OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

Cambodia Export Diversification and Expansion Program (CEDEP) II:

Marine Fisheries Component

Report

on

Environmental Impacts Assessment of Marine Fisheries Related Activities in Cambodia

Prepared

for

Royal Government of Cambodia

By

United Nations Industrial Development Organization (UNIDO)

Fisheries Administration (FiA), MAFF

SEPTEMBER 30, 2015

The views expressed in this report are based on the actual information and data collected during the study period and through review of currently available literatures. The views expressed in this report do not necessarily reflect those of the UNIDO or any participating organizations.

ENVIRONMENTAL IMPACTS ASSESSMENT OF MARINE FISHERIES RELATED ACTIVITIES IN CAMBODIA

TABLE OF CONTENTS

6. **RECOMMENDED MEASURES TOWARDS REDUCING ENVIRONMENTAL RISKS**

6.1 Measures towards Promoting Sustainability of the Fisheries Resource Base and Activities

6.2 Measures Towards Environmental Sustainability of Marine Fisheries

References

ACRONYMS

AMAF	ASEAN Ministers on Agriculture and Forestry
ASEAN	Association of South East Asian Nations
ASWGFi	ASEAN Sectoral Working Group on Fisheries (ASWGFi)
CCC	Coral Cay Conservation
CCCSP	Cambodia Climate Change Strategic Plan
CCD	Climate Change Department
CCTT	Climate Change Technical Team
CEDEP	Cambodian Export Diversification and Expansion Program
CFDO	Community Fisheries Development Office
CO_2	Carbon-di-oxide (a gas that is produced when fossil fuel is burnt, which also traps energy and warms of the earth crust/surface)
CT	Consultant Team
CZP	Coastal Zone Management Programme
DHI	Danish Hydraulic Institute
DOF	Department of Fisheries
EEZ	Extended Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FiA	Fisheries Administration
IC	International Consultant
KII	Key Informants' Interviews
MAFF	Ministry of Agriculture, Fisheries and Forestry
MOE	Ministry of Environment
MOE	Ministry of Environment
MPA	Marine Protected Area
NAPA	National Adaptation Plan of Action
NC	National Consultant
NCCC	National Climate Change Committee
NGO	Non-government Organization
SEAFDEC	South East Asian Fisheries Development Centre
SPS	Sanitary and Phyto-sanitary
TOR	Terms of Reference
Triage	Lowest tier of FiA system
UN	United Nations
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization

LIST OF TABLES

LIST OF FIGURES

ENVIRONMENTAL IMPACTS ASSESSMENT OF MARINE FISHERIES RELATED ACTIVITIES IN CAMBODIA

1. INTRODUCTION

UNIDO Cambodia has been collaborating with the Government of Cambodia to promote inclusive and sustainable development of food systems, thereby identifying, developing and managing programs towards improving the competitiveness of the food processing sector through access to support services, markets and business opportunities in Cambodia. The Cambodian Export Diversification and Expansion Program (CEDEP II) has been ongoing, where there is a component on Marine Fisheries that focuses on fisheries export so that benefits may be accrued by means of building synergies and generating complementarities with other fisheries programs/projects those are being implemented by the Fisheries Administration (FiA).

The CEDEP II project focuses on a number of aspects which include the following: (a) identification of and facilitation provided to a select group of fisheries processors to turn them from 'near-export-ready' to 'export ready', helping these processors so that they are better equipped with Sanitary and Phyto-sanitary (SPS) measures to meet the export market requirements, to create an Apex Association to provide the local associations so that it may act as a focal advocacy and policy dialogue platform on behalf of the processors, etc. Since marine fisheries export entails capture and extraction of marine fisheries resources, their handling, processing and packaging involve generation and management of wastes and polluters, it appears important to conduct an Environmental Impacts Assessment of the sector so that environmental costs are minimized and sustainability of resource base is ensured.

Having the abovementioned rationale in mind, UNIDO has engaged a two membered Consultant Team (CT), constituted by an International Consultant (IC) and a National Consultant (NC), to carry out the Assessment. This zero order draft report highlights the preliminary results that are gathered through the field activities which had been carried out during the first mission in Cambodia during June 23-July 03, 2015 and subsequent interviews and a questionnaire survey. It is to be noted that, the reflections of the analyses from questionnaire survey could not yet be incorporated in this report. Those will be taken into consideration in due course following the Second mission, which is still pending.

Section-2 of this report highlights the Approach and Methodology of the Assessment. Section-3 discusses state of marine fisheries management in Cambodia. Section-4 presents the narrative of the stakeholders' reflections on various aspects of environmental issues that are experienced by them in different stages of marine fisheries activities. Section-5 presents activities which are already carried out by various agencies and institutions. Section-6 highlights a few recommended actions which may improve environmental sustainability of fisheries resources in Cambodia.

2. APPROACH AND METHODOLOGY

2.1 General Approach for the Assessment

Following mobilization of the Consultant Team (CT) by UNIDO, the CT members have gathered a good number of background reports which had shed light on the marine fisheries sector of

Cambodia, the problems associated with overfishing, the recent phenomena of encroachment, destruction of mangroves, corals and other habitat fragmentation, community responses to mangrove regeneration, marine pollution from variety of sources, the regulatory reforms from time to time, the SPS issues involving marine fisheries export from Cambodia, and the use of chemicals and/or explosives for quickly catching marine fish and its consequences.

Following the literature review, the International Consultant (IC) planned for the first visit, as per the Terms of Reference (TOR), to Cambodia. The visit was hurriedly designed so that the CT members may join in the regional validation of Value Chain study. On the first day of the mission, the IC was introduced the marine fisheries related issues and briefed by Mr. Kang Sin. Following the brief introduction, the CT members travelled to Sihanoukville to take part in the regional Validation Workshop of the Value Chain study under the same programme. The event took place in Sihanoukville during 24-25 June, 2015, where a few environmental issues had been discussed. In the event, the CT members made important contacts with Provincial, District and sub-district level fisheries officials as well as representatives of fisherfolks, processors including exporting processors for the respective KIIs.

The overall approach of the Assessment therefore involved the following steps:

- Conducting missions in Cambodia and travel to the field areas (i.e., Sihanoukville and Kampot Provinces)
- Identification of Stakeholders (partly from the Sihanoukville Workshop)
- Conducting field activities
- Preliminary collation of data
- Collation of field information
- Debriefing at UNIDO Cambodia
- Framing up of Plans for questionnaire survey(s) and developing questionnaire
- Conducting a questionnaire survey

2.2 Methods and Tools Applied

A variety of methods have been applied to conduct the assessment. These methods include the following:

- Field Observation
- Key Informants' Interviews (KII)
- On The Spot Interviews of Key stakeholders
- Focus Group Discussions (FGD)
- Questionnaire Survey

2.2.1 Field Observation

The CT members visited various places (Pls see Annex-1) to meet key stakeholders. They have walked around the working areas of such key stakeholders, noticed keenly relevant aspects of marine fisheries capture, landing, transporting, handling, processing and post processing on site and shared within themselves the relevant issues which might have bearing on the overall assessment.

2.2.2 Key Informants' Interviews

The CT members interviewed a good number of target Key Informants (please see Annex-2), mostly on site, involving key stakeholders. Questionnaire checklist for each major target Key Informant types has been prepared to guide such KIIs, which have been applied in the interviews. The information gathered have been noted down by both the CT members, cross checked before collating such information base.

The following locations for KIIs have been used:

KIIs involving Provincial/Cantonment/Triage Fisheries Administration Officials/Inspectors	On the job, in specific office locations
Processors (Fish sauce, crab meat, etc.)	On the spot (at processing units)
Exporting processors	On the spot (at processing units)
Boat labours (fishing labors)	On the boat, in the harbor
Ice transporter, ice manager	On the jetty, on the boat
Fishermen/Crab catchers	On the boat, in their respective household
Crab Meat handlers/processors	On the spot where processing is done
Middlemen	In the Jetty (on the spot)
Central level policy makers	Mostly completed in Phnom Penh
NGOs/ Advocacy Agencies	In their respective Offices (in Phnom Penh)

2.2.3 Focus Group Discussions (FGD)

The CT members took advantage of the validation workshop in Sihanoukville and conducted two short FGDs involving processors and Triage level Fisheries Administrators/Inspectors. Another FGD has been conducted in the Jetty involving middlemen, mostly regarding handling and management of freshly landed fish in the Jetty through to handing over to processors. Questionnaire checklists have been utilized to guide the FGDs. Oral narrations have been noted down on the spot and shared amongst the two CT members.

The National Consultant also conducted rapid FGDs involving un-structured questionnaire checklists about the air quality impact of fish processing sites (dry shrimp, crab meat peeling, fish mill, fish bold, and indo-pacific mackerel steam) by asking 10 to 15 people living around each processing site except fish mill factory.

2.2.4 Questionnaire Survey

A questionnaire has been developed (please see Annex-3) to conduct questionnaire survey. The debriefing meeting allowed the CT to infer that a total of 60 numbers of questionnaires to be filled involving the fishermen, and another 15 numbers of open ended questionnaires to be filled in involving processors.

Field enumerators have been trained and the National Consultant (NC) accompanied them to the field to conduct the survey and fill in each questionnaire carefully. The UNIDO Cambodia Office kindly arranged for conducting the survey and offered required logistic support.

The data thus generated have all been inserted into a data format, tailor made for accommodating the survey data in a SPSS interface. The data have just been inserted into the said analytical format.

2.3 Limitations Owing to Methods and Tools Chosen

The current assessment has been a time-bound activity, involving only two professionals for atotal of about 82 working days shared between the two. A large number of stakeholders have been approached for having an interview. However, because of their busy schedule appointment for meeting concerned authority/official/contact persons could not arranged within given limitation of time. Therefore, a significant proportion of the actors have largely remained outside of the methodological reach.

Although a survey questionnaire has been framed and subsequently applied, the number of respondents had to be limited, spread over three of the four coastal provinces. Additional manpower had to be organized later to conduct the survey in far away places from the center. Again, due to limitation of time the number of questionnaires had to be limited so that time for transferring data from paper based survey questionnaires and computer based SPSS interface appears within manageable limit.

The responses are often perceptional and should be interpreted as indicative. With a different set of respondents, the same questionnaire survey might yield slightly different results based on the perception of those respondents. However, the general trends as emerged from the survey should be considered towards developing future courses of action.

3. STATE OF MARINE FISHERIES IN CAMBODIA

3.1 Marine Fisheries Sector, Production Volume and Its Importance

The marine fisheries sector of Cambodia is rich in biodiversity and also it provides for livelihoods of a large number of coastal people. Moreover, the sector provides for nutrition to the Cambodian population by supplying animal protein. According to published sources (Try, 2003), there are 476 species of marine finfish, 20 species of marine crabs, 42 species of marine gastropods and 24 species of marine bivalves. Official statistics organizes these marine species in nine categories (DOF, 2002). Table-1 provides for an overview of landing of marine fisheries in 2001.

Table-1: Marine fisheries landings recorded by DOF, 2001

Province	Fish	Trash Fish	Shrimp	Ray	Cephalopod	Slipper lobster	Crab	Snail	Blood cockle	Sea cucumber	Krill	Total
Kampot	2703	1786	284	165	247	0	870	176	199	0	0	6430
Sihanoukville	6943	4287	1730	0	1496	40	897	1236	226	210	0	17065
Koh Kong	7104	4764	1606	42	604	0	1410	1082	762	0	26	17400
Kep	123	10	42	2	8	0	285	0	0	470	123	1063
All provinces	16873	10847	3662	209	2355	40	3462	2494	1187	680	149	41958

Although this old data provides for a glimpse on the quantity of fish caught by major types, it only gives a partial picture because of the fact that people believe a significant proportion of fish are being caught on any given day in the marine areas of Cambodia, which are never landed within the territory of Cambodia and therefore remain completely unaccounted for. There have been efforts to

quantify the total amount of catch from Cambodian marine waters, however actual amount remained a unresolved question.

A study conducted under the Food and Agricultural Organization (FAO) opined that mangroves are considered part of fisheries resources, since mangroves are governed under Fisheries Law (Gillett, 2004). Available reports identify 34 species of mangroves along the coast of Cambodia (ICLARM, 1999).

Since the beginning of 1990s, production from marine fisheries has been increased significantly. According to DOF sources (DOF, 2002), production of marine fisheries increased from a mere 3000 metric tones to over 42,000 tonnes between 1982 and 2001. However, the marine fisheries production is manifold smaller than the inland fisheries in Cambodia. Try (2003) claims that catches of subsistence fishermen are not generally included in the production data for marine fisheries. It also claims that the catches by both Cambodian and foreign vessels landed outside Cambodia might account for about 25% of all the marine fisheries production in Cambodia. Many experts believe that in recent years, such proportion might be much higher compared to figures for landed marine catch.

Since 1990s, marine shrimp aquaculture has been introduced in Cambodia, primarily in Koh Kong province – which was rapidly emulated in Sihanoukville and Kampot provinces (Try, 2003). Since the early years of the new millennia, cage aquaculture of grouper, snapper and seabass has been continuing in Kampot and Koh Kong Provinces (Limsong, 2001).

There has been constant growth of fishing vessels in the marine waters of Cambodia. However, it is the increase in trawlers which has been causing rapid depletion of marine fisheries resources, including destruction of benthic structure, in shallow marine environment. There is denying the fact that with the gradual increase in fleet, more and more people have been engaged in exploitation of marine fisheries in Cambodia, including small scale fishermen and subsistent fishermen. It is really difficult to quantify how marine fisheries sector of the country has been contributing to the overall economy of the country. However, one may easily infer from the above discussion that livelihoods of a significant proportion of the coastal people are dependent on marine fisheries sector of Cambodia.

Apart from those who have been catching fisheries directly from the sea, there are a host of people whose livelihoods are also dependent on fisheries and fisheries value added products. The fishing labours, boatmen, ice producers and sellers, middlemen/traders, processors, transporters – all have been benefitting from fisheries related activities at various different stages of product manufacturing, processing and marketing. Not only local consumers are being satisfied by these value added products, Cambodian fisheries products have been found export markets in abroad.

3.2 Management of Marine Fisheries Sector

Cambodian marine fisheries sector is managed by a combination of legal and regulatory regime and traditional practices. Cambodia promulgated Fish Law in 1987 to guide Fisheries Management and Administration. The definitions, exploitation of inland fisheries, aquaculture and processing of freshwater fishery products, exploitation of marine fishery, aquaculture and processing of marine fishery products, competent authorities for addressing fisheries violation, penalization etc have all been put together under the legal framework. The ideas of conservation, restriction on certain gears and mesh size, definition of ‘dry days’ when fishing is temporarily banned for annual conservation, mangrove and coral conservation – all have been brought under the legal purview. Both Department of Fisheries (DOF) and Fisheries Administration (FiA) under the Ministry of Agriculture, Fisheries and Forestry (MAFF) are given authority to apply the legal provisions.

In a further effort, another legal instrument has been promulgated by MAFF in 1990 (Declaration No. 1470), which has been guiding the activities of DOF (on organization and functioning of the DOF). An analysis of the legal provisions indicates the intended objectives of marine fisheries management, which are categorized below (Gillett, 2004):

- Generation of Government's revenue,
- Production of information on the quality of fish caught,
- Avoidance of obstructing the passage of vessels,
- Protection of mackerel,
- Protection of the gear of inshore fishermen and/or bottom habitats; and
- Elimination of the use of destructive fishing gears and methods.

Only recently, the DOF has created modalities to work with fishermen/community based informal institutions towards promoting the concept of co-management, so that the community may assume their responsibilities towards safeguarding their source of livelihoods from degradation. The legal provisions and extended and the DOF has given some management mandate to community based institutions. A new Office titles Community Fisheries Development Office (CFDO) has been institutionalized to facilitate such co-management.

The Fisheries Administration (FiA) under the Ministry of Agriculture, Fisheries and Forestry (MAFF) plays important regulatory roles by patrolling in the open sea, controlling as much as possible illegal fishing and the use of illegal fishing gears. They also have an outreach programme to educate poor fishermen, especially the illiterate subsistence fishermen, and make them aware of activities which will ensure the productivity of the resource base and also benefit them the most.

Industries and urban centres which are polluting the marine environment are governed by different institutions. The environmental protection related legal regime is applicable for both the regulating institutions. Ministry of environment (MOE) is the body responsible to ensure ecosystem health and functioning. Ministry of Industries, Ministry of Commerce (MOC) and City Governments are all responsible to check that pollutions levels are kept as low as possible. Port Authority at Sihanoukville is responsible for ensuring safe port operations which would also restrict any damaging activities to ecosystems within their restricted areas. They are also responsible for coordinating such conservation activities involving other national agencies/bodies.

The management of marine fisheries are boosted greatly by declaring a few Marine Protected Areas (MPA). Once an area is designated and declared as an MPA, fishermen are not supposed to be going there and harvesting fish from those grounds. It is reported to the Research Team that illegal trawlers find these MPAs as lucrative grounds for catching fish.

3.3 Export of Marine Fisheries Products

Raw fish are directly transported to the landing grounds located in neighbouring countries, often without the permission of the respective authority. However, there are legal exports as well. A number of fish products are also exported. The following list provides for an overview of various fisheries products that are being exported from Cambodia.

- Chilled shrimp meat
- Chilled crab meat
- Frozen peeled shrimp

- Frozen squid/octopus
- Live mantis shrimp
- Live short neck clam
- Live blood cockle spat
- Dried shrimp
- Shrimp Paste
- Dried seaweeds/algae
- Dried fish
- Fish sauce
- Live ornamental fish

Source: DOF, field survey/observation/interviews

Despite the fact that a variety of products are exported from Cambodia, the real income from such exports are still very low. In most cases, major value additions occur outside the border of Cambodia, primarily in neighbouring countries. Moreover, Cambodian industries are still struggling to meet the growing imposition of sanitary and phyto-sanitary (SPS) standards by the importing countries, which is why they do not go for value addition themselves. The inability has become an advantageous position for industries in the neighbouring countries, which use the Cambodian products and after meeting SPS standards, they just use their brand label on their products.

4. ENVIRONMENTAL ISSUES INVOLVING MARINE FISHERIES OF CAMBODIA: PRELIMINARY FINDINGS

From the literature and field data collection, a number of issues involving marine fisheries management have been identified which have connections with environmental aspects of operation, handling, policy and overall management of the sector. The issues which came out may be categorized into the following aspects:

1. Overfishing and subsequent potential for the decline of marine fisheries resource base
2. Destruction of Mangroves, seagrass and corals
3. Illegal fishing activities, trawling, engine push net, blood cockle draggers
4. Environmental degradation through the discharge of waste water and/or solid wastes
5. The use of chemicals and/or explosives and potential threat to localized destruction of habitat
6. Encroachment into marine areas
7. Sand dredging for export
8. Biosafety involving indiscriminate import of larvae for culture, however without quarantine
9. Poor SPS measures
10. Climate Change and Surface Warming
11. Coral bleaching

4.1 Overfishing and subsequent potential for the decline of marine fisheries resource base

Extraction of marine fisheries resources from Cambodian marine/coastal areas has been on the rise. It grew from less than 5000 mt to over 50,000 mt between 1982 and 2007 (Tun et al., 2004; Gillett, 2004; Vibol, 2004). However, there remains a major methodological issue whether these numbers really indicate actual extraction. Available literature including newspaper articles suggest fisheries resources extracted from Cambodian coastal systems are often landed in neighbouring countries, therefore these extractions are not accounted for in the national accounting system. This is why, the actual amount extracted may be much higher than what the guestimates generally suggest.

In such a void of evidence, it is difficult to ascertain whether there is overfishing of marine resources from Cambodia or not. However, available literature suggests (Tun *et al.*, 2004) that overfishing has been one of most difficult problems associated with overall health of marine ecosystems in Cambodia and their regenerative capacity.

The Fisheries Administration (FiA) has developed a legal framework towards safeguard, conservation, exploitation, and regeneration of fisheries resources of the country, with specific regulatory and institutional directions in relation to marine fisheries (MAFF, 1989; MAFF, 2006). Despite the fact that there are regulations imposed by the FiA regarding mesh size of fishing nets, fishing gear types, prohibited-fishing zone trawling and engine push net, and there are surveillance by the respective inspectors at Triage level of FiA (and even occasional confiscation of nets), overfishing is a common practice involving marine fisheries in Cambodia – irrespective of locations in respective provinces. Field interviews for the assessment clearly found references to such widely noticeable observation.

Most of the artisanal fishermen of coastal Cambodia are poor (MOE, 2005; Fox, 2002), live generally on daily earnings from small catch which are often insufficient to pay for operation cost (fuel, food, net replacement, etc.). The fishermen try to optimize fishing in any given day, as they have been facing growing competition with other fishermen and the time for fishing is finite. Therefore, they try to catch not only the target species, but also those which do not give them a good earning (i.e., non-target catch). About two-thirds of the fishermen inform that they generally catch the target species, however the remaining proportion of the fishermen generally get secondary or tertiary target fish species – the latter two category only yielding little income. A significant proportion of fish being caught are treated as 'trash fish', yielding insignificant economic returns to the fishermen (Gillett, 2004; APIP, 2001). Official reports also recognize the presence of a significant proportion of trash fish in the overall catch mix (10,847 mt out of a total of 41,958 mt, as reported in DOF, 2002).

Out of the varieties fishermen generally catch, about 39% of the catch is shrimp, out of which only 2 to 6% are relatively higher grade shrimps. The survey reveals that, relatively high value swimming crab constitutes only 1% of their catch. In sharp contrast, the fishers opine that 17% of the catch is trash fish. The FiA Officials at Triage and Cantonment level believe even higher proportion of trash fish are generally harvested, which does not provide for appreciable income, however jeopardizes marine food chain and disturbs overall fisheries outputs.

It is found from the survey and interviews that the fishermen do not try to sort live fish (i.e., keeping only the species with higher economic returns) and release the live non-target species with lesser economic potential including juveniles. Although 61% of the fishermen claim that they do segregate fish (as opposed to 9% replying no segregation at all), such segregation practices is only applicable to dead harvested fish, just before those are sold to middlemen at the harbor. The survey reveals that there exists a significant regional difference. For instance, only one third of the fishermen segregates fish, while the proportion has been well over four-fifths for the other two provinces.

The inability to catch only the target fish increases a large amount of 'by-catch' in every fisherman's total catch. Moreover, even the lesser value by-catch has a price tag (which the middlemen in the Jetty are prepared to pay for). This is why the fishermen do not take the liberty to release any by-catch alive, rather bring them ashore.

Fishermen are asked whether they know any modality or technology which can catch only the target species. About 61% of the fishermen do not know any such technique or technology. From the survey results, there is a significant regional distribution on fishermen's response on this: while 100%

of the fishermen in Kampot do not know such technique, over 14% of the fishermen in Preah Sihanoukville indicate that they know how to catch only the target species.

Since the by-catch are also animal protein, either the poor purchase those for eating, or the commercial culture fisheries owners (for example, groupers are cultured in nearby marine areas where lesser quality fish are used for feeding groupers) pay a little amount per kilogram of by-catch with poor quality.

Although it is difficult to find correlation between 'overfishing' or 'increased by-catch' with decrease in abundance of fish or size of fish being caught, fishermen have clear perception regarding such consequences. About 66% and 29.5% of fishermen in the survey vouch that indeed, fish catch has declined and fish size has also decreased, respectively. The effect appears to be the highest in Koh Kong and Kampot provinces, respectively. Despite such consequences, due to sheer number of fishermen in the sea, the overall fish catch has increased over the past decade or so, as indicated by about 84.1% of the fishermen. The middlemen and the processors also largely agree on such results.

The NGO activists/officials also commented on the overall increase in number of fishermen with time, corresponding to ever increasing population in the coastal areas of Cambodia, which has also been contributing to overfishing. However, they also rate such overfishing as a function of increasing number of fisherman as relatively much lower than the illegal overfishing by the (overseas) trawlers (see the relevant section below).

4.2 Destruction of Mangroves, Seagrass and Corals

Along the coastal zones of Cambodia, there have been occasional destructions of critically important habitats of marine species, which involve mangroves, seagrass and coral reef (Rizvi and Singer, 2011; Kim *et al*., 2004; Kestl, undated; Tun *et al.*, 2004; Nelson, 1999; Major, 2011; Vibol, undated; FiA, 2004; Vibol et al., 2010).

Large industrial ventures are occasionally being approved at the expense of productive mangrove (in Kampot, in Sihanoukville), where clear felling of mangroves have been experienced by local people. People living in the vicinity of the forest area lack energy security, which is why they also cut mangrove forest. However, local people tend to believe that the level of mangrove destruction is much higher when industrial ventures cause clear felling in large tracts of mangrove forest. When such industrialists come with an approval of higher authority, the FiA officials cannot resist the destruction of mangroves and seagrass. Local people and sometimes NGOs launch protests if they observe mangrove destruction. However, often their protests are found to be too feeble to cease such activities.

A significant large proportion of local people (82% of all surveyed) is found to experience mangrove destruction on a regular basis (either often or every day). The respondents relate mangrove destruction with a number of reasons. The reasons for mangrove destruction, as cited by the respondents, are summarized in Figure-1. Perception of local people generally revolves around their own experience, which is why fuelwood collection has been cited as the main reason (45.5%). A significant proportion of the respondents have refrained from identifying any cause, partly because they would like to avoid being an easy target for being harassed by law enforcement agencies.

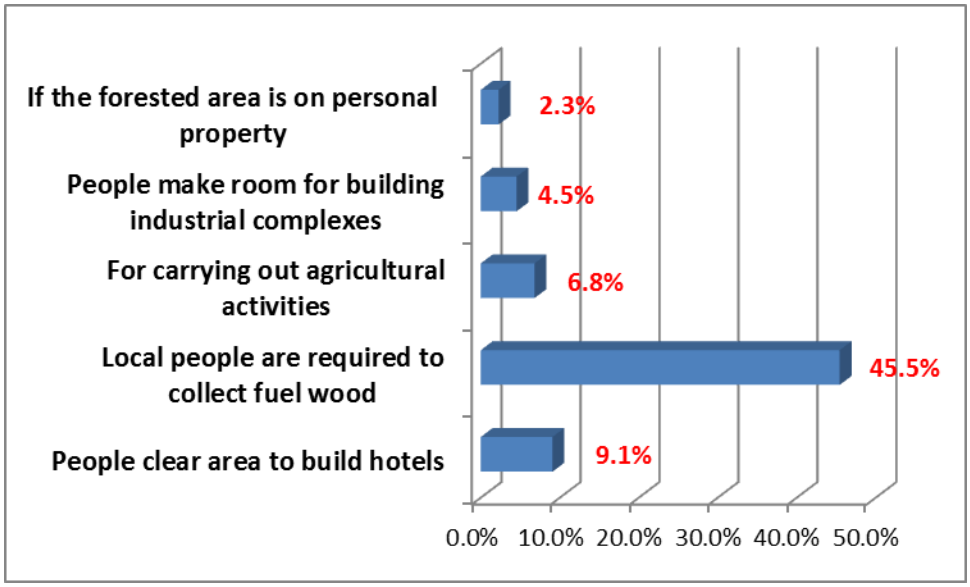

Figure-1: Reasons of mangrove destruction as perceived by the local respondents

Seagrasses are also being disturbed and even extracted for variety of reasons, often beyond the control and surveillance of the FiA Officials. About 91% of the respondents experience destruction of seagrasses. About 41% of the respondents experience such habitat destruction almost everyday, which indicates that significant level of habitat destruction has been occurring in the coastal areas. Sea grass destruction is most pronounced in Kampot and Preah Sihanoukville provinces. Respondents of Koh Kong province notice such destruction significantly less than those in the former two provinces.

The respondents are asked to comment on modalities and causes of sea grass destruction. A significant proportion of the respondents (about 73%) indicate that the motorized push nets, generally the gears used by trawlers, are the primary cause of sea grass habitat destruction. About 7% indicate the port activities have also been causing sea grass destruction. The incidences of trawling related sea grass destruction is more pronounced in both Kampot (81.8%) and Koh Kong (72.7%) provinces. Port activities related sea grass destruction is experienced by only the respondents of Preah Sihanoukville province. A significant proportion of the later fishermen (68.2%) also report sea grass destruction.

There have been allegations in the past concerning coral reef destruction, often to create room for foreign exchange earning tourism business in the offshore islands. According to FiA officials, such activities are now being stopped and no hospitality unit is allowed to do their business close to the shore so that corals are kept as it is.

The NGO officials comment on the adverse implications of such marine pollution and destruction of critical habitats of marine species. They opine that such wrong doings generally affect feeding and natural breeding grounds, which in turn result in gradual decline in important species including shrimps species – the latter being considered as a critical element in Cambodian cuisine.

4.3 Illegal Fishing Activities

According to fishermen and fishing labours, close-to-shore fishing is primarily responsible for overfishing and disobedience of government regulations. According to them, they generally catch fish at shallow water levels where there are periodic surveillance by the Fisheries Administration

Officials. Therefore, they are careful and as they are poor, they do not want their nets to be confiscated by the FiA Officials. However, they strongly opine that it were the overseas fishing boats which do most of the damages. Available literature generally highlight unauthorized fishing activities by foreign fishing vessels in Cambodian waters (Rizvi and Singer, 2011; Gillett, 2004).

About 81.8% of the respondent fishermen indicate that illegal fishing has indeed increased over the past two decades. According to them, the extent of illegal fishing has been on the rise despite increased surveillance by the FiA Officials. About 56.8% of the respondent fishermen suggest that patrol by the FiA Officials has been on the rise. There is a significant inter-provincial distribution in such observations. 72.7% of the fishermen of Preah Sihanoukville find that official patrol and surveillance has been increased, while only 27.3% of the fishermen belonging to Kampot province believe the same. The perplexing feature in the survey results is that, despite decrease in patrol in Kampot, 81.8% of the fishermen of Kampot say illegal fishing has been decreasing in Kampot areas.

The overseas trawlers generally come without any authorization (that includes registration etc.) and they want to catch fish quickly enough to avoid being held by FiA officials. So they drop their fishing gears to the bottom of the sea and almost sweep away all the fish – matured, juvenile and fingerling alike. They leave the fishing ground soon enough and do not care about sorting high value fish species. Such hasty nature of fishing and the fit-for-purpose (but illegal, nonetheless) gears allow these trawlers to disturb the overall stock available in the open sea (Rizvi and Singer, 2011; Garces, 2008).

The officials of the Fisheries Administration and the NGOs echo with the sentiment of general marine fishermen. To them, it is not the catch volumes which actually indicate overfishing. However, it is the indiscriminate extraction of juveniles and fingerlings – irrespective of species, which is rather alarming. To the FiA Officials, the lack of having advanced patrol boat, adequate manpower and financial allocation for increasing deep sea surveillance are the major reasons for not being able to arrest such illegal overfishing in the marine territory of Cambodia. The NGO Officials even cited official joint regional declaration by the respective Head Of States involving Cambodia, Thailand and Vietnam to work jointly towards arresting such illegal activities. However, such declarations could not have resulted in a decline of such illegal activities.

The issue of illegal fishing has also been addressed by the ASEAN through the formation of its Sectoral Working Group on Fisheries (ASWGFi). The group works in coordination with the regional forum titled ASEAN Ministers on Agriculture and Forestry (AMAF). A letter of understanding has been signed in November 2006 between both the Secretary General of ASEAN and of the South East Asian Fisheries Development Center (SEAFDEC). The letter of understanding was signed to promote cooperation on sustainable fisheries management in the region (Suharto, 2008). SEAFDEC even developed regional guidelines for responsible fisheries in Southeast Asia towards sustainable fisheries operation (SEAFDEC, 2004). And yet, little could be done to arrest illegal fisheries in the oceanic Extended Economic Zone (EEZ) of Cambodia.

All the major stakeholder groups are found to be equivocal about overfishing through illegal fishing, mentioning that overfishing would eventually contribute to the overall gradual decline in fish stock in the marine environment. The survey reveals that 73% of the fishermen agreed that illegal fishing has been going on. A significant proportion of the responding fishermen report that they have been experiencing such illegal fishing almost everyday (48.5%), or once/twice every week (42.9%). The regional distribution of the perceptions of the fishermen is placed in Figure-2.

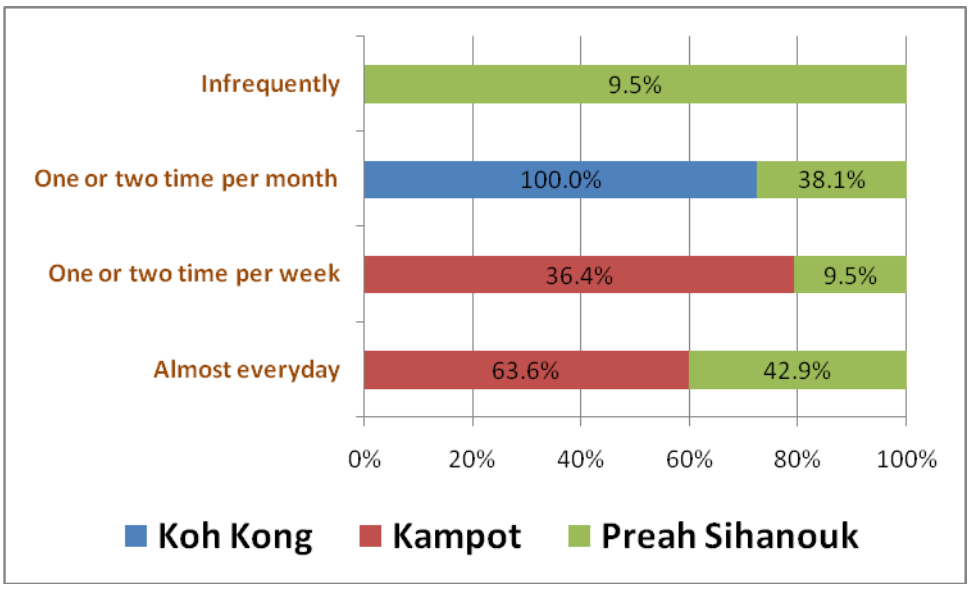

Figure-2: Provintial distribution of fishermen's experience regarding frequency of illegal fishing by fishermen from other countries

However, the Fisheries Administration higher officials (at Provincial level) did mention that, despite the fact that the overall official catch (recognizing a large amount of catch not being officially recorded because of the nature of illegal fishing) has been increasing over time, the marine fisheries resources in Cambodia are still regenerating themselves and are not particularly at risk of decline in near future.

4.4 Environmental degradation through the discharge of waste water and/or solid wastes

It is found that all the municipal establishments in the coastal cities, the hotels and restaurants in the offshore islands do release sewage and waste water (even solid wastes) into the open including the ocean without any treatment, which must have been contaminating the water and affecting healthy environment for the marine species. Rizvi and Singer (2011) highlights deteriorating water quality (of household, municipal and tourism activities including hotels & resorts) as a major reason which causes threat to marine fisheries ecosystem. Tun et al. (2004) observed that marine pollution has been a threat to marine environment.

It is found that refinery wastes are also being discharged into the sea! Moreover, the international vessels frequenting the port area in the Sihanoukville marine area also allegedly releasing bulge water, often without hiding such operation from the Port Authority's nominal surveillance. It is found that multiple actors are given the task to manage such activities and inter-agency coordination has been relatively inadequate to stop such pollution. Available literature provide for indications how these aspects cause degradation of marine environmental conditions leading to deterioration of ecosystem health and reduced productivity (Tun et al., 2004; Boesch et al., 2001; Vibol, 2004; Rizvi and Singer, 2011).

It is found that all the hospitality service providing units (i.e., hotels, resorts and restaurants) are forced in Sihanoukville to subscribe a central treatment service, following the construction and opening of a centrally operated treatment plant. However, in reality a visit to the site indicated that the plant has been operating below its design capacity, largely because of lack of (trained) manpower and overall management. Other than Sihanoukville, no other coastal tourism areas (in Kampor and Kep Provinces) has such facility, functional or not, and therefore a large amount of household and municipal sewage, sludge, solid wastes and waste waters are being discharged every

single day into the sea, leaving the marine environment including the coral reef environment at the mercy of environmental pollution. Available literature highlight that dumping of wastes, debris and waste water is resulting into marine pollution with detrimental environmental effects (Vibol, 2004; Rizvi and Singer, 2011; Tun et al., 2004).

The City Hall Officials of Sihanoukville assumed responsibility and commented that they have invested towards addressing the issue for the Sihanoukville city. But, other cities could not quite follow the suit due to lack of capital. They firmly believe that the overall situation may be improved with adequate political will, financing and engagement of all stakeholders along the coastal zone.

The fishermen also are somewhat responsible to leave net fragments in the open sea, which in turn keep catching fish ('ghost fishing') without any purpose. Though such incidents are localized, the unintentional ghost fishing leads to decomposition of the fish being caught and localized pollution. Moreover, the fishermen take packaged and canned food material on board and use those. Once the food is consumed, the trash cans and debris are generally thrown into the sea. The FiA Officials indicated that the lack of management of trash and debris by the fishermen is also a reason for polluting the marine environment. Such behaviours are directly linked with marine fishing operation.

The fishermen are asked to what extent they leave their solid wastes into the sea. The fishermen inform that they do use packaged and/or canned food, however the proportion is very nominal. Only 6.8% of the fishermen indicate that they use packaged and/or canned food items, while 43.2% of them inform that they depend mostly on freshly cooked food on board. Figure-3 gives a summary of their replies.

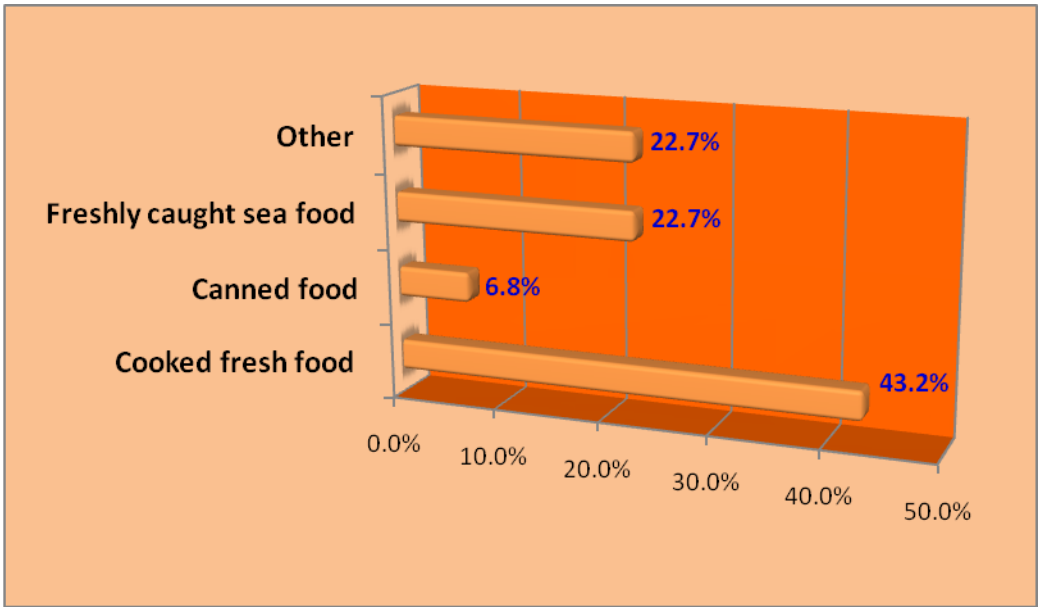

Figure-3: The pattern of using food by the fishermen while on board in a fishing trip

A closer look into the food choices/options by the fishermen reveals that there is a considerable regional difference in such choices. While the fishermen of Kampot rely mostly on freshly cooked food (72.7%), the fishermen of Koh Kong rely on freshly caught sea food (63.6%).

A significant proportion of fishermen (46%) inform that they generally keep the solid wastes including food wastes in a bin, which is brought to the shore for ultimate disposal. This is how they manage their own wastes. However, 27% of them generally throw the wastes into the open sea, while another 27% remain silent about their waste disposal behaviour while on a fishing trip. The

regional distribution of the answer indicates (Figure-4) that the level of awareness regarding safe waste disposal is low in Kampot province. About 45.5% of the respondents in Kampot indicate that they throw the food waste into th eopen sea.

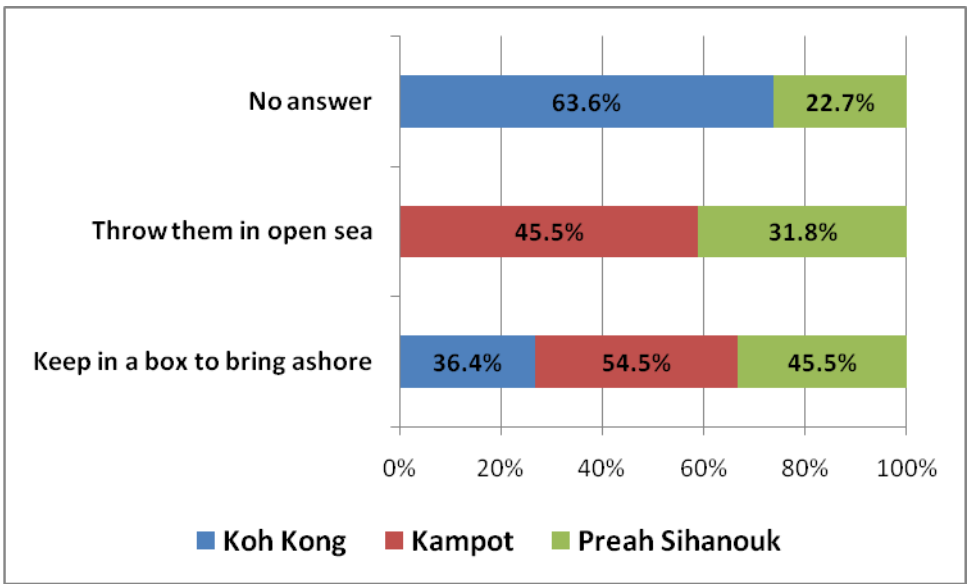

Figure-4: Regional distribution of food waste management behaviour while on a fishing trip

Upon inquiry, it is found that only 36% of the fishermen bring ashore fragmented nets and dispose off properly, when a net is identified to be no longer repairable. 27% of them generally throw them in open sea, while another 16% leave the debris behind (mostly dumped into open sea). This means that about 43% or more of the fishermen do not bring their fragmented net and trigger ghost fishing, thereby affecting marine environmental conditions.

Fishermen are required to wash their fish before handing over/selling to middlemen and/or traders at the jetty. A large proportion of them (56.8%) use sea water and let the water to be drained into the sea. Only 9.1% of them use freshwater for cleaning, which indicate low level of awareness regarding phyto-sanitary safeguards. Moreover, in most cases, water is drained into the sea. Only a handful of fishermen in the survey in Preah Sihanoukville Province indicate that they not only use freshwater for washing, they collect such waste water and bring back into the shore for proper disposal. Labours and middlemen in the jetty indicate that such awareness is rate amongst the fishermen.

In sharp contrast with the three former type habitat destructions, oil spillage from fishing boats do occur occasionally, which causes pollution of marine ecosystem. Oil spillage is being experienced by only 14% of the respondents. About 77% of the respondents have not experienced oil spillage. Despite the fact that only a small fraction of respondents report that oil spillage is a concern related to fishing practices, 63% of the respondents believe that such occasional spillage could have been easily avoided if checking of leakage of oil tank of each boat before leaving the jetty could be made mandatory. A significantly large proportion of the respondents express their belief that oil spillage could have been avoided had there been regular checking of the performance of the oil tank.

People surveyed possess high level of awareness regarding pollution of marine environment. They identify major sources of marine environmental pollution. All of the respondents hold household discharge of waste water as the cause of marine pollution, while 31.8% and 27.3% of the

respondents find hotels/resorts and aquaculture practices as the major sources of pollution, respectively. Figure-5 summarizes the findings in relation to sources of marine pollution.

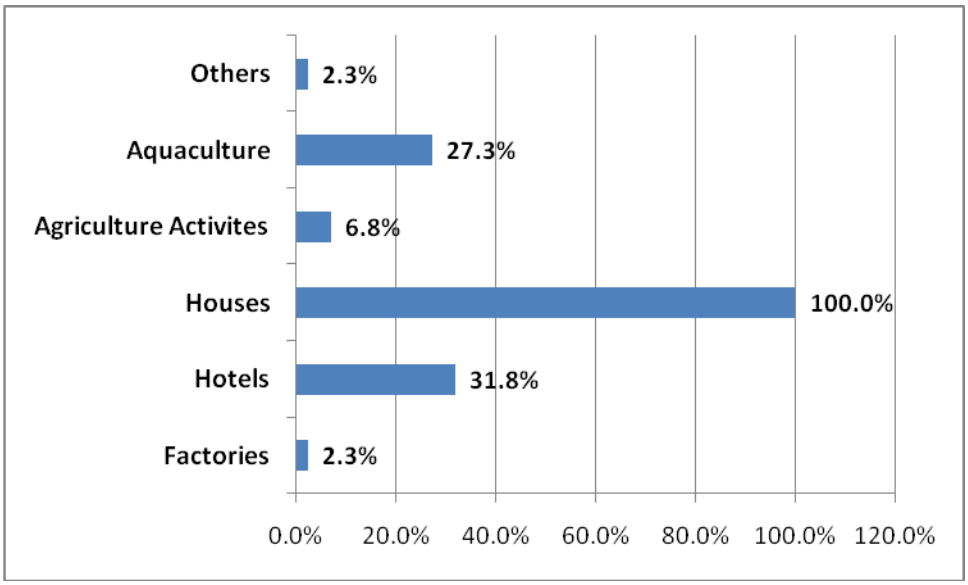

Figure-5: Various sources of marine pollution as identified by the respondents

People believe that marine pollution has partly affected marine fisheries resources (46%), while 49% believe that the effects are only slight in extent. In Preah Sihanoukville province, two-thirds of the respondents find marine pollution has been partly affected the fisheries resources, while only 9.1% respondents of Koh Kong believe the same. To the majority of the respondents in Koh Kong province, pollutants have affected the marine fisheries only slightly.

4.5 The use of chemicals and/or explosives and potential threat to localized destruction of habitat

It is alleged that fishermen sometimes had been throwing chemicals, even explosives to catch fish in a short span of time (Rizvi and Singer, 2011; WEPA, undated). Such activities had been experienced along the off shore islands – close to the proximity of coral reef areas, often far away from the monitoring and surveillance of FiA officials. Chemicals with properties of absorbing available oxygen from water, which generally choke fish in the neighbourhood soon after throwing such chemicals, allow fishermen to quickly catch fish. Explosives create shocks in the water, which can kill fish efficiently.

According to both fishermen groups and FiA officials, such illegal activities have been brought down to zero level in recent times. The fishermen have been relentlessly pursued not to use such hazardous elements, which not only kill the fish but also make the fish poisonous. The fishermen do not generally practice such chemicals or explosives driven fishing. The survey reveals that about 73% of the respondents indicate that they no longer observe the use of explosives to catch fish. An overwhelming majority of the fishermen (over 90%) in both Kampot and Koh Kong indicate that they no longer experience/observe explosive-related fishing. Only in Preah Sihanoukville province about 22.7% of the respondents opine that they still observe explosive based fishing. About 59.1% of the fishermen in Preah Sihanoukville province indicate that the propensity of using explosive has remained unchanged over the past one or two years, which warrant immediate action to cease such illegal act. Figure-6 summarizes trends of the use of explosives in three surveyed provinces.

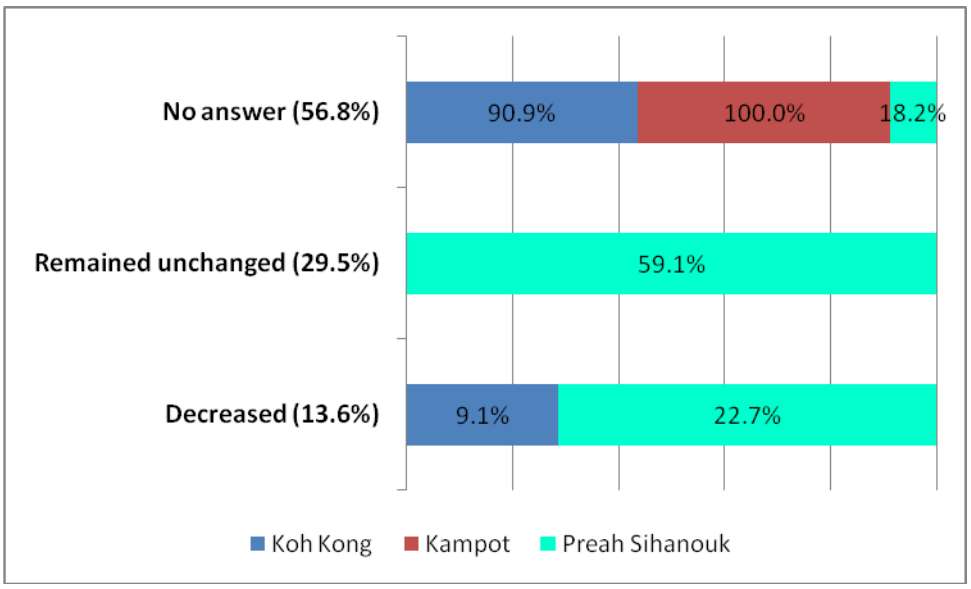

Figure-6: Perception regarding trends of the use of explosives for fishing in different provinces

A large majority of the respondents of the survey (almost 82%) find that the use of chemicals for catching fish no longer be observed. It appears that, the known and reported cases of cyanide fishing (Vibol, 2004; Tun et al., 2004) has been significantly reduced in recent years, as has been revealed by the survey. The respondents also do not indicate the use of electricity to catch fish in recent years. It may be inferred that the trends concerning the illegal use of explosives, chemicals and electricity to catch fish has been on the decline in the coastal areas of Cambodia.

4.6 Encroachment into marine areas

With the recent economic growth and gradually increasing industrial and tourism activities, it is alleged that encroachment into marine areas has increased over the past two decades. The local people including fishermen and NGOs are the most vocal about such encroachments. The NGOs however could not site any published research work which might have presented evidence of such occurring. However, they firmly believe that, given a comparison of two or more satellite imageries (involving past reference year and current year) could have clearly provided for scientific evidence to their allegations regarding continued encroachments.

The FiA Officials tend to agree with the fact that, sometimes higher authority allows a critically important installation to be located in the coastal zone, often superseding the authority of the FiA. In such cases, once parts of the marine environment is treated as just a piece of land and given to someone to change the landuse, FiA has little authority to overturn the decision and maintain the marine environment. People believe that such power and authority is given to the powerful, often driven by political economic decisions and perhaps through political interferences. That is why, no effective resistances could be launched in order to revert those self-destructive as well as counter-productive decisions.

People in the coastal areas, including families of the fishermen and processors, opine that the Government of Cambodia must adhere to its own laws and cease any further encroachment. They do not want to see that the GOC asking for an excuse to justify any further land use change, in a bid to encroach into marine environment, including corals, seagrass and mangroves.

4.7 Sand dredging for export

Sand dredging is also seen as a growing environmental problem in coastal Cambodia (Yoong et al., 2011). Sand is taken out in large quantities from the shallow sea floor, thereby affecting benthic structure and destabilizing habitat for fisheries species. People have been asked to comment on their experiences regarding sand dredging. About 72.2% of the respondents indicate that they experience sand dredging along the coastal zone. Two-thirds of them witness sand dredging very often, while 30% experience it occasionally. There is a significant regional distribution of experience of sand dredging. For example, 81.8% of the respondents in Preah Sihanoukville experience of sand dredging, while that for Koh Kong appears only 54.5% of the respondents. Local people are aware of such dredging activities and they do not like such activities.

Although sand dredging is being highlighted by local people, the same issue hasn't been discussed by other major stakeholders. Perhaps this has been done in off shore areas or perhaps in smaller scales, much outside the purview of other stakeholders. NGOs raised their concerns regarding sand mining by means of dredging. It is claimed that a significant proportion of the mined sand is exported to other Southeast Asian countries such as Singapore.

4.8 Biosafety involving indiscriminate import of larvae for culture, however without quarantine

There are allegations that larvae of foreign origin are being imported through the international borders with the neighbouring countries (for instance, Thailand) for the fish culture industries, without having to go through any quarantine procedure. Therefore, these larvae are a potential threat to spreading unknown and new viral and other fisheries related diseases. Any such episode will be severely affecting the marine fisheries resources.

Only a small proportion of the fishermen (about 9%) find that small fingerlings are imported to Cambodia for fish culture activities. About 23% of the respondents opine that such imported fingerlings/larvae might bring in exotic diseases from elsewhere, which might have grave consequences on marine fisheries in Cambodia.

The authority which allows such import of larvae want official explanation from the importer and information regarding the exporter. If they are satisfied, they authorize the importer to import. As per the relevant authority (Inspectorate), only if something wrong happens they will take away the import license and even ban the importer. However, this measure does not guarantee spread of deadly diseases.

The NGOs feel that a quarantine clause in the legal framework and necessary institutional provisioning is a must to avoid being exposed to life threatening diseases in future. However, to their liking, this has to be done in cooperation with the FiA and the Department in charge of Environment at appropriate level.

4.9 Poor Sanitary and Phyto-sanitary Measures

In general, there is hardly any awareness or understanding regarding safe sanitary and phyto-sanitary (SPS) measures in catching, handling, preserving, processing and marketing of marine fisheries products. No careful efforts are being made at any stage by any stakeholder, which suggests that SPS measures are not being applied in all those steps of managing marine fisheries products.

The fish, after disentanglement from the nets, are handled by bare hands by the fishermen and fishing labours. Those are kept on the roof top/hold of the boat, without taking much of additional SPS care. The survey reveals that a majority of the fishermen (about 72.7%) use polluted sea water to wash the fish. Figure-7 summarizes responses of the fishermen regarding fish washing behavior.

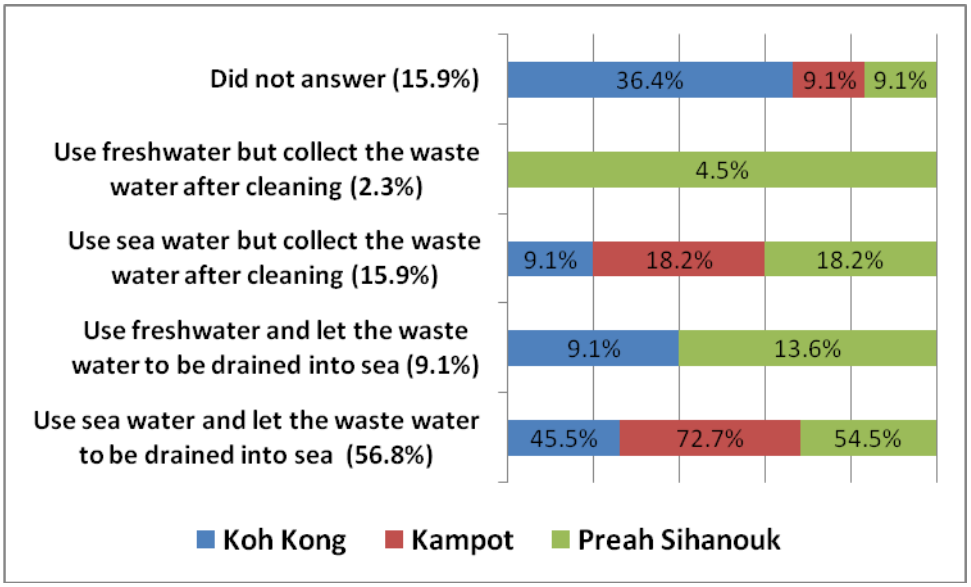

Figure-7: Responses of farmers regarding water use for washing freshly caught fish

Then they apply crushed ice. They collect ice sheets from the jetty, as those are supplied by ice middle men straight from the ice factories. The fishermen have no idea whether ice sheets are produced by using contamination-free water or not. The ice middlemen also do not know what quality of water is being used to produce ice. Neither of the groups has the idea regarding SPS norms, practices and international standards.

The fish middlemen at the Jetty are found to be little more conscious regarding quality of ice. They opined that ice sheet are generally made of (drinking quality) water, which are generally collected from the (springs of neighbouring) mountains. They know that no further treatment is generally committed by the ice factories before utilizing the water for freezing and converting into sheets. The middlemen looked a bit more confident regarding SPS requirements. They opined that had there been any reported contamination and subsequent sickness involving the consumers, they would have been informed by the people serving the value chain.

However, when it comes to fish processing for export, the entire system appeared to be tuned to the needs of the exporters. In every step of export oriented processing, specific SPS norms are imposed upon and 'expert human resources' are deliberately deployed full time to ensure that:

(a) Gloves are being used by the handlers at any stage of processing;

(b) Workers are forced to learn SPS requirements, while trainings are imparted by international experts, following a training manual;

(c) Proper gears, attires are used and cleaning procedures are followed everyday to satisfy the specific SPS needs of the exporter; and

(d) There are in-house supervisors who monitor day to day handling with high SPS standards.

One such export oriented processing unit in Sihanoukville has informed the CT members that they had made all the arrangements to meet SPS standards, which cost up to 30% additional amounts of

a monthly turnover cost. However, they have been earning some 20% higher for maintaining the standards for handing over every batch of products to the exporter.

It is clear from the opinion of the export oriented processors that the local market is quiet conservative and the willingness to pay for proper SPS standard is rather low by the local consumers. As a result, they feel discouraged to bring such changes to processing behavior at an additional cost, only for the sake of meeting higher SPS standards. They also informed that had they not been pushed so hard by the exporters, they would not have implemented such SPS norms and practices on their own. A combination of additional profit margin and the constant pressure from the exporter have forced them to implement the stringent SPS standards.

4.10 Climate Change and Surface Warming

Implication of climate change is not yet a major issue in coastal Cambodia. However, the research and academic communities find it as a data gap, which is why the general awareness level appears to be low. Available documents suggest that climate change might change the environment of coastal fisheries (IFAD, 2013), which might even trigger a decline in productivity of marine fisheries. Researchers indicate that climate change may trigger loss of habitats, while sea level rise will cause damage to fishing boats with a likelihood of medium level impact by 2050 (Sophal, 2013). Storm surges will tend to cause damages to housing of coastal communities (including those of fishermen), and damage to fishing boats. The national strategy paper considers measures to ensure climate resilience of critical ecosystems including coastal ecosystems and biodiversity in protected areas (objective-3), also to improve mangrove ecosystems, coastal zones and protected areas (NCCC, 2013).

Although there is hardly any scientific understanding amongst the primary stakeholders (fishermen, middlemen/traders, processors, etc) regarding climate change, such stakeholders generally hold climate change responsible for bringing change in the marine environment, which might have bearing on the overall productivity of fisheries along the Cambodian coast. People cannot decisively report whether climate change, especially global warming and subsequent surface warming has been causing any increase or decrease in productivity. However, they apprehend that the warming trend which they are also experiencing might eventually lead to adverse consequences on the overall marine fisheries productivity.

People vaguely can relate to loss of critical marine resources such as coral with increasing surface warming and/or increasing deviation from observed oceanic stream patterns. About 82% of the surveyed respondents claim that they are aware of climate change. The survey also finds that 38.6% of the respondents fear that sea surface temperature will increase from average, while 34.1% of the respondents anticipate that sea current will change its path as a consequence of climate change. The summary of the potential consequences of climate change, as considered by the respondents, is placed in Figure-8.

Perhaps due to lack of scientific understanding, only about 2.3% of the respondents indicate that corals will be bleached as a consequence of climate change. About 18.2% of the respondents also wrongly perceive that sea surface temperature will be decreased under climate change, which may not be otherwise possible in a warmer world.

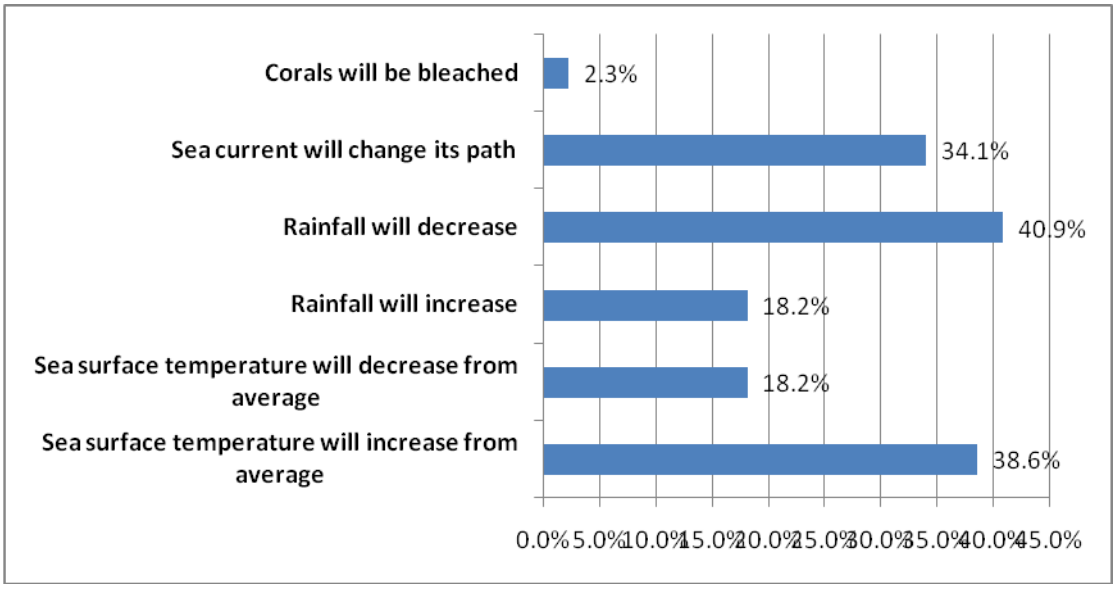

Figure-8: Implications of climate change in coastal environment, as perceived by the respondents

With such imperfect awareness and understanding, the fishermen indicate that the marine fisheries sector might be affected by climate change in various different mechanisms. The summarized results are presented in Figure-9. Clearly, a large majority (over 77%) indicate that overall fish stock will decline, while 59.1% indicate that fish growth will decrease due to climate change related implications. People also fear that fish will spawn untimely (29.5%), which might have significant economic implications on the overall marine fisheries sector. However, there is hardly any scientific data to bring evidence to such popular beliefs and perceptions.

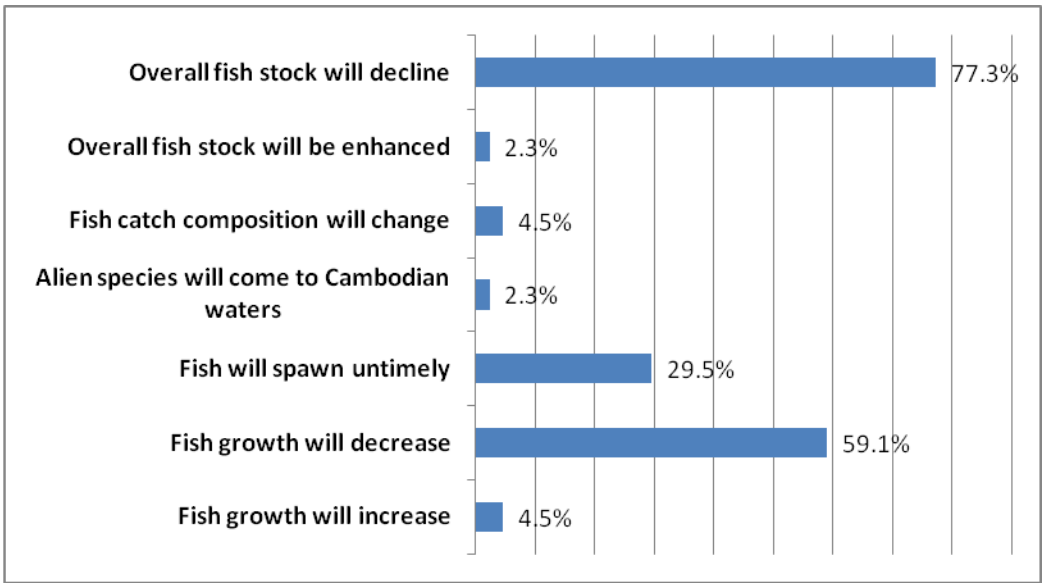

Figure-9: Implications of climate change related effects on marine fisheries sector

The NGO representatives and the officials of the Ministry of Environment who have been dealing with the complex issue of climate change opined that surface warming related phenomena might have strong influence on the energy distribution among oceanic strata, which might also change primary production capacity of the marine environment – the latter might have significant implications on benthic structure and food chain in the marine environment. Unfortunately, no systematic research has so far been conducted on these issues by the local as well as international

academics. The environment related personnel emphasized on conducting systematic research along the shores of Cambodia.

4.11 Coral Bleaching

Literature clearly indicates that in tropical marine systems, surface warming and gradual acidification due to speciation of atmospheric CO_2 into both aquatic as well as airborne phases will eventually lead to coral bleaching. However, general primary stakeholders have little understanding on coral bleaching as a function of global warming induced rise in sea surface temperature.

In contrast, the NGOs and higher level government officials are somewhat aware of the phenomenon. They understand that with declining coral colonies as a consequence of coral bleaching, many species (some being economically important for Cambodia) will also lose their suitable habitats and food chains of certain species might also be changed. However, it remains an apprehension due to the fact that no research has so far been conducted in Cambodia to suggest how these cause-effect relationships hold for the species in the marine environment of Cambodia.

5. OBSERVED EFFORTS TOWARDS BETTER MANAGEMENT OF ENVIRONMENTAL ISSUES

5.1 Overfishing and Conservation of Marine Fisheries Resources

Overfishing is a phenomenon which is related to a number of factors, which include the following:

- The increasing number of population who depend on fishing
- The easy access to gears by these fishermen
- Availability of nets with mesh sizes which are smaller than permissible limits
- Relatively inadequate application of regulatory regime

The major actor towards reducing overfishing is the Fisheries Administration (FiA), under the Ministry of Agriculture, Forestry and Fisheries (MAFF). There is also a sense of concern which involves overfishing. In order to reduce catch of juveniles and fries and/or to reduce bycatch volume, cantonment/ district/triage officials of the FiA are in charge not only to ensure that legal provisions are being followed, they have been given authority to enforce legal provisions. They, therefore, go to the extent that they confiscate nets having smaller than permission level of mesh sizes and even arrest non-complying fishermen. In addition to these, the FiA also have a reach out programme to educate/make fishermen aware of the long term risks of overfishing.

However, they cannot impose a ceiling for number of boats applying for registration – which might have implications in terms of reducing overall catch and therefore, by catch. Since poverty reduction is among the major development goals of Cambodia, FiA officials are forced to accept registration applications and permitting aspiring fishermen.

FiA officials are not in a position to stop the production of nets of small mesh size. Law enforcement up to this extent is found to be too much for FiA. Moreover, the FiA at Triago and Cantonment levels are not equipped with bigger and faster surveillance boats, which does not permit the FiA officials to increase patrol and their effectiveness. Fishermen clearly understand such limitations and take full advantage of it.

The NGOs and media are apparently aware of such damaging fishing practices. There are sporadic programmes considered by NGOs which concentrate on one specific aspect of the whole spectrum.

For example, saving turtles from entanglement has been promoted by NGOs such as Fauna and Flora International (FFI). NGOs have been working with communities to raise their awareness. However, those awareness raising programmes have not be adequately designed to address overfishing.

NGOs have been promoting 'Crab Bank' to save juvenile crabs and giving those a chance to grow and contribute to the available stock. However, experts believe that such efforts are bringing localized and short-term (i.e., immediate) gains.

The larger institutions such as World Fish (as a UN body) concentrate on many things. However, their programme is much less pronounced on environmental issues, including overfishing.

There have been efforts driven by both the Department of Fisheries (DOF) and NGOs to establish Community Fisheries programme, having common objective of fisheries management by involving the beneficiary communities. Gillett (2004) reported that about 12 marine community fisheries have been established and approved to function. In the Co-management programme under Community Fisheries, local level surveillance is given high priority towards ceasing the use of illegal gears and boats, promoting conservation of juvenile fish and crabs, promoting sustainable harvest from the community fisheries grounds. The DOF is the national agency in charge of the establishment of management of Community Fisheries programme in cooperation with local level fishermen bodies and informal associations. The Community Fisheries Development Office (CFDO) sits within the DOF to foster such co-management and promote conservation, thereby reducing overexploitation of marine fisheries resources.

5.2 Destruction of Important Productive Habitats

Destruction of mangroves, seagrass meadows and corals is always at the centre of attention. Ministry of Environment (MOE) has the mandate to create institutional and legal provisions to ensure conservation of such specific ecosystems. There are a number of policies and Action Plans to facilitate the process, which include National Environmental Action Plan, Biodiversity Conservation 1992, and Marine Pollution Convention, etc. However, these broad policies and action plans lack specific actions which could have saved such critically important ecosystems from being destruction. MOE has developed National Strategy and Action Plan on Mangrove Conservation. They have invited Mangrove for Future (MFF), an NGO, to launch a US$1.2 million programme in 2013 to implement such as Action Plan.

The MAFF has also been involved in safe guarding such ecosystems. In 2012, MAFF has signed and approved the National Action Plan for Coral Reef and Seagrass 2006-2015. MAFF has been collaborating with an NGO, Coral Cay Conservation (CCC), to implement the Action Plan with a budget of about US$3.12 million.

In the past, there have been efforts to educate the forest beneficiaries, often by the NGOs. Later on, NGOs have involved local administrators, local poor beneficiaries, FiA and Forest Officials, teachers, priests etc to influence a co-management regime involving mangrove ecosystem conservation. There have been efforts to declare Marine Protected Areas where fishing is banned. A larger programmatic effort has been designed to involve regional level actors for the conservation of critically important ecosystems such as the coral reef. People believe that coral destruction has been checked significantly due to such efforts.

NGOs have been trying to trigger community reforestation of mangrove species. There are sporadic efforts to develop mangrove nurseries. Communities have been mobilized by NGOs such as MCC,

where mangrove plantation has been promoted as a part of rituals for the newly-wed couples (in Sihanoukville and Kampot). High social values are attached to mangrove plantation. However, all these good deeds have localized effects and are not found to have profound implications towards reversing the mangrove destruction.

5.3 Illegal Fishing

FiA is the only authorized national agency to cease illegal fishing. As indicated before, they do their best to chase fishers with illegal gears, boats and even boats/trawlers of foreign origin. However, their capacity is rather inadequate and efforts are hardly meaningful considering the vast coastal and marine resource areas and the ever increasing capacity of illegal fishermen, especially those coming from international waters to catch fish without authorization.

There have been regional/international efforts involving high government officials to stop illegal fishing in the Gulf of Thailand or in the South China Sea. Those efforts are limited to signing generally broader policy level agreements, without much to do in terms of real on-the-ground implementation. NGOs and other national/international institutions have little say in terms of ceasing the menacing illegal fishing in the coastal areas of Cambodia.

5.4 Management of Waste and Waste Water

There is no denying the fact that most of the wastes and waste water is generated in coastal urban areas. Although the fishermen themselves dump their wastes while in a fishing trip, the overall amount is far less compared to urban waste and waste water. The Department of Environment is the authorized body to tackle such dumping of polluting wastes and waste water. It appears difficult to manage point source based dumping units, since there are thousands of such units in larger cities such as Sihanoukville.

Under the Provincial Government of Preah Sihanoukville, the Office of Coastal Zone Management Programme (CZP) is located in the Sihanoukville City Hall. With their active participation, the Provincial Government has managed to establish a central waste water treatment plant in Sihanoukville. The authority ensured that all the houses and the hotels/resorts/restaurants oblige by participating in this centrally managed waste water treatment facility and provide for service charge. Although the set up has been impressive, it is found (by means of physical observation in the site) that the facility is not being made completely functional, mostly due to lack of adequate human resources.

The second largest coastal city is Kampot. There is no such facility. A similar facility could have been useful towards reducing pollution load in the marine environment.

5.5 Arresting the Use of Harmful Chemicals and Explosives for Fishing

DOF and FiA are the authorities to stop the use of chemicals and explosives for catching fish. Through outreach programme, they have cooperated with NGOs to make wide scale awareness regarding the potential harmful effects of the use of such banned items for fishing. It has been reported that in recent years, the propensity of using such banned items and methods has been declined significantly.

5.6 Encroachment into Marine Areas

Since most of the encroachment related incidents are linked with political economic decisions that are also associated with political interference, FiA has little to offer resistance against such encroachments. Ideally there should be media outcry and mobilization of community Based Organizations and NGOs. Despite the fact that sometimes media carry stories to build public opinion, however there exists little public pressure to cease such environmentally damaging activities.

5.7 Sand Dredging

Sand dredging is often occurring for the promotion of export. The concerned ministry should be the Ministry of Commerce. However, the Ministries involving Commerce and Environment have inadequate coordination towards reducing environmental degradation in the process of collection of sand and exporting it.

Again, media sometimes highlight such activities and try to raise public concerns. The consultants are reminded that media outcry often does not lead to a wider social mobilization for or against an issue in Cambodia. NGOs have not been able to take up this issue and launch a campaign against habitat damaging sand dredging in the marine environment of Cambodia.

5.8 Biosafety

This is yet to be a major issue, partly because of the fact that no major adverse impact has been noticed along the coastline of Cambodia. Both post-larvae and fries of particular species (mostly grouper, sea bass and tiger shrimp) are imported from neighbouring countries (mostly from Thailand). These fries and post-larvae are released into marine aquaculture beds and fed well to ensure growth. After attaining certain growth, these fish are sold in the market.

In the entire process, the importers and aquaculturists do not pay adequate attention to a potential risk of spreading diseases in the marine environment. There is every possibility that such post-larvae and fries may be carrying virus or other deadly organisms which may attack other species in the open marine environment. Generally, it is mandatory to apply a quarantine process at the point of entry of the recipient country. However, in case of Cambodia no quarantine is made mandatory by law.

The current management warrants filling in a form where the importing agency is asked by the Fisheries Inspectorate under the MAFF. When the importing agency sends the filled in form, declaring the type of post-larvae and/or fries to be imported and the origin, the concerned officials of the Inspectorate evaluate the proposal and approve the import process. Often the importers mention that they will be held liable if an (biological) accident occurs as a consequence of the release of the imported fish.

The arrangement is found to be a partial one, since it does not ensure physical threats to marine environment. The imports generally occur through two land-based border points: one having common border with Thailand and the other involving the common border with Vietnam. A proper quarantine system could be imposed as a prerequisite, which could have ensured that the imported species are clean and carrying no physical risk to the marine environment. Obviously, this is perhaps a bit clumsy to implement by the Fisheries Inspectorate. However, if the entire procedure may be coordinated by the approving authority (i.e., the Fisheries Inspectorate) and the implementing authority (i.e., the FiA) – both belonging to the same ministry (i.e., MAFF), then a much safer management system could have been developed.

There has not been any NGO pressure regarding such potential threat to marine environment. Since no accident has been reported, the media never sensed such risks and never came forward to sensitise public opinion.

5.9 Sanitary and Phyto-sanitary Measures

Sanitary and phyto-sanitary (SPS) management in fish handling, preserving, cleaning, and processing stages is found to be rather poor. The FiA Officials deployed at Triago level sometimes tell fishermen not to use obnoxious water from the near shore to clean the fish at both landing and small-scale processing stages. However, the Officials of Health Directorate are not seen to take any actions to ensure SPS good practices. Similarly, Officials of Ministry of Industries do not visit the processing industries in a bid to educate them regarding potential risks to human health towards handling the fish for human consumption.

The CEDEP-II project has been dealing with the SPS measures. A separate study is conducted under the project to find out potential institutional gaps in meeting international SPS standards in a bid to enhance marine fisheries export. Recommendations from the study may be revisited and coordinated actions involving all the major actors are needed to improve upon management of SPS quality involving marine fisheries sector.

5.10 Climate Change and Coral Bleaching

Climate change is again a new phenomena in Cambodia. There is hardly any credible research on particular impact of surface warming with marine species well being, including their productive cycles. The concerned national agency is the Ministry of Environment (MOE), which formed an inter-ministerial body titled National Climate Change Committee (NCCC), having the Prime Minister as the Honorary Chair of the Committee. Under the NCCC, there is a Climate Change Technical Team (CCTT), involving technical representatives of 18 ministries and agencies which are made part of the NCCC. The NCCC has launched a Coastal Adaptation and Resilience Planning project, which is implemented by Danish Hydraulic Institute (DHI). The Climate Change Department (CCD) is dealing with climate change policy development and knowledge management aspects of NCCC.

Coral bleaching is one of the manifestations of adverse impacts of climate change. The MOE has formulated National Adaptation Plan of Action (NAPA) and recently released the Cambodia Climate Change Strategic Plan (CCCSP). Specific projects towards understanding causes and effects relationships between climate change and marine productive environment has yet to be launched, although eight projects have already been launched in line with NAPA and CCCSP. The projects dealing with coastal areas are trying to address damages to socio-economic conditions (habitat, livelihoods etc.) as a priority.

A good number of NGOs are also very active in securing livelihoods of coastal people, including the fishermen. Media is also found to be sensitized regarding human aspects of climate change, which often highlight immediate needs and issues, not really the long-term issues such as ecosystem health and productivity as a consequence of climate change.

6. RECOMMENDED MEASURES TOWARDS REDUCING ENVIRONMENTAL RISKS

6.1 Measures towards Promoting Sustainability of the Fisheries Resource Base and Activities

Addressing all the issues that generally determine environmental linkages with marine fisheries sector, especially its wellbeing of resource base is a daunting task. The following may be forwarded

as recommendations which will help address reducing the adverse impacts, if not eliminate those completely.

Addressing Overfishing: The existing awareness raising efforts should be continued, especially among fishermen communities. Thousands of small scale crab catchers, irrespective of age, are already harvesting swimming crabs which are of tender age and have little economic value. They must be made aware of potential negative impacts of juvenile harvesting practices.

Fisheries resource base will have a much greater boost if fishing with trawler at shallow depth could be checked or eliminated. However, having the current equipment and manpower, it would not be possible for the FiA officials to effectively reduce trawler fishing at shallow depth. They need better equipments as well as adequate finance to increase patrol frequency.

The CEDEP-II project may launch an advocacy with the concerned ministries (Ministry of Agriculture, Fisheries and Forestry and Ministry of Finance) so that the Royal Government of Cambodia increases its budgetary allocation, providing for better equipment and even increasing manpower so that better service may be ensured in this regard.

The same is also recommended for ceasing ***illegal fishing***, especially by foreign trawlers. Without better (stronger, faster) patrol vessels, it appears impossible for FiA to chase down and challenge (heavy duty) trawlers of foreign origin. This must be brought to the decision makers' tables so that such advocacy may help the decision making process. To this goal, the Project may collaborate with leading newspapers so that public opinion may be built on such issues.

***Encroachment into Marine Ecosystems*:** Although encroachment into marine ecosystem generally falls under environmental sustainability, it may have much profound impact on fisheries resource base. To address encroachment issue, the political hierarchy needs to be made aware of adverse implications of encroachment. The existing legal provisions are good enough to solve the issue if the political masters realize the bad consequences of encroachment. The project may engage in raising awareness of the political processes through targeted advocacy, in collaboration with advocacy NGOs working Cambodia. The media can also play a significant part by creating public awareness and building pressure from the voters.

Biosafety measures are highly desirable to address threats from unknown harmful micro-organisms those are transported with imported post larvae and fries. A pro-active role of the approving authority is needed. The Project may launch a coordinated effort involving the Fisheries Inspectorate and the FiA so that a joint quarantine process is considered at the points of entry. That will demand the establishment of a quarantine laboratory in each of the land-based entry points at the respective borders and a joint activity by both the Fisheries Inspectorate and the FiA. Moreover, the importers need to be made aware that paper-based certification will no longer be useful. In needed, a new legal provision may be created by involving the MAFF and the Ministry in charge of Law. The CEDEP-II project may extend its support to the participating agencies and provide technical support to make such changes realities.

6.2 Measures Towards Environmental Sustainability of Marine Resources

Destruction of habitat cannot be completely addressed through regulatory regime. Since much of the destruction of habitats occur by people living in extreme poverty, often without basic needs and services, existing legal provisions are never adequate to stop such small scale destruction. However, they may be organized through community involvement and consultations so that they also take part in micro-scale conservation.

The Community Fisheries programme needs a thorough evaluation to make sure that the model is flawless and giving big dividend. Once proven useful, the model needs to be advanced and replicated in other areas so that more and more communities are brought under the co-conservation framework. NGOs generally play critical roles in establishment and running of Community Fisheries Programme. The CFDO's/DOF's current efforts must be evaluated carefully and remodeled of necessary so that the advanced model may be replicated.

Waste and waste water disposal issue cannot be solved at every single point. An awareness raising programme can certainly help towards egregating solid wastes etc, but the success depends on bringing all the stakeholders under a single management system. First, the existing waste water treatment plant at Sihanoukville needs to be made fully operational. Meanwhile, an effort must be made to launch a feasibility study for Kampot city. If proven viable, effort must be made to involve the city Government and empowering them so that they may quickly learn from Sihanoukville and run a centrally operated Waste water treatment plant for themselves.

Meanwhile, the fishermen may be made aware of adverse implications of throwing solid wastes while in fishing operation in the open sea. They should be given training to bring back all the solid wastes, including debris of nets, so that the sea remain pollutant free. NGO involvement might be sought/pursued in order to raise awareness and provide for training to the fishermen.

The mangrove re-plantation has been confined within small communities, the bigger positive impacts are yet to be seen. NGOs having success stories may be given greater support from the project or from other sources so that these activities are not confined in limited scale.

Sand dredging brings home money. However, it is unsure whether the proper economic analysis of such action has been duly done and shared with concerned authorities. The project may consider launching a study in collaboration with the DOE to understand the cost and benefits of export of sand, thereby damaging the ecosystem health.

The SPS measures are being actively considered by the CEDEP-II project.

The DOE/NCCC has taken up a number of projects on climate change. Yet, there is dearth of information on impacts of climate change and sea level rise on marine ecosystems and marine fisheries. A study needs to be launched, involving the Royal University faculty members serving the Department of Environmental Management, so that authentic scientific information is gathered first and then used towards building awareness among the primary stakeholders. A policy recommendation appears superficial if the knowledge base appears to be weak and non-conclusive.

References

Allan, J. D., Abell, R., Hogan, Z. E. B., Revenga, C., Taylor, B. W., Welcomme, R. L., & Winemiller, K., 2005. Overfishing of inland waters. *BioScience*, *55*(12), 1041-1051.

APIP. 2001. Marine fisheries review. Agriculture productivity improvement Project (APIP), World Bank, Phnom Penh.

CFDO. **2003**. Strategic plan for the Community Fisheries Development Office (CFDO) of the Department of Fisheries, Cambodia.

Chou L.M., Yuan V.S., Yeemin T., Cabanban A., Suharsono and Kessna, I., 2002. Status of the southeast Asia coral reefs. p 123-152 In: Wilkinson, C.R. (ed.) Status of coral reefs of the world: 2002, Australian Institute of Marine Science.

DOF. 2002. Fisheries Data Collection 1980 – 2001, Report produced by Department of Fisheries (DOF), Cambodia.

FiA, 2004. National report of status of seagrass of Cambodia, Fisheries Administration (FiA), Report no. 186, Phnom Penh, Cambodia.

Fox, M. 2002. Cambodian coastal fisheries communities. Community Fisheries Development Office, Department of Fisheries, Cambodia.

Garces, L.R., Pido, M.D., & Pomeroy, R.S., 2008. Fisheries in Southeast Asia: Challenges and Opportunities. *Transnational Trends: Middle Eastern and Asian Views, Washington: The Henry L. Stimson Center*.

Gillett, R., 2004. The Marine Fisheries of Cambodia, Food and Agriculture Organization of the United Nations (FAO), Rome.

ICLARM. 1999. Management of fisheries, coastal resources, and the coastal environment in Cambodia: Institutional, Legal, and Policy Perspectives. Cambodia Working Group, Working Paper No. 03, Policy Research and Impact Assessment Program, International Center for Living Aquatic Resources Management.

IFAD, 2013. Cambodia: Environmental and Climate Change Assessment, Main Report, ECCA No. 3215-KH, International Fund for Agricultural Development (IFAD).

Kastl. B., Kimsreng, K., Kong, S., Chuerattanakul, S., Prohorsarith, N. and Ran, O., **Undated**. Study of Coastal Mangrove Devastation and Channel Sedimentation: Community-based Solutions Koh Kong Province, Cambodia. International Union of Conservation of Nature (IUCN), Glantz.

Kim, S., Chou, L.M., Tun, K. 2004 The coral reefs of Cambodia: present state of information and management capacity (mimeo).

Limsong, S. 2001. Aquaculture sector review (1984-2000) and outline of aquaculture development Plan (2001-2020) in Cambodia. Agriculture productivity improvement Project, World Bank.

MAFF, 1989. Law on Fisheries Management and Administration, Ministry of Agriculture, Fisheries and Forestry (MAFF), Phnom Penh.

MAFF, 2006, The Review of the Roles And Linkages of Sub-National Fisheries Institutions for Service Deliveries, The Fisheries Administration, Ministry of Agriculture, Fisheries and Forestry (MAFF), Phnom Penh, Cambodia.

Major, R., 2011. Cambodian Reef Conservation Project: Mapping the Coral Reefs of Cambodia, Coral Cay Conservation Project, Cambodia.

MOE and UNEP, 2009. Cambodia Environment Outlook, Ministry of Environment, Ministry of Environment (MOE) and United Nations Environment Programme (UNEP), Phnom Penh, Cambodia.

MOE, 1996. Law on Environmental Protection and Natural Resources Management, Ministry of Environment (MOE), Phnom Penh, Cambodia, Phnom Penh.

MOE, 2005, State of the Coastal Environment and Socio-Economy in Cambodia, Ministry of Environment (MOE), Phnom Penh, Cambodia.

MOE, 2006, National Adaptation Programme of Action to Climate Change (NAPA), Ministry of Environment (MOE), Phnom Penh, Cambodia.

NCCC, 2013. Cambodia Climate Change Strategic Plan 2014-2023, National Climate Change Committee (NCCC), Royal Government of Cambodia, 42 pp.

Nelson, V., 1999. State of Coral Reefs Cambodia. Environment Coastal Zone Project, MoE/Danida, Phnom Penh, Cambodia.

O'Brien, J. 2003. The National marine fisheries management and development policy and action plan. Department of Fisheries, Ministry of Agriculture, Forestry and Fisheries, Cambodia.

Rizvi, A.R. and Singer, U., 2011: *Cambodia Coastal Situation Analysis: Building Resilience to Climate Change Impacts – Coastal Southeast Asia*, Gland, Switzerland: IUCN. 58 pp.

SEAFDEC, 2004. Regional guidelines for responsible fisheries in Southeast Asia: responsible fishing operations. Bangkok: Southeast Asian Fisheries Development Center (SEAFDEC) Secretariat; 2004.

Sophal, S., 2013. Climate Change Issues Inland Coastal Area related to Water, paper presented in a Conference titled Climate Change Issues and Urban Flood Management, held on 19-20 March 2013, Daegu, Korea.

Suharto, E., 2008. ASEAN 2009: Time to deal with illegal fishing, opinion published in the Daily Jakarta Post, March 24, 2008, Jakarta.

Try, I. 2003. Fish stocks and habitats of regional, global and transboundary significance in the South China Sea (Cambodia). In: Reversing environmental degradation trends in the South China Sea and Gulf of Thailand. UNEP and Global Environment Facility.

Tun, K., Chou, L.M., Cabanban, A., Tuan, V.S., Thamasak, P., Suharson, Y., Sour, K., and Lane, D., 2004. Status of Coral reefs, Coral Reef Monitoring in Southeast Asia 2004, In C. Wilkinson (ed.), Status of Coral reefs in the World: 2004; Global Coral Reef Monitoring Network, Vol. #1, Queensland, Australia Government and Australian Institute of Marine Science, pp. 235-275.

Vibol, O., Nam, S., Puy, L. and Wath, P.S., 2010. Seagrass diversity and distribution in coastal area of Kampot Province, Cambodia, Int J Env Rural Dev., 1-2 (2010):112-117.

Vibol, O., Undated. National Report on Seagrass in the South China Sea: Cambodia, jointly published by UNEP, UNEP/GEF South China Sea Project and GEF.

WEPA, undated. Cambodia, available in the net http://www.wepa-db.net/policies/state/cambodia/seaarea3_9.htm, downloaded on August 23, 2015.

Yoong, S. 2011. Cambodian Sand Dredging Threatens Environment, Ecotourism Industry. Huffington Post, Aug 22, 2011.

Annex-1

FOCAL POINTS, INSTITUTIONS AND STAKEHOLDERS WHERE THE CONSULTANT TEAM MEMBERS VISITED

Provincial Offices of Fisheries Administration	Sihanoukville, Kep
FiA Division Officials	Sihanoukville, Kep
FiA Cantonment Offices	Sihanoukville, Kampot
FiA Triage Offices/Office Bearers/ Inspectors	Tumnub Rolok District Kampong Smach
General Inspectorate, Min. of Agriculture, Forestry and Fisheries	Phnom Penh
Ministry of Environment	Phnom Penh
Climate Change Unit, Ministry of Environment	Phnom Penh
Integrated Coastal Zone Management Project (Provincial Authority)	Sihanoukville
Small and Medium Sized Processors (Crab, Dry Shrimp, Fish Oil, Fish ..)	Sihanoukville, Kampot,
Handling Agents, labours	Sihanoukville Harbour/Jetty
Fishermen	Sihanoukville Harbour/Jetty
Middlemen/Traders of Fisheries products	Tumnum Rolok Zone, S'ville
Ice suppliers	Sihanoukville Harbour/Jetty
On boat Ice management personnel/labour	Sihanoukville Harbour/Jetty
NGOs (FACT)	Phnom Penh

(The list needs to be updated)

Annex-2

LIST OF TARGET KEY INFORMANTS WHO HAVE BEEN INTERVIEWED SO FAR

Target Key Informants by Type	**Name & designation of the representative Informant**
FiA Cantonment Sihanoukville	Mr. Hoc Laim, Deputy Director, FiAC (Sihanoukville)
FiA Cantonment Kampot	Mr. An Tha, Head of Fisheries Inspection, FiAC, Kampot
FiA Division	Mr. Phuon Phala, Director, FiA Division, Kep
	Mr. Em Phea, Director of FiA Division, Prey Nab, S'ville
FiA Triage	Mr. Bou Sour, Head of FiA Triage, Tumnub Rolok Dist., S'ville
	Mr. Samreth Keila, Head of FiA Triage, Kampong Smach
ICM Project, Provincial Authority	Mr. Prak Visal, Project Manager, ICM Project
Small Processor	Ms. Ty Rean, Vill. Pick Pros, Prey Nub District, S'ville
	Mr. Sam Sinoun, Vill. Koh Kchong, Sihanoukville Province
Small processor (informal exporter)	Ms. Tep Sokha, Prey Nub District, Sihanoukville
Medium Processor & Exporter	Ms. Seng In, Vill. Trapaing Ropov, Kampot
	Mr. Lim Nghea, Tumnup Rolok Thmey, Stung How District, S'ville
Medium Processor	Mr. Soun Sothearith, Head of Packaging, ……., Kampot
	Mr. Oeur Phala, Jetty area, Sihanoukville
Ice loader/supplier (to fishing boat)	Mr. Mouy, Fish Landing Jetty, Sihanoukville
Middle man (fish trader)	Mr. Thim Seak (Ta Ven Ta), Tumnup Rolok Zone, S'ville

(The list needs to be updated)

Annex-3

SAMPLE QUESTIONNAIRE WHICH HAS BEEN UTILIZED FOR THE SURVEY

Questions for fishers/middlemen/jetty owner/processor

A. Background Information

a.1: Q ID: ____ ___ ____ (three digits)

a.2: Name of the respondent ……

a3. Address: …… **Village** …… **District** …….. **Prov.** ……..

a.4: Type of respondent: (Plz tick) …….. **Fisher** …….. **Processor** …….. **Boatman/labour** …….. **Jetty owner**……. **Middle man** ……. **Others** (plz specify) …….

a 5: Educational qualification of the respondent: (1) Illiterate, (2) Primary level drop out, (3) Primary level completed, (4) secondary level completed, (5) Professional degree, (6) Baccalaureate, (7) Masters

a.6: Monthly household level cash expenditure ……**US$, (99) no answer**

a7: Number of household members: (a) Total ……., (b) Adults (>15 yrs) ……., (c) Adolescent (>5yrs, < 15 yrs), (d) Children (<5 yrs) (96) no answer

a8: Number of earning HH members: ……. (99) no answer

a 9.Monthly household level (collective) income from fisheries related activities ……**US$/mo (99) no answer**

B. ENVIRONMENTAL IMPACTS:

B1: What type of net/gear do you use? (Multiple-choice) : (for fisher only)

(1).gill net (2) trawl (3)collapsible crab trap (4) long tail-crab trap

(5) other (pls speify:_____

(99). no answer

B2: which species is the target one? (please be specific) a) primary target ……., b) secondary target ……c)third target.....d)all.....

B3: In an average day, what fractions of primary and secondary targets (out of total catch/buy) do you generally get? (one approximate fraction, may not be exact, will be OK) a) Primary target ……..%, b) secondary target ……%, c) others (100-a-b)……%.

B4: How often do you segregate <u>among non-target</u> fish to obtain a good market price? (1) Everyday/ regularly, (2) often, but not everyday, (3) never.

B5: What are the species-wise market price you generally get (average of past 15 days) for the above target fish types? a) Primary target ……%, b) secondary target ……%, c) others (100-a-b)……%.

B6: What is the overall percent of moderate to high value fish types in the overall catch? ……%

B7(for fisher only): Is there any way/mechanism you could catch only the target fish types? (1) yes, (2) no, (3) do not know (99) non-fisher

B8: Which one of the following have you experienced in recent one to two years? [Let them know the choices] (1) number of boats/vessels increased, (2) number of boats/vessels decreased, (3) number of illegal fishing activities increased, (4) number of of illegal fishing activities decreased, (5) amount of catch increased, (6) amount of catch decreased, (7) amount of non-target catch increased, (8) amount of non-target catch decreased, (9) patrolling by Fisheries officials increased, (10) patrolling by Fisheries officials decreased.

B9: Have you experienced illegal fishing being conducted by fishermen from other countries? (1) yes, (2) no

<u>If yes</u>, how often do you experience such illegal fishing? (1) almost everyday, (2) once or twice every week, (3) once or twice every month, (4) not regularly, (5) cannot tell specifically (99) no answer

B10: How often have you experienced the use of explosives? (1) Everyday/ regularly, (2) often, but not everyday, (3) never (99) no answer

B11: Do you think the tendency of using explosive to catch fish has changed over the past one to two years? (1) Increased, (2) Decreased, (3) Did not change (99) no answer

B12: How often have you experienced the use of chemicals? (1) Everyday/ regularly, (2) often, but not every day, (3) never. (99) no answer

B13: Tendency of using chemicals to catch fish has (1) **<u>increased</u>**, (2) **<u>decreased</u> over the past one to two years? (99) no answer**

B14: While on a fishing trip, on sea, what types of food and beverage do you take? [let the respondents know the options] (1) cooked fresh food, (2) canned food, (3) packaged food, warmed up, (4) packaged food, as it is, (5) freshly caught sea food, (6) other type (please mention) …… (99) no answer

B15: After having food/beverage, how do you treat/do the fisher treat/ the solid wastes? [let the respondents know the options] (1) keep in a box to bring ashore, (2) throw them in open sea, (3) do not know what happens later (99)no answer

B16: How do you/fishers treat snapped piece of net? [let the respondents know the options] (1) bring those pieces ashore and dispose off, (2) throw them, (3) if cannot recover, leave them behind (99) do not know

B17: How do you wash/think the fish after being caught? [let the respondents know the options] (1) use sea water and let the waste water to drain, (2) Use freshwater and let the waste water to drain, (3) use sea water but collect the waste water after cleaning, (d) use freshwater but collect the

waste water after cleaning, (4) do not care what happens to the waste water, (5) do not know (99) no answer

B18: How often do you see/hear mangroves are being destroyed? (a) Everyday/ regularly, (b) often, but not everyday, (c) never observed such thing.

B19: If you have noticed or heard that mangrove forests are destructed (if a or b above are answered), what do you think can be the causes for such destruction? [multiple answers possible] (1) People make room for building industrial complexes, (2) people clear area to build hotels, (3) Local people must cut mangroves to collect fuel wood, (4) other reason (please specify) ……..

B.20: How often do you observe/hear sea grasses are being destroyed? (1) Everyday/ regularly, (2) often, but not everyday, (3) never observed such thing (99) no answer

If you have seen/heard about sea-grass destruction (if the answer has been either a or b above), why do you think they destroy sea-grasses? (Please narrate) ……

B21. How often oil spillage occurs from fishing boats? (1) Everyday/ regularly, (2) often, but not everyday, (3) never observed such thing

B22: Do you think, with adequate care before fishing trips, oil spillages may be reduced significantly? (1) Yes, (2) No, (3) Do not know

B23. Where do you discharge /observe jetty or processing site discharge/ the waste water? (1) Directly into the sea (2) store and bring to the mainland (3) treatment tank (4) other:_____pls specify, (99) no answer

B24: How do you think the impact of waste from jetties and processing sites discharging directly into the sea ? (1) Extremely affected, (2) marginally affected (3) Not affected (99) now answer

B25: Do you know of incidents of importing and transporting post-larvae and/or fingerlings of certain species (e.g., Grouper) from other countries? (1) Yes, (2) No, not happening, (3) Even if it has happened, I do not know.

B26: Do you think release of such alien species without quarantine might pose any risk of infection or viral attack to available local species? (a) Yes, it might be possible, (b) No, not possible, (c) Even if it is possible, I do not know.

B.26: Have you heard of the phenomenon called climate change or global warming? (a) Yes, (b) No.

If the <u>answer is yes</u>, how do you think the marine environment will be affected? (a) sea surface temperature will increase from average, (b) sea surface temperature will decrease from average, (c) rainfall will increase, (d) rainfall will decrease, (e) sea current will change its path, (f) corals will be bleached, (g) other effects (pls narrate) …….

B.27: Do you think such changes (you've mentioned) will have any implication on marine fisheries? [please be specific, *<u>multiple answers possible</u>*] (1) Fish growth will increase, (2) Fish growth will decrease, (3) fish will spawn untimely, (4) alien species will come to Cambodian waters, (e) fish catch composition will change, (5) overall fish stock will be enhanced, (6) overall fish stock will decline.

B.28: Have you ever heard of/noticed any sand dredging/mining from a beach area? (1) Yes, (2) No, (3) not possible.

If you have heard of/noticed sand dredging/mining, how often do you think it has been happening? (1) Almost regularly, (2) irregularly, (3) at negligible frequency.

How do you think is the scale of such sand dredging? (a) large scale, (b) moderate scale, (c) nominal scale, (d) insignificant scale.

B.29: Have you been involved in crab fishing? (a) Yes, always, (b) yes, but occasionally, (c) no, never.

<u>If yes</u> (answers a and b), **what percentage of your daily crab catch can be sold to the processors?** (a) upto 25%, (b) below 25%, (c) Up to one third (i.e., 33%), (d) above 33% but below 50%, (e) above 50%, but below 66% (i.e., two-thirds), (e) above 66% but below 75%, (f) above 75% but below 90%, (g) above 90%.

On an average day, what is the amount of crab you harvest? …….. kg/day

For how many days in an average year, you can catch crabs? …… day/year.

B.30: How do you think about the current demand of crabs? (1) increased (2) same as before (3) decreased (99) no answer

B.31: How do you evaluate the catch per unit effort (catch/trip, catch/100 trap, catch/500m of gill net...)? (1) increased (2) same as before (3) decreased (99) no answer

B32. In the future, if fish and fish products of Cambodia meet the international standard, do you agree demand will increase? (1) yes, (2) no (3) do not know

B.33. If yes, do you think how would it affect to fisheries resources? (1) Extremely affected, (2) marginally affected (3) Not affected (99) now answer