	Vessel cost	Gear cost	Communication devices	Depreciation cost per month	Opportunity cost
SHT	1 000	30	10–15	4	10
APT	10 000	300	30–40	40	80
MPT	16 000	300	40–60	67	128

Shrimp trawlers

There are four main commercial catch groups from shrimp trawlers operating in Ha Tien: mixed fish (economically important species); squid and cuttlefish; shrimp/prawn; and pig fish/fertilizer fish (threadfin porgy, flathead fish, cardinal fish, soles, puffers). The shrimp catch accounts for around 59 percent of catch volume and 64 percent of catch value. The "trash fish" group accounts for about 20 percent of catch volume but contributes only 3 percent to total catch value. The price of pig fish/fertilizer fish from shrimp trawlers is low as it is made up of mixed fish species and so is not comparable in terms of quality to the pig fish/fertilizer fish from anchovy pair trawlers (Table 19).

TABLE 19
Average monthly catch and revenue estimated of the shrimp trawl fishery in Kien Giang based on survey conducted in November 2015

Commercial group	Catch (kg)	Proportion (%)	Price (1000 VND)	Total Revenue (1000VND)	Proportion (%)
Mixed fish	900	14.6	20	18 000	14
Shrimp	3 600	58.5	25	90 000	64
Squid	450	7.3	100	27 000	19
Pig fish/ fertilizer fish	1 200	19.5	4	4 800	3
Total	6 150	100		139 800	100

Fuel consumption is an important cost of trawl fishing operations, accounting for 71 percent of the total cost of a shrimp trawling fishing trip, followed by food, ice and other costs (include payments for local brokers and local motorbike taxi drivers hired to find new crew members). On average, for each crew member, the broker may receive 200 000–300 000 VND, and one vessel may have to pay around 3.0 million VND each month for finding new crewmembers (Table 20). Vessel owners may also have some additional costs related to fishing labour, as new crewmembers may have received some payment in advance but did not actually work. Additionally, some small costs are incurred such as gear repair, landing site fees, unloading fees etc. Even though the average fishing trip is short, varying from 3 to 5 days, these vessels try to stay at sea for as long as possible to avoid costs associated with travelling to and from the fishing grounds.

Frequently, net benefits are subtracted by 10 percent to cover the depreciation costs of the fishing vessel, engine, fishing gear etc. Typically, a vessel owner takes 50 percent of the remaining share and the other 50 percent is shared by the crew members, with the skipper normally taking double the share of a single crewmember. The average income of a crewmember is 7.0–10.0 million VND per month. Income benefits during the main fishing season (May to September) are normally higher than during the northeast monsoon (November to March).

TABLE 20
Average monthly operational costs estimated of the shrimp trawl fishery in Kien Giang based on survey conducted in November 2015

Expense	Amount (1000 VND)	Proportion (%)
Fuel	38 000	71
Ice	3 200	6
Food	6 400	12
Fees to brokers for recruitment of crews	3 000	6
Others (unloading, small repairs etc.)	2 700	5
Total cost	**53 300**	**100**

The monthly net benefits from a shrimp trawler in Kien Giang are estimated at around 86.5 million VND. The vessel owner will take 10 percent of the net benefit for vessel and gear depreciation and a half of net benefit remaining. In this way the vessel owner receives 47.5 million VND and each crew member earns about 7–8 million VND per month (Table 21). If the net benefit is low, then the vessel owner may decide to pay 200 000 VND to each fisher per day, so that they can keep the crews working onboard their vessels.

TABLE 21
Average monthly economic efficiency estimated of the shrimp trawl fishery in Kien Giang based on survey conducted in November 2015

Item	Amount (1000 VND)	Remarks
Total Cost	53 000	Gear reparation, small reparation, vessel maintaining, loan interest costs are excluded
Total Revenue	134 000	
Net benefit	81 000	
Depreciation: 8–10.0%	8 000	
Vessel owner share	36 000	
Crew share	7 000	
Skipper share	15 000	

Anchovy pair trawlers

The most important commercial catch from anchovy pair trawlers in Kien Giang (mainly Ha Tien, Hon Dat) are anchovies, which account for 91 percent of the catch volume and 65 percent of the catch value. Cephalopods account for a considerable proportion of catch value (27 percent) but account for less than 2 percent of the catch volume. On average, the operational cost of a single trip (15–20 days) is estimated at more than 200 million VND, and the average monthly operational costs are estimated at 340 million VND, while monthly revenue generated by a pair of anchovy trawlers is about 540 million VND (Table 22, Table 23).

TABLE 22
Average monthly catch (tonnes) and revenue (1000 VND) estimated of the anchovy pair trawl fishery in Kien Giang based on survey conducted in November 2015

Commercial group	Catch (tonne)	Proportion (%)	Price (1000 VND)	TR (1000 VND)	Proportion (%)
Mixed fish	2.4	5	20	45 000	8
Squid, octopus	1.6	4	110	148 000	27
Pig fish/fertilizer fish (mainly anchovies)	43.0	91	8	351 000	65
Total	**47.0**			**544 000**	**100**

TABLE 23
Average monthly operational costs (1000 VND) estimated of the anchovy pair trawl fishery in Kien Giang based on survey conducted in November 2015

Expense	Amount (1000 VND)	Proportion (%)
Fuel	195 000	58
Ice	24 000	7
Food	33 000	10
Access fishing ground of other gears	45 000	13
Gear repair cost	20 000	6
Others (crew recruitment costs, unloading costs, port in/port out fees)	21 000	6
Total	**338 000**	**100**

The mean income of each crew member is around 8 million VND per month while the skipper will receive 16 million VND per month. The method of sharing benefits or allocations of the catch value is similar to that used for other trawlers i.e. after subtracting the depreciation costs of the fixed investment, the net benefit is divided by two; the crew members receiving one half and the vessel owner the other. Therefore, the average monthly income of anchovy trawlers is 55 million VND per vessel or 110 million VND per pair of trawlers. Yearly, each unit of pair trawlers needs to go to the dock for maintenance, once a year and this may cost around 100 million VND. Where the vessel owner has a loan from the bank, for example, an amount of 6 000 million VND, then he will have to pay back around 50 million VND per month (Table 24).

TABLE 24
Average monthly economic efficiency estimated of the anchovy pair trawl fishery in Kien Giang, based on survey conducted in November 2015

Item	Amount (1000 VND)	Remarks
Total Cost	338 000	Gear reparation, small reparation, vessel maintaining, loan interest costs are excluded
Total Revenue	544 000	
Net benefit	206 000	
Depreciation	20 000	
Vessel owner share	110 000	
Every crew share	8 000	Skipper normally gets double share of a crew

Mixed pair trawlers

Mixed pair trawlers in Kien Giang are relatively large compared to other trawlers. The average operational cost per trip of one pair of mixed trawlers varies from 500–700 million VND (Viet Nam Dong) for a voyage of 20–25 days. Pig fish/fertilizer fish accounts for 40 percent of the landing volume but only 9 percent of the landing value (Table 25). This is due to the long preservation time on board and the fact that there are many different species mixed together. Economically important fish species are dominant in the catches of mixed pair trawlers, accounting for 44 percent and 30 percent of the landing volume and value respectively. However, the most important catch item in terms of income is squid, which although may not account for a large proportion of the catch, normally accounts for about 60–65 percent of total revenue per trip. Some estimates of operational costs, associated costs and benefits of this fishery are presented in Table 26 and Table 27.

TABLE 25
Average monthly catch and revenue estimated of the mixed pair trawl fishery in Kien Giang, based on survey conducted in November 2015

Commercial group	Catch (tonnes)	Proportion (%)	Price (1000 VND)	Total Revenue (1000VND)	Proportion (%)
Mixed fish	22	43.6	15	360 000	30
Pig fish/fertilizer fish	20	39.7	5.5	110 000	9
Squid	8	15.9	90	720 000	59
Cuttlefish, octopus	0.4	0.79	60	24 000	2
Total	**50.4**	**100**		**1 214 000**	**100**

TABLE 26
Average monthly operational costs estimated of the mixed pair trawl fishery in Kien Giang, based on survey conducted in November 2015

Expense	Amount (1000 VND)	Proportion (%)
Fuel	402 000	68
Ice	52 000	9
Food	35 000	6
Small reparation	70 000	12
Others (crew recruitment cost, unloading port in/port out fees, plastic bag…)	30 000	5
Total cost	**589 000**	**100**

TABLE 27
Average monthly economic efficiency estimated of the mixed pair trawl fishery in Kien Giang, based on survey conducted in November 2015

Item	Amount (1000 VND)	Remarks
Total Cost		Gear reparation, small reparation, vessel maintaining, loan interest costs are excluded
Total Revenue	1 214 000	
Net benefit	625 000	
Depreciation	80 000-100 000	
Vessel owner share	375 000	
Every crew share	9 300	Skipper normally gets double share of a crew

f. Labour and income

It is estimated that there are 27 500 fishers directly involved in the trawl fishery in Kien Giang; 1 800–2 000 vessel owners; 400–500 workers at fishmeal processing plants; and approximately 2 000–3 000 labourers working in the seafood processing industry. In addition there are 2 700–2 800 crews working on large-scale trans-shipment vessels in the province and several hundred people working on small-scale trans-shipment boats in Kien Giang and the nearby provinces (Ca Mau, An Giang, Dong Thap, Bac Lieu). Additionally, there are about 1 200 people working at landing sites and fishing ports unloading catches from trawlers and sorting fish, providing a main source of income for their households (Figure 11). Other fishery service work also provides incomes for a large number of labourers e.g. vessel construction and reparation, ice making, fueling, food supplying, fishing gear making etc. Average incomes are quite different between different actors. Women play important roles in seafood processing, sorting fish and handling fish. Briefly, there are about 36 000–37 000 people earning livelihoods either directly or indirectly associated to the trawl fishery in Kien Giang. This is really important to the socio-economic aspect in terms of work and livelihoods generation not only in Kien Giang but also in surrounding provinces as mentioned above.

Household size: Survey information shows that stakeholder household size is strongly varied. Typically, 4–5 members from one family are engaged in working as crew or seafood/fishmeal processing. Later generations tend to have a smaller household size (normally 4 members). Some vessel owners and seafood, fishmeal processors may have "big" families with several generations staying together, as many 15–20 members in each household.

Age structure: The survey shows that more than 80 percent of crewmembers working on board anchovy and mixed pair trawlers have ages ranging from 18 to 45 years. About 70 percent of shrimp trawler crews are below 40 years old. The age of people involved in sun drying shrimp varied from 16 to 70 years. This greater range can be explained by the fact that labourers can work onshore and it is not particularly heavy work. Additionally, a small number of children, normally in range of 12 to 15 years, and very old persons (65–75 years old) are involved in shrimp processing activities. In the seafood and fishmeal processing industries, 90 percent of the labourers are within the age range of 20–45 years. Around 80 percent of labourers working at the landing sites and fishing ports are in the age range of 20–40 years, the rest are between 41–55 years old. This work requires healthy employees as the work is hard.

Gender structure: 100 percent of the interviewees working on board trawlers were men. Conversely, women (80 percent) dominate employment in the seafood processing industry. The seafood processing lines require skillful work which women are well suited to. Women are also dominant in the sun-dried shrimp processing industry, where 85 percent of the labourers are women. In the fishmeal industry, the proportion of women is less, about 30–40 percent of the total number of employees. Fish porter work at the landing sites and fishing ports is dominated by men (60–70 percent), while the women tend to be in charge of sorting fish.

Education: 60–70 percent of crews working in the trawl fishery have a primary school education (about 5 years in school), 10–20 percent finished secondary school (about 8–9 years in school), and 20 percent have a higher level education (about 10–12 years in school); no one interviewed had reached university level. A significant proportion of crews (70–80 percent) have not been formally trained on fishing operations or safety at sea. The educational background of labourers working in sun drying shrimp and as fish porters is low. Conversely, workers in the seafood and fishmeal processing industries tend to have achieved higher education, with 50–60 percent educated to primary level and 30–40 percent to secondary school level. The remaining labourers are technicians and skilled workers who tend to have graduated from high school or college.

Income: Average incomes of the fishing crews are in the range of 6–10 million VND per month. There are no significant differences in incomes between labourers working on shrimp trawlers or anchovy pair trawlers. However, average incomes varied seasonally and from trip to trip. The incomes of the crew are strongly dependent on the volume of their catches, fish prices, and the cost of fuel. Working at sea is considered difficult and risky, and crews have to live away from their homes for several months at a time, although they do not have to pay for meals or accommodation while working at sea. When compared to local workers in the construction industry, the average income of a fishing crewmember is higher than a construction worker, who typically earns 4.5–5.0 million VND per month (Table 28).

TABLE 28
Estimated monthly incomes of some actors in supply chain of the trawl fishery in Kien Giang, based on the survey conducted in November 2015

Industry/Stakeholder	Average income per month (1000 VND)	Additional livelihoods of the family	Remarks
Shrimp trawl crew	5 000–7 000	No	No additional incomes
Anchovy pair trawl crew	8 000–10 000	No	
Mixed pair trawl	8 000–12 000	No	
Shrimp sundried labor	3 000–5 000	No	
Fishmeal processing worker	5 000–7 000	Yes, spouse and children may have additional incomes from agriculture sector, services	Company pays social and medical insurance, free accommodation including electric power, clean water and 50% food costs
Fish porter	6 000–10 000	Yes	Agriculture and/or small service businesses
Seafood processing worker	5 000–6 000	Yes	Agriculture and/or small service businesses
Fish picker	2 000–3 000	No	Collect the fish at the landing sites/fishing ports
Middlemen	90 000–300 000	No	Taxes, bank interests, transporting and opportunity costs are excluded

FIGURE 11
Labourers involved in unloading, sorting and processing catches unloaded by trawlers in Kien Giang province

g. Fishmeal industry

In Kien Giang there are currently 12 fishmeal processing companies. The main fishmeal producers are Minh Chau, Phuc Ngoc and Ha Tien. Other important fishmeal processing companies can be found in Kien Hung, Kien Hung 1, Tac Cau, Kien Giang and Bien Xanh. Mostly, these companies buy raw materials from local fishing vessels. Ha Tien fishmeal is considered to be the best quality fishmeal in Kien Giang because the raw materials used are anchovies harvested by local trawlers, while the other companies are using mixed pig fish/fertilizer fish. Most fishmeal processing companies are buying anchovies and mixed pig fish/fertilizer fish. Pig fish/fertilizer fish for fishmeal processing is transported from Ha Tien, Ca Mau (Song Doc fishing port),

Bac Lieu (Ganh Hao fishing port) to Tac Cau (Kien Giang) which is the main fishmeal processing area. Usually, Kien Giang trawlers unload their catches at Tac Cau fishing port and Ha Tien landing sites, with some vessels operating close to the fishing ports in Ca Mau, Ba Ria Vung Tau, and Bac Lieu provinces. At these locations, the vessels come to shore for loading food, ice and fuel and their catches are transported to Kien Giang by trans-shipment boat.

Very few vessel owners sell their catches directly to fishmeal processing companies. However, about 30 percent of the raw material volume of Ha Tien Fishmeal Company is directly bought from vessel owners, with the rest being bought through middlemen. It is not convenient for small vessels and vessels with small quantities of pig fish/fertilizer fish to sell directly to fishmeal companies. Additionally, it may take time for fishers to complete the selling process. Therefore, middlemen play an important role in linking raw material sources to fishmeal processing plants. Middlemen have to pay transport costs, and unloading costs at the landing sites or at the quay of the processing plants. It was estimated that for each kilogram of pig fish/fertilizer fish, middlemen receive a benefit of 50 VND.

The average income of workers in the Ha Tien Fishmeal Company is estimated at 5–7 million VND per month. Workers are also provided with accommodation, clean water, electricity and 50 percent of daily food expenses. The volume of raw materials for fishmeal processing in this company has been stable in recent years.

Most of the fishmeal produced is purchased by domestic aquafeed companies and some joint stock companies, such as Tom Boy, Nutreco (Skretting Vietnam), Uni-president, and Thang Long. Currently, less than 10 percent of fishmeal production is exported to Japan, China and Hong Kong.

Phuc Ngoc, Minh Tam, Minh Chau and Ha Tien fishmeal processing plants are considered as the biggest ones in Kien Giang. Phuc Ngoc, and Minh Tam Fishmeal companies have a pig fish/fertilizer fish demand of 250–300 tonnes of raw materials per day; the average ratio between the raw material and final fishmeal product is about 3.0–3.4:1 (Table 29). The Phuc Ngoc Fishmeal Company buys and processes around 200 tonnes of pig fish/fertilizer fish each day, producing around 20 000 tonnes of fishmeal per year. The other processing plants have a production rate of about one third to one half of the Phuc Ngoc fishmeal processing plant. It is estimated that the raw materials used for the fishmeal industry in the Province is in the range of 300 000 to 350 000 tonnes/year which can produce 90 000–110 000 tonnes of fishmeal. This industry creates full-time jobs and supports the livelihoods of around 500 workers. The production capacities of the processing plants have been designed higher than the current volume of raw materials available. For instance, Ha Tien fishmeal can daily process 280 tonnes of raw materials but on average the company only buys 130 tonnes of raw material per day (Table 29). The study results are similar to the official data reported by the Provincial Department of Commerce and Industry, which estimates the 2015 total production of fishmeal processed in Kien Giang to be 106 747 tonnes.

TABLE 29
Estimated basic production and associated indicators of some fishmeal processing plants in Kien Giang based on data collected in November 2015

Company	Year of foundation	Production capacity of raw material (tonnes per day)	Actual production of raw material (tonnes per day)	Annual Production of fishmeal (tonnes)	No of Laborers	Sources of raw materials	Fish preservation method
Company 1	2010	280	130	13 000	70	Local trawlers	Ice
Company 2	2007	240	200	19 000	75	Local trawlers	Ice
Company 3	2005	240	200	16 000	75	Local trawlers	Ice

Table 30 shows the monthly benefits to some fishmeal processing plants. Benefits look high but a number of costs have not been included, for example, taxes, depreciation costs of the equipment, electric power supply, water, wastewater treatment, and transportation of the raw materials. Additionally, the processing plants also provide unlimited time loans to the owners of vessels sourcing raw materials. On average, each pair trawler unit borrows 200–300 million VND per year, and the vessel owners only pay back the full amount if they do not want to sell their fish to the fishmeal processing plant providing the loan. There are about 250–300 pair trawler units selling pig fish/fertilizer fish to the Phuc Ngoc fishmeal processing company, showing that the company has invested a large amount of money in the vessels from whom they are buying fish. This opportunity cost, where money could have been invested in another enterprise instead of into fishing vessels is probably significant. However, this study did not collect detailed information for further clarification.

TABLE 30
Estimated economic indicators of fishmeal industry in Kien Giang based on data collected in November 2015

Company	Raw materials volume per month (tonnes)	Price of raw material (1000 VND/kg)	Raw material cost per month (1000VND)	Production per month (tonne)	Labour cost per month (1000 VND)	Benefit (1000 VND)	Remarks
Company 1	4 500	8	36 000 000	1 400	600 000	12 300 000	Taxes, depreciation costs are excluded
Company 2	6 000	5	30 000 000	1 700	650 000	18 500 000	Taxes, depreciation costs are excluded
Company3	6 000	5	30 000 000	1 700	650 000	18 500 000	Taxes, depreciation costs are excluded

h. Seafood industry

There are 14 seafood-processing companies located around Tac Cau fishing port, in Chau Thanh district, Kien Giang. Additionally, there are other seafood processing companies located in Phu Quoc, Ha Tien, Kien Luong, Hon Dat, and Kien Hai districts. The processed seafood products are diverse, including value-added products, frozen fish, canned fish, fish sauce, surimi, and semi-processed products. Raw materials used are also diverse, and include squid, octopus, fish, shrimp, crab, and bivalves (Figure 12). The seafood processing industry is making increasing demands on raw materials from both aquaculture and capture fisheries. Under this study, one company, Huy Nam Seafood Company was studied in more detail. The company is the biggest cephalopod processing company in Viet Nam with an annual production of around 3 000 tonnes. The main products are squid, octopus, and cuttlefish and they are processed in several different ways for markets in Japan, South Korea, United States of America, Russia, Italy, and Spain.

There are also a number of surimi processing factories located in Kien Giang and other provinces which are supplied with raw materials from trawlers. Normally, the best quality economically important species, such as lizardfish, threadfin bream, snapper, and red bigeye are used for either export or domestic consumption. However, fish which are of a poorer quality are sold to surimi processing plants. Additionally, some good quality but economically low value species e.g. goatfish, are also used for the surimi processing industry.

FIGURE 12
Some important commercial groups caught by trawlers in Kien Giang, from information collected in 2015

i. Fisheries issues

Lack of a fisheries labour management system: All vessel owners interviewed did not have long-term contracts with fishers. Fishers freely moved from one vessel to another, from trip to trip. Vessel owners often faced difficulties in finding crewmembers and may have to pay 200 000 VND for middlemen to find each crewmember for a fishing trip. There is no service to check or verify whether the crew is qualified enough in terms of health, skill, fishing experiences, and level of trustworthiness. Fishers may receive money from vessel owners in advance, before going to the sea, and then run away. This results in losses to the vessel owner and makes it hard to plan for the trip. Therefore the lack of a management system for crews creates risks for vessel owners in not only technical fishing operation but also finance. Vessel owners interviewed reflected that management of the crews is one of the hottest fishery issues in the Province.

Serious competition for fishing grounds: It is common for anchovy and shrimp trawlers to be involved in conflicts, some of them serious, with other fishing gear users, including octopus trappers (using snail shells) and crab trammel netters operating nearshore or near island waters. Normally, anchovy pair trawlers have to pay around 2 500 000 VND to the octopus trappers to fish for one night in such an area. This makes the fishing operational costs of the trawlers significantly increased.

Lack of, or weakness of fisher associations: There are few formal fisheries association and/or fisher associations operating at the community level in the Province. However, in some places fishers are aggregating together to informally form cooperatives among themselves. Such cooperatives are formed by a group of individuals who use the same type of vessel and gears and fish the same fishing grounds. Often they may be relatives or friends. On average, a cooperative is made up of 30–60 vessel owners, depending on the gear types used. For otter trawlers and shrimp trawlers on short fishing trips, the number of members under each cooperative is large (around 40–60 units). Thus, they alternate in collecting catches from other members and going to shore. Such cooperatives have a verbal code of conduct to collaborate at sea, including some important activities such as, search and rescue, transporting catches and necessary items (foods, fuel, water), and assisting each other to overcome risks and accidents. They are not registered with any management body or no administrative procedures are implemented.

There is a Provincial fisheries association and a Rach Gia city fisheries association. The Rach Gia city fisheries association has 436 members, who are mainly vessel owners. This organization has some regular activities, meetings and administrative staffs working at the office. However, the provincial fisheries association is not active. Two fisher associations in Kien Giang are ineffective and are limited in scale.

Poor and weak management of the fisheries infrastructures: The province has a plan to upgrade 10 fishing ports[3] and six landing sites. However, Tac Cau fishing port is categorized as a national fishing port and is operating fully. Most of the trawl vessels in the province unload their fish at Tac Cau fishing port. The fishing port has facilities for fishing vessels and crews, and around the fishing port are 14 seafood processing plants and three fishmeal processing plants. Important facilities in the port include: quays, sorting houses with shade, clean water supplies, fuel stations, stores, vessels and engine workshops, car parking, and ice making plants**.** However, many of these facilities are old, and ice producers do not use stainless steel vessels, the fish sorting house is not well planned or managed, no clean water supply system is installed at the sorting area, and there is no house or space for workers, or accomodation for crews, skippers, or vessel owners during their time at port (Figure 13). Additionally, the system of wastewater and garbage collection are ineffective and inadequate and result in localised pollution.

The infrastructures and facilities in landing sites in other districts such as Muong Dao (manmade channel) are very poor. At these landing sites, there are no sunshades, no proper fish sorting places, no cold stores, and insufficient services for fishers, skippers and local government staff (fisheries managers, local enumerators). The poor status of the fisheries infrastructures provides poor services for fishing operations

FIGURE 13
Poor landing site/fishing port infrastructures and sun drying shrimp facility in Kien Giang, survey conducted in 2015

[3] Tac Cau fishing port located in Chau Thanh district, Duong Dong and An Thoi fishing ports in Phu Quoc district, Nam Du (Kien Hai district), Tho Chau, and Bai Dong (Phu Quoc), Ba Hon (Kien Hai), Xeo Nhau, Linh Huy (Hon Dat), Hon Ngang (Kien Hai).

and increases the costs of transporting water, fuel, food and other logistic services for fishers, vessel owners, middlemen, fisheries managers etc. Additionally, this often leads to an increase in the proportion of post-harvest losses, in terms of fish quality as well as catch volume. Poor infrastructure also causes environmental issues for surrounding communities, particularly around landing sites and fishing port. On shore, there is insufficient space for local fishers to dry their catches of shrimp and prawn.

Weak linkages within actors along the supply chain: At present there is little collaboration between seafood processing companies and middlemen, fishers or fishing vessel owners. Therefore, there are few incentives to improve fish handling and processing from market chain actors. However, a number of fishing vessel owners take loans from middlemen or fishmeal processors. This connection helps fishers to cover part of the costs of fuel, ice blocks and foods, gear and vessel reparation. However, in return fishers must sell their catches to their creditors at a price below the market price. In addition, the weights of the fish sold may be under-represented.

Weak management of the fishery: The legal framework and regulations for managing the capture fishery are available. A number of regulations relating to closed season, closed areas, mesh size limitation, zonation of the fishing grounds, logbook completion, fishing reports etc. are in force. However, the compliance of fishers and enforcement of the law are weak. Patrol vessels mainly focus on offshore trawler violations in inshore fishing grounds. Fisheries dependent data are not regularly collected and some small trawlers may be registered as using other gears. The fisheries management authority has tried to implement regulations to control the fishing operations and monitor the sector (logbook completion, fishing reports etc), mesh size limitation and zoning fishing grounds etc. However, the compliance from fishers are poor. Currently, there are seven patrol vessels operating in Kien Giang waters. The number of fishing ground violations has tended to increase in recent years.

Post-harvest loss: There are no available studies on post-harvest losses of the trawl fishery in Kien Giang. The freshness of fish landed by mixed pair trawlers in Tac Cau fishing port and Muong Dao landing sites is normally poor and significant proportion of the catches landed are already spoiled. According to assessments made by the fishers, about 10–20 percent of the economically important fish landed are sorted into the ”pig fish/fertilizer fish” category for fishmeal processing purposes, and 40–50 percent of the commercially valuable fish are of a bad quality. The poor quality of trawled fish is thought to be due to: the long towing time (6–8 hours per haul) and poor handling and preserving practices onboard. In addition, poor facilities at the fish landing sites may have negative impacts on the quality of the fish. Long waiting times at the quays for unloading, lack of sunshade, lack of clean water and low quality ice used cause a further reduction in catch quality (Figure 14). Additionally, careless transportation of the fish may also have negative impacts on the quality of the fish.

FIGURE 14
Poor fish handling practices in trawl fishery in Kien Giang, survey conducted in 2015

Open access fishery: In practical terms, Viet Nam's trawl fishery has been in a state of open access fishery for many years (Figure 15). The Ministry promulgated Decision No 3602/QD-BNN-TCTS on 19 August 2014 on the allocation of the number of new vessels built by provinces, in which Kien Giang was allowed to build up to 10 new trans-shipment vessels and 95 new fishing vessels. However, increasing the total quantity of trawlers is now forbidden. There was no further control on the number of trawlers until 18 November 2015, when the Ministry of Agriculture and Rural Development (MARD) issued a formal document to coastal provinces in Viet Nam to ban any new trawlers entering the fishery or other vessels switching to trawling. The Ministry of Agriculture and Rural Development has issued a formal document, No. 9443/BNN-TCTS on 18 November 2015, to the coastal provinces to control the number of new trawlers, freezing the number of trawlers in all 28 coastal provinces. The central government policy is therefore to freeze the number of trawlers in the country. However, there are already too many trawlers operating, particularly in South Viet Nam. No taxes are applied, the licensing fee is low, and cheap or free unloading fees lead to a reduction in the operational costs of the fleet. Consequently, this creates incentives for fishers to increase their fishing effort above sustainable limits.

FIGURE 15
Trawlers at Muong Dao landing site in Ha Tien, Kien Giang, survey conducted in 2015

j. Household economics

Trawler crewmembers and processing industry workers are usually poor; however, their incomes are slightly higher than the official poverty line issued by the central government (<800 000 VND per month per individual income for the suburban areas). Crewmembers and processing labourers are mainly local people from Kien Giang (70 percent), with the rest coming from other districts or neighbouring provinces. The average income of each vessel owner is estimated at approximately 36 million VND per month while crew and dried shrimp workers have average incomes of 6–8 and 4–6 million VND per month, respectively (Table 31, Table 32, Table 33). Shrimp processing workers can earn an estimated average of 3 million VND per month with their incomes dependent on the production completed. The rate for processing of 1 kg shrimp production varies from 7 000 to 10 000 VND, depending on the size of the shrimp processed. Normally, each worker works for one or two vessel owners under a long-term verbal contract.

TABLE 31
Average incomes and monthly household expenses estimated of relevant stakeholders of the shrimp trawler in Kien Giang, based on the survey in 2015

Actor	No of family member (person)	Main income	Household income (1000 VND)	Monthly expense (1000 VND)
Vessel owner	4–6	Fishery	36 000	12 000
Crew	4–5	Fishery	8 000	6 000
Shrimp sundry worker	4–5	Fishery	6 000	5 000

TABLE 32
Incomes and monthly household expenses of relevant stakeholders of the anchovy pair trawlers in Kien Giang, based on the survey conducted in November 2015

Actor	No of family member (person)	Main income	Household income (1000 VND)	Monthly expense (1000 VND)
Vessel owner	4–6	Fishery	93 000	10 000–15 000
Crew	4–5	Fishery	8 000	3 000–6 000

TABLE 33
Incomes and monthly household expenses estimated of relevant stakeholders of the mixed pair trawlers in Kien Giang, based on the survey conducted in November 2015

Actor	No of family member (person)	Main income	Household income (1000 VND)	Monthly expense (1000 VND)
Vessel owner	4–8	Fishery	120 000 – 150 000	15 000–20 000
Crew	4–5	Fishery	8 000–10 000	5 000–6 000

Typically each crewmember is responsible for the main income for one family. The average income of each crew per month is estimated at 7 million VND. In addition, their wives can do small jobs onshore such as involvement in the seafood-processing sector including crab shell peeling, shrimp processing, and may earn 2.0–2.5 million VND per month. Crew and vessel owner families have an average of 2–3 children who are sent to local schools and tend to have a better education, compared to their parents.

Vessel owners have the biggest share of the trip catches but they also have to pay for many different expenses including preparation of vessel, engine, bank interests, and fees for finding new crews, parking and keeping vessels at the landing sites or fishing ports etc. Most vessel owners have to borrow money from the banks to either buy the secondhand vessels or build new ones. Some vessel owners that can process their catches themselves do not have to hire additional people to dry and peel shrimp, thereby saving money.

In this study, the incomes of crews in mixed trawlers appear to be higher than with other gears. However, crews working on board these trawlers work harder because the vessels are fishing the whole day. These trawler fleets have almost double the number of crewmembers compared to anchovy pair trawlers and about 4–5 times as much number of crews working on board shrimp trawlers.

The main expenses of each household are education fees, food and electric power, clean water and rent accommodation. Normally, education fees of the kids account for about 30–40 percent of the incomes of each fisher household, followed by food (20–30 percent) and other expenses.

k. Supply chain and markets

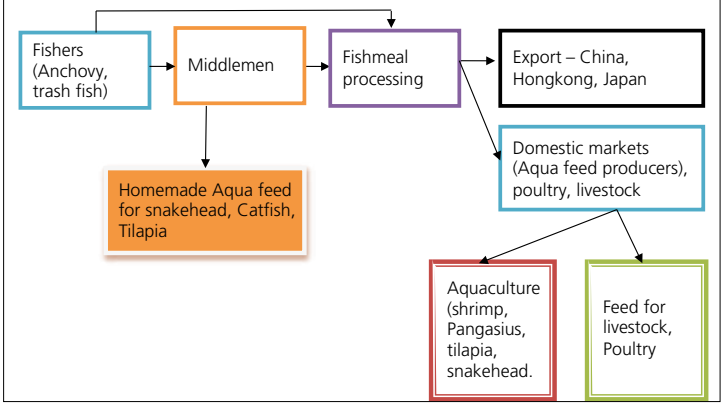
a) Pig fish/fertilizer fish supply chain

Trawlers in Kien Giang play an important role in contributing to the landing volume of fish caught by the province, about 85 percent, and the most important suppliers for fishmeal industry in the province as well as in south Viet Nam (Figure 16). In Viet Nam

in general, and in Kien Giang in particular, the fishmeal industry is heavily dependent on trawl fishery.

Pig fish/fertilizer fish from trawl fisheries in Kien Giang are comprised of anchovies, low value species and certain proportion of spoiled fish from the economically important fish group from shrimp trawlers and mixed pair trawlers (Figure 17). Accordingly, 80 percent of the pig fish/fertilizer fish in anchovy pair trawlers are provided to fishmeal processing plants in Ha Tien district and Chau Thanh district. The other 20 percent are transported to other provinces in the Mekong Delta areas for either fishmeal processing or homemade feed production for pangasius, tilapia, or snakehead (Figure 18). Normally, anchovies caught by trawlers are not good enough quality to make fish sauce and cannot be used for human consumption. The fish sauce industry sources raw material (anchovies) from purse seines and the lift net fisheries.

FIGURE 16
Supply chain of pig fish/fertilizer fish exploited by trawlers in Kien Giang



There are two types of middlemen for pig fish/fertilizer fish in Kien Giang; large-scale middlemen who provide loans to vessel owners; and small-scale middlemen who buy smaller catch volumes and who do not provide loans to vessel owners. Large fishmeal processing plants can directly buy fish from fishers or vessel owners. However, they also provide loans to vessel owners to maintain their business relationships. A large processing plant can have verbal contracts with 200–300 pair trawler units.

There are about 20 large-scale middlemen in the Province, collecting about 50–200 tonnes of pig fish/fertilizer fish per day, depending on the season and number of vessels unloading. However, the average volume of pig fish/fertilizer fish collected by these middlemen is usually around 100 tonnes per day. The price of mixed trawl fleet sourced pig fish/fertilizer fish varies from 5 000–6 000 VND per kg while the anchovy price is in the range of 7 000 to 8 000 VND per kg. Middlemen hire labourers for unloading pig fish/fertilizer fish from the vessels, weighing and transporting to trucks. The cost of this is about 250 000 VND per tonne. Labourers earn a benefit of 500 VND per kg or 500 000 VND per tonne.

There are about 30–40 small-scale middlemen in the province. Small-scale pig fish/fertilizer fish middlemen earn approximately 1 000 VND per kg and they also sell produce to local fishmeal processing plants. The small-scale middlemen can collect around 3 tonnes per day.

FIGURE 17
Some fish species dominant in "trash fish" group unloaded by the trawlers in Kien Giang

There are about 40 small-scale middlemen dealing with pig fish/fertilizer fish in Chau Doc district (An Giang province) and about 10 small-scale middlemen doing businesses on pig fish/fertilizer fish come from Dong Thap province. They buy pig fish/fertilizer fish from Tac Cau fishing port, Ha Tien landing site and other landing places in Kien Giang. On average, it takes four days per trip to buy and sell their fish; two days for transportation from their hometown to Kien Giang; one day for loading; and one day for unloading their fish. It is estimated that about 130 000 tonnes of pig fish/fertilizer fish are annually transported to An Giang for direct use in catfish and other species aquaculture. Yearly, farmers in Dong Thap Province may use about 12 000–15 000 tonnes of pig fish/fertilizer fish from Kien Giang, for homemade feeds for aquaculture activities.

Fishmeal processing plants mainly supply their products to joint stock companies, e.g. Vietnamese aquafeed companies, such as CP Vietnam, Uni-President, Thang Long, or Tomboy etc. About 5–10 percent of the total volume of fishmeal is for export to China, Hongkong, and Japan, and a part is used for local livestock and poultry feeds.

FIGURE 18
Transshipment boats loading "trash fish" from trawlers in Kien Giang

b) Shrimp supply chain of shrimp trawlers

There are four middlemen working with sundried shrimp in Ha Tien and several in other areas of the province. However, most shrimp trawlers unload their catches at the Ha Tien landing site. Trawler operators usually hire 1.0 to 1.5 workers per vessel to carry out sun drying, processing and peeling. The final products are then sold to local middlemen, each afternoon. This type of product is for human consumption, and sold to markets in the region, most notably Cambodia. A small part of the sun-dried shrimp is used to supply domestic markets, mainly in Ho Chi Minh City. On average, each middleman may collect 1.0–3.0 tonnes of dried shrimp per day (see Figures 19 and 20).

FIGURE 19
Supply chain of shrimp and prawn exploited by the shrimp trawlers in Kien Giang

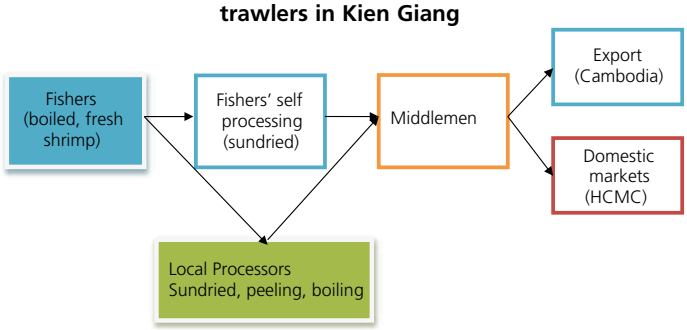
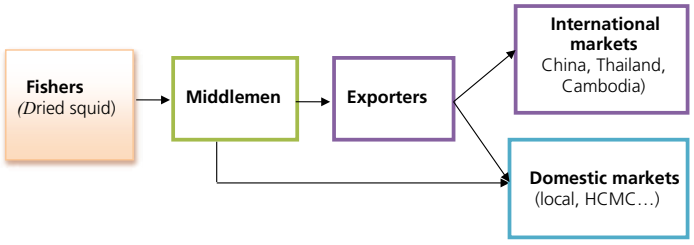


FIGURE 20
Shrimp caught by the shrimp trawlers in Kien Giang

c) Cephalopods supply chain of trawl fishery

Sun dried squid play an important role in terms of income to the vessel owners and fishers on the pair trawlers. Dried squid mainly comes from mixed pair trawlers or so-called fish pair trawlers in Kien Giang. The major landing site for dried squid in Kien Giang is Tac Cau fishing port, in Chau Thanh district. The landing of dried squid is highly varied from vessel to vessel and there are also strong seasonal variations. Normally, one fishing trip by one mixed pair trawler unit, lasting 20–25 days, produces a volume of about 1.5-3.0 tonnes of dried squid (equal to 6.0–12.0 tonnes of fresh squid).

FIGURE 21
Supply chains of the dried squid exploited by trawlers in Kien Giang



Dried squid is considered as the highest priced item of the pair trawlers and is fully used for human consumption. Middlemen collect all of the sundried squid that are unloaded. Some vessel owners sell their products at sea to trans-shipment vessels. However, these trans-shipment vessels are also owned by middlemen. There are about 20 middlemen working with sundried squid in Tac Cau fishing port, and each middleman buys squid from their own suppliers (about 50–80 pairs of the mixed pair trawlers). The quantity of dried squid can vary from 3–20 tonnes per day per middleman, with an average of 3 tonnes per day per middleman. The volume of dried squid in the southwest monsoon may be two to three times as high as during the northeast monsoon. Currently, the average price at port, for dried squid is about 350 000 VND per kg. The main markets for sundried squid are China, Thailand and Cambodia (Figure 21). Squid destined for international markets are handled by specialist exporters. However, the domestic market (Ho Chi Minh City and other provinces) also claims a significant share.

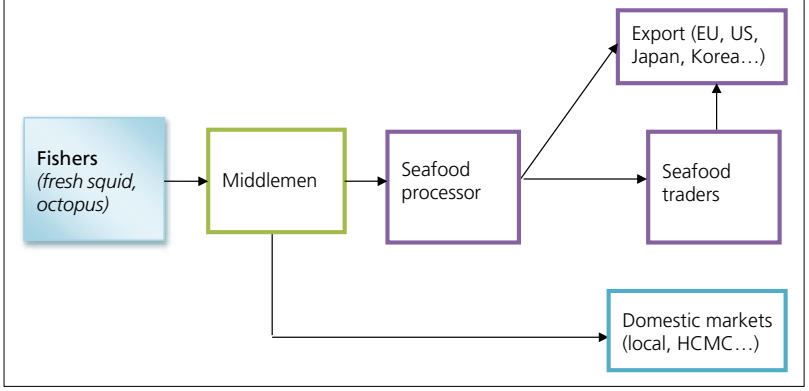
Another important group of cephalopods in the trawl fishery in Kien Giang, is fresh squid, octopus and cuttlefish (Figure 22). Middlemen collect squid, cuttlefish and octopus daily from the landing sites, mainly in Tac Cau fishing port and in Ha Tien. On average, the landing volume of mixed cuttlefish, squid, and octopus from one pair trawler unit can be in the range of 2.0–4.0 tonnes. Mixed pair trawlers can land about 3 tonnes of cuttlefish, octopus and some squid, while anchovy pair trawlers can land around 3.5 tonnes of fresh squid per trip (20–25 days per trip).

Fresh squid and cuttlefish are collected by local middlemen and either sold to the seafood processing industry or directly to domestic markets via other upstream suppliers (Figure 23). Huy Nam Seafood Company located in the Tac Cau industry zone, Chau Thanh district (Kien Giang) is one of the most important cephalopod processing plants in the region. Annually, this company can process and export about 3 000 tonnes of produce, in which squid accounts for about 20 percent, cuttlefish, 20 percent and octopus, 30 percent, with the rest being other seafood. Raw materials may also be bought from some other small fisheries such as squid handlines, squid pots and traps, and squid poles and lines to boost production.

Mostly, the processed products of cephalopods are for export to the main markets in the European Union (Italy, Spain) and Asia (Japan, South Korea). Local seafood processors can either directly export their products or do so through a seafood trader. In Kien Giang, some seafood processing companies also process some cephalopods but this is not important in terms of their total production volume.

FIGURE 22
Fresh squid and octopus exploited by trawlers in Kien Giang

FIGURE 23
Supply chains of the fresh squid, octopus exploited by trawlers



There are about 15–20 large-scale fresh cephalopod middlmen doing business at Tac Cau fishing port. On average, each middleman collects 3.0–5.0 tonnes of cephlapods per day. Among the fresh cephalopods, cuttlefish account for about 60–70 percent and octopus for 20-25 percent, with the smaller part being made up of squid. Fresh cephalopods may come from different gears but mainly come from the trawl fishery. Small-scale middlemen for fresh octopus, cuttlefish and squid mainly supply local and domestic markets. On average, one small-scale middleman can source 0.5–1.5 tonnes of product per landing site per day. In Tac Cau there are about 10 small-scale middlemen buying fresh cephalopods and several more at the Ha Tien landing site. Conversely, the large-scale middlemen mainly target seafood producers for exporting purposes. Due to limitations of this study, detailed information on large-scale middlemen and other information relating to fresh cephalopod marketing was not gathered.

I. Social impacts of the fishery

Trawl fishing in Kien Giang is important in terms of providing jobs and livelihoods for a large number of households. The number of people directly involved in this fishery is large. There are about 27 500 fishers working on board trawlers in the province and about 600 persons directly working on sun-drying shrimp and 800–1 000 labourers unloading fish at landing sites and fishing ports (Table 34). Survey results show that 95 percent of labourers working onboard are the main breadwinner for their household. Additionally, the trawl fishery provides work for porters at landing sites (Ha Tien, Kien Luong, Hon Dat, Phu Quoc, Kien Hai) and Tac Cau fishing port. On average, each landing site can provide work for more than 100 porters (average of 150 labourers); the porter rate is 50 000–100 000 VND per metric tonne of fish unloaded. About 20–30 percent of crewmembers working on trawlers in Kien Giang come from other provinces e.g. An Giang and Dong Thap.

Each shrimp trawler provides full-time jobs for 3–4 crew plus 1–2 persons hired on a short-term basis for sun-drying and peeling shrimp. Normally, crewmembers are flexible and very few of them have long-term work or stable work with a given vessel. This creates difficulties for vessel owners to proactively arrange fishing trips and increases operational costs. However, for those vessels which are fishing effectively, a good-shared income arrangement is likely to persuade crewmembers to seek long-term work on those vessels.

TABLE 34
Number of labourers directly involved in the trawl fishery in Kien Giang, based on the survey conducted in November 2015

Fleet	Quantity	Unit	Average number of crews onboard (person)	Total No of crews (person)
Shrimp trawlers	560	Vessel	5	2 800
Anchovy trawlers	350	Pair	10	3 500
Mixed pair trawlers	966	Pair	22	21 252
Total				**27 552**

Otter trawlers and shrimp trawlers also provide a significant number of business opportunities for local people and outsiders, e.g. 400–500 women dominate the sun-dried shrimp production. The average income for sun dried and peeling shrimp labour is just enough to survive, with no surplus to save. However, this sort of work is low risk compared to some other jobs and can be a year-round activity. Older persons can also do these jobs. For a number of vessel owners, this activity is considered as an additional income and it is common for the wives of the vessel owners to be involved in this kind of work. Additionally, the trawl fishery also provides work through the trans-shipment vessels used to transport raw materials to fishmeal processing plants/factories. There are hundreds of these vessels, involved in transporting fish from landing sites and fishing ports to fishmeal factories and aquaculture farms (snakehead, Pangasius).

TABLE 35
Number of labourers involved in some services related to the trawl fishery in Kien Giang, based on the survey conducted in November 2015

Services	Gear	Total number of labourers engaged (person)	Average monthly income (1000 VND)
Peeling shrimp	Shrimp trawler	560–1 120	3 000–4 000
Unloading fish	Anchovy pair trawler (in Ha Tien)	150–200	6 000–10 000
Unloading fish at the landing place	Fish trawler (in Tac Cau fishing port)	800–1 000	6 000–10 000
Unloading fish at the fishmeal processing plants	Trawlers	60–100	
Fishmeal processing	Trawlers	500–800	
Seafood processing	Trawlers	8 000–10 000	
Transporting from the sea to home ports	Anchovy and mixed pair trawlers	4 000–4 500	
Transporting from other ports to home ports	Trawlers	400–500	Not available
Transporting fish to other provinces	Trawlers	400–500	Not available
Other services (gear reparation, vessel construction, ice making, fuel, food, water supply	Trawlers	Not available	Not available

Note: Some information was not available due to time limitation and short duration of the survey.

From 10 to 20 labourers are needed for unloading raw materials to each processing plant. Their average incomes are around 6 000 000 VND per month. According to the Tac Cau fishing port authority, in the large fishing port, such as Tac Cau, there are 420 fishing porters unloading fish every day as their main livelihoods. However, in reality the number is possibly double this. Each team of fishing porters is comprised of 24–25 persons and it is said that there are several tens of team working at the port. The team ratio between male and female porters and sorters is 60:40 respectively. Women are responsible for fish sorting while men are in charge of transporting fish from the vessels to the sorting places and/or to the trucks.

The fishmeal industry also provides long-term work and livelihoods for a large number of labourers. On average, 60–70 labourers work in each fishmeal processing factory and the average income per worker is 5 000 000–6 000 000 VND per month. Some factories, such as Ha Tien Fishmeal Company provide their workers with free accommodation and cover 50 percent of food costs and all clean water and electricity costs.

The trawl fishery also creates jobs for large number of employees working in the seafood processing plants in Kien Giang. On average, there are 600–1 000 employees working in each seafood processing plant or company. The majority of workers in the seafood processing industry are women, accounting for 80 percent of the number of total employees. There are approximately 300 women working in the shrimp processing industry, from Kien Giang and nearby provinces as well. Therefore, in the whole province, the seafood industry creates work and livelihoods for several thousands of employees securing the livelihoods of many thousands of households (Table 35).

In addition, there are small groups of old people and children picking up the fish dropped at the port and landing site. They are able to collect around 10–20 kg of pig fish/fertilizer fish per day and may earn 50 000–100 000 VND per day for their efforts. They are normally from very poor local households and few have additional or alternative livelihoods.

There are numerous associated service opportunities for the trawl fishery, including fuel, food, ice production, clean water supply, vessel building, repairing, and transporting which create jobs for large number of labourers. There is no doubt that the trawl fishery contributes to improving the economic conditions in the surrounding communities.

Fisheries infrastructure, labour operations at landing sites, fishing ports, and associated services have significant social as well as economic impacts on the surrounding communities. These are generally positive; for instance, generating employment opportunities and alternative livelihoods and providing more services to the surrounding communities. But some negative impacts do result, for example, water pollution, bad smell from the fishing port, landing site and fishmeal processing plant, the noisy atmosphere, and complicated and mixed cultural environments, e.g. crews from other areas, different religions, languages.

Furthermore, this fishery is important to aquafeed producers and aquaculture in terms of both work generation and the production of feeds for many aquaculture species, including catfish, tilapia, snakehead, grouper, snapper and shrimp. A number of aquafeed companies in Viet Nam are importing fishmeal, but most are using fishmeal from domestic sources.

On average, the amount of fish consumed by the households of skippers and vessel owners varied from 10–20 kg per month. This depended on the fishery and number of their family members. For instance, pair trawlers may stay at sea for several months, so the vessel owner will use less fish than the otter trawl which come to the shore after several days. Crews are normally not allowed to take fish to their home without permission from the skipper or vessel owner.

m. Attitudes towards sustainability

Of the interviewees from shrimp trawl fishers, 80 percent reflected that their shrimp catches are stable. However, competition for fishing grounds with other gears (crab, octopus fishing fleets) makes fishing operations difficult. As a result, shrimp trawlers now move further offshore to operate. This increases the costs of fishing operations and fishers may need to upgrade and make their fishing vessels larger to ensure safety at sea. Fishers also propose that there needs to be regulation of the fishing times and fishing areas for crab and octopus fishing and for shrimp trawlers, to mitigate future conflicts.

About 70 percent of anchovy pair trawl fishers interviewed had the attitude that catches had been stable in recent years, while 90 percent of persons involved in the shrimp trawl fishery opined that the shrimp resource is being harvested at a sustainable level and their concern was more with problems over conflict and competition with other fishing fleets. As a result, shrimp trawlers are fishing further offshore than their 'traditional fishing grounds'.

More than 80 percent of persons questioned about the stability and sustainability of the fishery and trend in their catches and landings in recent years answered that total catches had not changed, but catch values had changed as the proportion of pig fish/fertilizer fish to higher-value species had increased. Landings of squid, cuttlefish and octopus were stable compared to previous years.

About 90 percent of anchovy pair trawler fishers would support a closed season for the anchovy fishing grounds. They would also like to have regulations on fishing times for crab and octopus fisheries, and suggest that crab and octopus fisheries should fish during the daytime while anchovy trawlers operate at night.

Above 70 percent of pair-trawl fishers sampled have the point of view that fishing operations should be year-round. Although in some months during the northeast monsoon, catches were significantly lower than in the other months.

Very few endangered, threatened, or protected species are being caught by trawlers. Sea mammals have not been observed in the trawling catches and sea turtles only rarely showed up in catches. Due to religious concerns, catching sea mammals even by accident is believed to bring bad luck to the family, so fishers normally release any sea turtles or sea mammals caught at sea, particularly dolphin and whales, which are highly respected by local fishers. Some fishers also added that towing speeds of their trawlers were slow (2.0–2.4 knots) while sea turtles could easily escape through the large mesh sizes at the wings of the gear. It seems that there are not so many problems with sea mammals and sea turtles in Kien Giang.

No trawl fishers and/or vessel owners interviewed wanted to change to alternative gears or switch to other fisheries as they lack experience in the use of other gears. They also said that trawlers could not easily be modified or upgraded to use other gear types. Vessel owners confirmed that annual catches have been stable for the recent years. The strong impacts on their businesses are the market prices of fish and fuel costs.

n. Fisher organizations

Kien Giang has established a provincial fishery association. At the district level there is the Rach Gia City Fisheries Association with 436 official members, mainly vessel owners and skippers and some retired persons with experience in the fisheries sector. The associations are free for all kind of fishers, vessel owners, regardless of gender and fishing gear types to become a voluntary member. The fisheries association has already a code of conduct for members to follow. The association is considered as a platform for members to exchange information, experiences and a bridge between fishers, enterprises and the management authority. All new policies, changes in management regulations, and frameworks are updated to the members via the meetings convened.

The associations also aim to protect the rights and benefits of fishers in the Province, and provide proposals and advice to central government for development and for amending the legal framework of the fisheries sector.

Two fisher associations, under the system of Viet Nam's Labor Union, have been established in Kien Giang. The first organization was formed in An Hoa Ward, Rach Gia city in January 2012, with 91 voluntary fishers of multi-fishing gears. The second one was founded in Vinh Hoa Hiep commune, Chau Thanh district in October 2014. There are 25 local fishers involved in this organization without consideration of the gear types. The aims of these syndicates are to unite fishers to assist one another while operating at sea, as well as to exchange experiences, offer financial assistance for fishing business, and particularly to coordinate search and rescue operations and to mitigate risks while fishing at sea. These associations also may create better collaboration among fishers during fishing operations at sea, thereby reducing conflict and some other negative activities.

Unofficial cooperatives or informal cooperatives (no administration, not registered) have also emerged in the trawl fishery in Kien Giang. Members of these cooperatives are normally voluntarily involved and have verbal agreements. Depending on fleet sizes, membership can range from 10 to 60 vessel operators. In the shrimp trawl fishery, typically there are 30–40 vessel owners aggregated per cooperative. In addition, the skippers may found their own cooperatives based on family relationships. They also have verbal agreements to assist each other at sea, participate in search and rescue operations, and importantly to provide alternative transportation of catches from their members to the shore every day. This type of fisher organization is very popular in the Province.

o. Transshipment vessels

In Kien Giang, there are currently 273 professional transshipment vessels, and the province may increase this by 10 more transshipment vessels, based on the legal documents issued by the Ministry of Agriculture and Rural Development. Gross tonnage of each transshipment vessel is from 60–100 tonnes, with the length of each vessel between 24–26 m. The average engine capacity of this fleet is in range of 450–1 000 hp, typically around 600–800 hp (see Figures 24 and 25).

FIGURE 24
Transshipment boats for trawlers in Kien Giang

FIGURE 25
Transshipment vessel for trawlers in Kien Giang

These vessels operate by transporting catches from all types of gears used in the offshore fishing fleets, to the shore. Onboard each of the transshipment vessels, there are usually 8–12 persons. To hire the transshipment vessel to carry catches from the fishing ground, each pair trawler unit has to pay 25 million VND and provide 2 000 litres of fuel which is equal to about 53 million VND. Each transshipment vessel can carry catches from a number of trawlers to the landing sites.

p. Fisheries management

Policy development: Provincial fisheries regulations are developed in accordance with legal frameworks promulgated by the central government. These include fishery laws and decrees issued by the central government and circulars promulgated by the Ministry–MARD. Currently, the Kien Giang Provincial People's Committee (PPC) has responsibility for promulgating regulations on the management of capture fisheries and aquatic resources in the Province's territory (Decision No 23/2015/QD-UBND). The Province has identified fishing grounds, namely coastal waters, nearshore waters, offshore waters and shared waters with neighboring provinces (Ca Mau). No-take zones have been identified in the shallow coastal waters (3 nautical miles shoreward and 1 nautical mile around islands). Additionally, closed seasons have been introduced for certain areas. Regulations on banning destructive methods of fishing and those that cause negative impacts on the ecosystem and aquatic resources have been drafted.

The Kien Giang government does not now allow for any increase in new fishing boats below 30 hp for all gear types, and smaller than 90 hp for trawlers. However, scientific evidence is not sufficient to provide a concrete basis for policy making or the development of fisheries management measures, such as gear restrictions, zonations, mesh size regulations, closed seasons, fishing effort levels etc. (Nguyen Viet Nghia, 2014). Policy development is still top-down in nature and the involvement of relevant stakeholders in management planning and strategizing is limited. In other words, the participation of fishers and the industry (fishing, seafood processing, trading etc.) in policy decision-making is limited.

Currently, fisheries management operations are managed by the provincial Department of Agriculture and Rural Development (DARD). Under this department, the Sub-Department of Fishery (now a merger between Sub-DECAFIREP and Sub-Department of Aquaculture) is the organization responsible for management. There are seven patrol vessels operating in Kien Giang waters which are mainly doing surveillance work for violations in fishing operations, particularly fishing ground incursions.

At present, there are insufficient human resources and financial resources for the Department of Fishery to manage the sector well. The management of landing sites and fishing ports is poorly implemented, landing data are not well collected, and transportation and people access is not controlled. Hygiene and food safety conditions as well as environmental pollution concerns are paid attention to but not yet seriously acted upon.

The local authority does not routinely collect landing data and a number of small trawlers are neither monitored nor registered. Some data on landing volume were collected, following a 'sample based' approach but estimated landings cannot be disaggregated by species and are inaccurate.

Although the local government has a policy to freeze the current number of trawlers (as well as an ambition to mitigate the negative impacts on the fishery), recently, MARD allocated funds to Kien Giang to build 95 new fishing vessels and 10 more transshipment vessels (Decision No 3602/QD-BNN-TCTS dated 19 August 2014).

Despite great efforts made by local government and local authorities to better manage the fishery, compliance of fishers with management measures in Kien Giang remain relatively poor. Violations in mesh size standards are common in the trawl fishery. Similarly, most large trawlers (above 90 hp) are violating fishing grounds in the southeast waters (Bui Van Tung *et al*., 2013). In addition, many anchovy pair trawlers are illegally operating in nearshore waters. No fishers and skippers have documented contracts and the management of labourers working on board fishing vessels is weak. Local fishers tend to decide on fishing activities at sea, based on their experience rather than on science. Fishers tend to fish as much as possible and the quality of fish retained is not much paid attention. For instance, the towing duration is relatively long (average of 5–8 hours per haul) and fish are not well handled onboard. Fishing operations are carried out all year round that may have negative impact on fishery resources recruitment patterns and environmental conditions. Although middlemen play a most important role in fishing operations, there are no auction markets for local fishers. Therefore, the local government finds it hard to intervene in the businesses of local fishers. Finally, connections between fishers and seafood processing and traders remains weak.

5. RECOMMENDATIONS

Development of a provincial fishery management plan is a necessary step towards sustainability. The plan should take into account a number of issues and priorities and objectives must be clearly identified, milestones must be set, and a practical implementation plan developed. Some important aspects to be covered under the management plan include: a review of the current number of trawlers; development of routine landing data collection; monitoring of fishing effort; promotion of logbooks; improvements in fish handling practices (onboard and at shore); upgrading of important fisheries infrastructure; promoting best practices in fishing, handling, and transporting catches, and strengthening linkages between actors in the supply chains.

Knowledge of the overall fishing effort and its distribution is important for planning appropriate management actions. A comprehensive review of the current number of trawlers and the number of days at sea must be done to calculate actual fishing effort and to assess spatial distribution. The gear types used by fleets and districts need to be clarified for management and fisheries statistical purposes. Illegal trawlers must be banned.

There is a need to develop a policy and management body for fishing crews. The aims would be to legally manage the fishing labour pool to: ensure that qualified crews work on board fishing vessels; reduce conflicts between vessel owners and fleets over the recruitment of crews; and mitigate risks for both crews and vessel owners to ensure

social harmony. The management body for fishing crews would also help to improve the awareness of fishers in respect of natural resource protection and be more effective in the application of fisheries regulations.

Upgrading of the fishing ports and landing sites for better services and reduce post-harvest losses is required. Important facilities such as sunshades, sorting places, clean water supplies, parking places and services for fuel and food are poorly organized and managed. People are free to enter the port and hygiene and food security are not well dealt with. Not enough attention is paid to the pollution of the surrounding environments.

Studies on post-harvest losses on board and at landing sites leading to technical solutions for mitigation of post-harvest losses in trawl fisheries are required. It does not make sense to fish as much as possible when the quality, which is strongly linked to market price, is largely ignored.

Assistance should be provided to local fishers to develop fisher associations at district level and should be considered in the action plan being developed for management of trawl fisheries in the Province. The aim would be to formally set up organizations and platforms for fishers to raise their voices in the development of fisheries policy or in implementing the existing regulations. This would help fishers to address any conflicts that may be occurring at the fishing grounds and promote unity in fishing operations as well as strengthen the scope for mutual assistance in the event of natural hazards or accidents.

In order to harness collective efforts in addressing issues in the fishery, it is critical to strengthen linkages between actors along the supply chain. Fishers, middlemen, seafood processors, seafood traders and retailers require strong and transparent connections. The development and implementation of Fisheries Improvement Projects is necessary to establish roundtables and platforms for all relevant actors in the supply chains and associated stakeholders (government, association, NGO, academic institutions, donor community etc.) to become more involved in the fisheries management processes.

The Ecosystem Approach to Fisheries Management (EAFM) should be implemented. EAFM strives to establish a balance between ecosystem and human well-being, via good governance. It should be implemented for the following reasons: the small-scale fishery context; poor data collection and multiple gears/multiple species that require comprehensive solutions; and the collective participation from all relevant stakeholders. The participation of stakeholders in fisheries management decision-making process will ensure that the management measure will be more likely to be complied with, and consensus among stakeholders should ensure the effectiveness of the policies promulgated.

Species composition surveys must be planned and performed regularly for all trawl fleets which would help both fisheries managers and the fishmeal industry. The concept of "pig fish/fertilizer fish" in the trawl fishery should be clarified, especially for "anchovy pair trawl fleets".

REFERENCES

Bui Quang Tung, Nguyen Nhu Son and Dong Quang Hong. 2013. *Variation and distribution of fishing efforts of trawl, purse seine and gillnet fisheries in the southeast offshore waters of Viet Nam. Science and Technology Journal of Agriculture and Rural Development.* December 2013. Hanoi.

Cao Van Hung, Bui Van Tung. 2013. *Variations in landing volume of some important fishing fleets operating in offshore waters of the southeast area by engine capacity groups and locations.*

Dang Van Thi, Nguyen Ba Thong. 2008. *Status and potential of offshore resources in Viet Nam*. National paper prepared for the FAO/SEAFDEC workshop on "Assessment and Management of the offshore resources of south and Southeast Asia" to be held 17-20 June 2008, Thailand.

Do Van Thanh, Pham Van Tuyen. 2014. *Fishing capacity of all fleets in Viet Nam waters.* Science and Technology Journal of Agriculture and Rural Development, September 2014. Hanoi.

FAO. 2014. APFIC/FAO Regional Expert Workshop on *"Regional guidelines for the management of tropical trawl fisheries in Asia"*. Phuket, Thailand, 30 September–4 October 2013. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2014/01, 91 pp.

Ha Tien Socio-economics Division. 2015. *Annual report of the socio-economics in Ha Tien Township in the year of 2015.* IFFO, 2014. Fishery Feasibility Trial for developing the IFFP Fishery Improvers Component for: Kien Giang province trawl fishery, Viet Nam.

Kien Giang Department of Fisheries. 2015. *Report of structure of the fishing fleets in the province by districts, gear types and engine capacity.* Internal report, database.

Kien Giang fisheries Association. 2015. *Results of the operation of the association in 2015, responsibilities and orientation to 2016.*

Le Thanh Luu, Nguyen Ba Thong, Luca Micciché and Mai Thanh Chung. 2012. *Prelimary study of raw material supply for producing surimi products in Viet Nam.* Report of the activities implemented under the Luvina Software Joint Stock Company - ICAFIS agreement

MARD. 2015. Document No 9443/BNN-TCTS dated on 18 November 2015, strengthening the capture fisheries management.

Nguyen Hoai Nam, Nguyen Thi Hien, Nguyen The Anh, Vu Viet Ha and Tran Van Cuong. 2014. Data collection of trawl fisheries by catch in Kien Giang, Viet Nam – year 2014. Research Institute for Marine Fishery.

Nguyen Quoc Tinh, Bui Van Tung. 2013. *Study on variation and distribution of fishing efforts in offshore waters in the southeast Viet Nam.* Research Institute for Marine Fisheries (RIMF), Hai Phong, Viet Nam.

Nguyen Viet Nghia. 2014. *Fishery resources assessments in Viet Nam: status and orientating solutions.* Science and Technology Journal of Agriculture and Rural Development, September 2014. Hanoi.

Nguyen Xuan Thi, Bui Thu Hien, Pham Thi Diem. 2014. *Status and solutions for mitigating post harvest losses for offshore fishing fleets in Viet Nam.* Science and Technology Journal of Agriculture and Rural Development, September 2014. Hanoi.

Rach Gia Fisheries Association. 2015. *Annual report of the fisheries association operations in 2015 and orientation to 2016.*

Ramiscal, R.V. & Dickson, Jo. O. 2009. *Bycatch Management and Discard Reduction Strategies National Report – Philippines.*

Stamatopoulos. 2002. *Sample-based fishery survey: A technical handbook.* FAO Fisheries Technical Paper. No. 425. Rome, FAO.2002. 132p.

Tac Cau fishing port. 2014. *The yearly report of the operation and results in Tac Cau fishing port in 2014.*

APPENDICES

Questionnaires for socio-economic survey for trawl fishery

Sample ID:_____

(For crew, vessel owner and skipper)

I. PERSONAL INFORMATION

Full name: _____
Address_____
Age: _____ Sex: _____ Marriage status: _____
Year of experiences in fishery:_____ Vessel registration No:_____

II. HOUSEHOLD INFORMATION

Number of family members: _____

Name	Relation	Sex	Age	Livelihoods	Time	Average income

Other incomes if any?

Additional livelihoods/incomes	Amount (VND)

III. EDUCATION BACKGROUND

☐ Illiteracy
☐ Primary school
☐ Secondary school
☐ High school
☐ Post graduate
☐ Vocational training
☐ Others
☐ College

IV. MEMBERSHIPS OF ASSOCIATION AND ORGANIZATION?

☐ Fisheries association: _____

☐ Women union/Farmer association: _____

☐ Cooperative: _____

☐ Other: _____

V. FINANCIAL SUPPORTS ☐ Yes ☐ No

If no, why?_____
If yes, why?_____

VI. TECHNICAL SUPPORTS?

A. SUPPORT FROM GOVERNMENT ☐ Yes ☐ No

No, why? _____

Are there any supports from other organizations? _____

B. SUPPORT FROM NGO ☐ Yes ☐ No

No, why? _____

Yes, why, what services?_____

VII. GEAR INFORMATION

Trawl	Number of gears/nets onboard
Squid trawl	
Fish trawl	
Shrimp trawl	
Pair trawl	

Number of crews onboard ?: _____

VIII. VESSEL INFORMATION
Engine brand: _____Engine capacity (hp): _____

IX. VESSEL SIZE

Vessel name	Length (m)	Width (m)	Height (m)

X. POSITION OF INTERVIEWEE

☐ Vessel owner ☐ Skipper ☐ Crew

☐ Chief engine ☐ Other _____

XI. HOUSEHOLD EXPENDITURES

Item	Amount (VNĐ
Food	
Health	
Education	
Housing	
Travelling	
Power supply Telephone cost Clean water supply Television service cost	

XII. CATCH INFORMATION

Number of hauls per day (set)	Number of fishing day per trip (day)	Mean trip catch (kg)	Discard at sea (kg)	Number of trips per month (trip)	Number of operating month per year (month)

CATCH SHARE INFORMATION

	Net benefit (%)	Catch (%)
Vessel owner		
Crews		

XIII. FISH CONSUMED BY THE FAMILY?

_____ kg.

XIV. INFORMATION OF FISHING GROUND?

Fishing grounds	Main fish caught

XV. ECONOMIC INFORMATION:

a. Fixed investment:

Items	**Year**	**Price (VNĐ)**	**Depreciation (year)**
Vessel			
Gear			
Devices Basket Storage Electric system GPS Compass Telecommunication Safety equipments Navigation devices			
TOTAL:			

b. Fishing operational costs:

Expenses	**Amount (VNĐ)**
Fuel	
Salary for crews	
Fees for finding crews	
Repair cost	
Ice block	
Salt	
Food	
Gas	
Other costs	
Fees (unloading, anchoring in landing sites/fishing ports)	
Other fees and taxes	
TOTAL	

XVI. FACTORS IMPACT TO FISHERIES OPERATIONS

Events/actions	Explanation
Storm/typhoon	
Northeast monsoon	
Southwest monsoon	
Fisheries law	
Fish price	
Fuel price	
Fishing ground competition	
Social events	
Season	
Health care/crews' physical	
Policy	
Engine broken	
Others	

XVII. VIEWS OF FISHERY TREND

1. What is your perception on the status/condition of your fishing ground?

_____

_____

2. What are the problems and recommendations relevant to fishing activities?

Issues of the fishery	Recommendation

3. What fishery law or regulation do you know that affects your fishing?

_____

_____

4. What are the benefits and other household amenities gained from your trawl fishing?

_____

_____

5. Is your income from trawl fishing enough to sustain your daily family needs? Why?

_____

_____

6. Would you like to shift or retain your fishing gear? If yes, what gear? If no, why not?

_____

_____

7. What measures do you practice and equipment you have to ensure your safety at sea?

_____

_____

_____

8. Are you willing to take the debris/basura you collected into port for proper disposal?

_____

_____

Name of Interviewer: _____ **Date:** _____

TRAWL FISHERIES SOCIO-ECONOMIC INTERVIEW GUIDE

(For Middlemen, Brokers)

XVIII. RESPONDENT'S PERSONAL INFORMATION:

Full Name:_ _____

Municipality/City:_____

Age: _____ Sex: _____ Civil Status: _____

Religion: _____ Spoken: _____

No. of Years Engaged in Trawl Fishing:_____

XIX. EDUCATIONAL BACKGROUND:

Ang gin Adman

- ☐ Never Attended School
- ☐ Elementary Level
- ☐ Elementary Graduate
- ☐ High School Level
- ☐ High School Graduate
- ☐ Vocational
- ☐ College Level
- ☐ College Graduate
- ☐ Post Graduate

XX. HOUSEHOLDE IFORMATION

Questions	Answer	Remarks
No of family member?		
Main incomes from?		
Average monthly expenditure?		
Other income than fishery?		

XXI. RELATIONSHIP WITH VESSEL OWNERS

Questions	Answers	Remarks
Where is main vessels you buy fish		
Do you provide loans to them?		
Do you have any forms of contract?		
How do you pay them money?		
Do you request vessel owners to change their fishing/handling practices?		
Do you have any incentives to improve/promote good practices?		
Do you have/achieve any incentives from your buyers/market?		

XXII. QUANTITY AND PRICES OF FISH BOUGHT

Landing sites/ fish port	Gear types	Commercial group (Mt)	Ave. Price (2015)	Time period (Season)	Local vessel or outsider

XXIII. QUANTITY OF FISH BOUGHT FROM TRAWLERS AT SEA (IF ANY)

Fishing ground	Gear types	Commercial group (Mt)	Ave. Price (2015)	Local vessel or outsider

XXIV. FISH HANDLING PRACTICES

Commercial group (Mt)	Handling methods	Transportation method	Markets/ Customers	Distances (Km)	Post hervest loss (%)

XXV. RECENT TREND IN CATCHES BY GEARS

Commercial group	Otter trawlers	Pair trawlers	Other gears	Remarks
High economically value fish				
Octopus				
Squid				
Cuttlefish				
Trashfish				

XXVI. RECOMMENDATIONS

Fisheries issues	Recommendations

Name of Interviewer: _____Date: _____

TRAWL FISHERIES SOCIO-ECONOMIC QUESTIONNAIRES

(For fishmeal and seafood processing industry)

I. RESPONDENT'S PERSONAL INFORMATION:

Full Name:_____
Company:_____
Age: _____ Sex: _____ Position: _____
Address: _____

II. EDUCATIONAL BACKGROUND:

☐ Never Attended School
☐ Elementary Level
☐ Elementary Graduate
☐ High School Level
☐ High School Graduate
☐ Vocational
☐ College Level
☐ College Graduate
☐ Post Graduate

III. HOUSEHOLDE IFORMATION

Questions	Answer	Remarks
No of family member?		
Main incomes from?		
Average monthly expenditure of the family?		
Other incomes than fishery?		

IV. COMPANY INFORMATION

Questions	Answers	Remarks
Name of the company		
Year of foundation		
Number of labour? Male: Female:		
What are main products?		
Production capacity (MT)		
Where are main fish/raw materials sourced?		
Does your company have any forms of contract with your suppliers?		
How does your company pay them money?		
Does your company directly buy fish from vessels?		
Does your company request vessel owners to change their fishing/handling practices?		
Main markets?		
Does your company have any incentives to improve/ promote good practices?		
Does your company have/achieve any incentives from your buyers/market?		

V. QUANTITY AND PRICES OF FISH BOUGHT DIRECTLY FROM FISHERS/VESSEL OWNERS

Landing sites/ fish port	Gear types	Commercial group (Mt)	Ave. Price (2015)	Time period (Season)	Remarks

VI. QUANTITY OF FISH BOUGHT FROM MIDDLEMEN/SUPPLIERS

Province	Gear types	Commercial group (Mt)	Ave. Price (2015)	Local vessel or outsider

VII. FISH HANDLING PRACTICES

Commercial group (Mt)	Handling methods	Transportation method	Markets/ Customers	Distances (Km)	Post hervest loss (%)

VIII. RECENT TREND IN FISH SOURCE

Commercial group	Otter trawlers	Pair trawlers	Other gears	Remarks
High economically value fish				
Octopus				
Squid				
Cuttlefish				
Trashfish				
Others				

IX. RECOMMENDATIONS

Fisheries issues	Recommendations

Name of Interviewer: _____ **Date:** _____

FAO FISHERIES AND AQUACULTURE PROCEEDINGS 50

Socio-economics of trawl fisheries in Southeast Asia and Papua New Guinea

Proceedings of the Regional Workshop on Trawl Fisheries Socio-economics
26-27 October 2015
Da Nang, Viet Nam
and
Socio-economic Write-shop
25-26 April 2016
Cha Am, Thailand

Socio-economic surveys were carried out in pilot sites in Papua New Guinea (Gulf of Papua Prawn Fishery), Philippines (Samar Sea), Thailand (Trat and Chumphon) and Viet Nam (Kien Giang) under the project, Strategies for trawl fisheries bycatch management (REBYC-II CTI), funded by the Global Environment Facility and executed by FAO. In Indonesia, no study was conducted owing to the ban on trawl fisheries beginning January 2015. However, a paper based on key informant interviews was prepared. The socio-economic studies were undertaken to understand the contribution of trawl fisheries to food security and livelihoods and determine the potential impacts of management measures on stakeholder groups. Among the socio-economic information collected were the following: demographic structure of owners and crew; fishing practices – boat, gear, season, duration; catch composition, value chain and markets; contribution to livelihoods, food security and nutrition; role of women; costs and income from trawling; catch/income sharing arrangements; linkages with other sectors; and perceptions – resources, participation, compliance and the future.

ISBN 978-92-5-109929-2 ISSN 2070-6103

9 789251 099292

I7812EN/1/09.17