The 6th Regional Scientific and Technical Committee Meeting

For the SEAFDEC/UNEP/GEF Project on Establishment and Operation of a Regional System of Fisheries *Refugia* in the South China Sea and the Gulf of Thailand

4-6 July 2022
SEAFDEC/Training Department, Samutprakarn, Thailand

THREATS AND BEST PRACTICE FISHING GEARS AND METHODS IN THE SOUTH CHINA SEA AND GULF OF THAILAND

I. INTRODUCTION

The South China Sea is a global center of shallow-water marine biological diversity that supports significant fisheries that are important to the food security and export income of Southeast Asian countries. These fisheries are characterized by high levels of fishing effort from the small-scale sector. Accordingly, all inshore waters of the South China Sea basin are subject to intense fishing pressure. This high small-scale fishing pressure and declining fisheries resources have contributed to adopting unsustainable fishing methods to maintain catch and increase incomes in the short term. These include using destructive fishing gear and practices, detonating explosives, and releasing fish poisons in critical marine habitats such as seagrass, coral reef, and mangrove. Small-scale inshore fishing pressure has been identified as a significant cause of the degradation and loss of coastal habitats in the South China Sea. For these reasons, the rate of loss of coastal habitats has been implemented by countries bordering the South China Sea, and the decadal rate of loss of such habitats remains high, e.g., seagrass beds (30 percent), mangroves (16 percent), and coral reefs (16 percent)(Vo et al, 2013). This continued decline in the total area of habitats critical to the life cycles of most aquatic species, combined with the high levels of coastal community dependence on fish, has raised serious concerns for the long-term sustainability of small-scale fisheries in the region. With fish production intrinsically linked to the quality and area of habitats and the heightened dependence of coastal communities on fish, a need exists to improve the integration of fish habitat considerations and fisheries management in the region.

II. USE OF DESTRUCTIVE AND NON-SELECTIVE FISHING GEARS IN SOUTHEAST ASIA

This issue is prevalent across various fisheries and habitat types in the South China Sea. For example, destructive and unsustainable fishing gear and practices have been identified as critical threats to fish stocks and their habitats in the mangrove areas at Trat in Thailand and at Batu Amphur in Indonesia, the extensive seagrass areas of Bolinao in the Philippines and Kampot in Cambodia, and at the regionally significant coral reef areas at Belitung in Indonesia, Masinloc in the Philippines and Phu Quoc in Vietnam.

Several studies on destructive and unsustainable fishing gear and practices in Southeast Asia have been reported as follows:

- Push net and inshore trawling cause habitat impacts and selectivity issues. Catches in these gear types from coastal waters are composed mainly of juveniles, and at high fishing effort levels are thought to contribute to growth overfishing. Such a situation hinders fisheries management efforts which primarily focus on developing sustainable livelihoods, and is a critical threat on inshore where push nets are used extensively over seagrass beds to take juveniles of the economically important species.

- Digging and gleaning of seagrass beds and mangrove forests is an area of concern at most of the priority refugia sites in the South China Sea. Growing demand for seafood in local markets has resulted in a marked increase over recent years in the number of people digging for sipunculid worms, gastropods, and crustaceans in the seagrass beds, leading to damage of seagrass plants, de-stabilization of sediments (and subsequent erosion), and the over-exploitation of benthic organisms. Intensive digging and grazing in some mangrove areas contribute to the occurrence of the dwarf; low-density mangrove stands at several sites due to disturbance of mangrove roots and seedlings.
- Blast fishing, poisons, and non-selective fishing gears and practices are well-known and documented threats to fisheries and habitats in nearly all areas of the South China Sea. These fishing practices often result in mortalities of a wide range of size classes of target and non-target species, contributing to growth and recruitment overfishing. The effects of blasting on the physical structure of coral communities are of particular concern, and blast fishing "craters" on heavily discharged reefs significantly impact coral reef-associated fish assemblages.
- Non-selective fishing gears, such as trammel nets, are utilized in most fished coral reef areas along the South China Sea coast. The use of non-selective fishing gear and practices and methods, such as luring light purse seine and large-scale lift net with light, has been identified as an environmental-unfriendly fishing practice due to catching of immature stock, high rate of by-catch and discard. Those unselective fishing activities are causing the problem of declining fisheries resources. The growing need to minimize the impacts of such practices on critical habitats necessitates developing best practices to manage these problems.

III. CAUSAL CHAIN ANALYSIS FOR SUSTAINABLE FISHERIES REFUGIA MANAGEMENT

The fisheries refugia project applies the Causal Chain Analysis (CCA)[1], often also called Root Cause Analysis (RCA), for a better understanding of an ordered sequence of events linking the causes of a problem with its effects. Each link in the causal chain is created by repeatedly answering the question 'Why?' A simple schematic showing the major components of a CCA are shown below in the Figure 1.

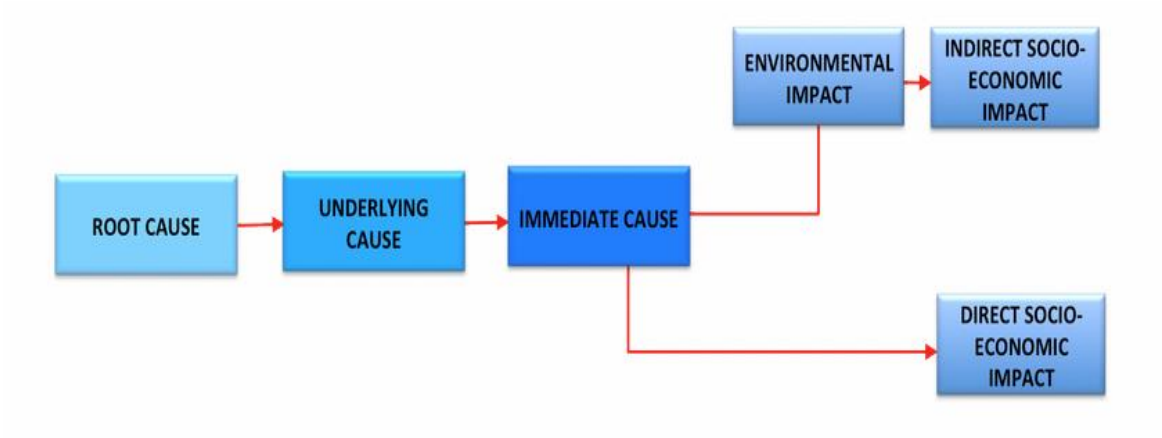

Figure 1: A simple schematic showing the major components of a CCA

At the initial stage of the project implementation, the national lead agency of each respective country worked locally with multi-stakeholders at project priority refugia sites on causal chain analysis. The resulting matrix of the Causal Chain Analysis (CCA) is defined from the stakeholder consultations as compiled from five countries, namely Cambodia, Indonesia, Malaysia, Philippines, and Thailand, shown in Table 1. This table composed of identified threats to the critical fisheries resources and their habitats, immediate cause, root cause, and proposed management actions. For Viet Nam, due to delayed implementation, the PCU will closely work and update them later when inputs are available.

[1] https://iwlearn.net/manuals/tda-sap-methodology/development-of-the-tda/causal-chain-analysis/what-is-causal-chain-analysis

Table 1. The resulting matrix of the Causal Chain Analysis (CCA) from multi-stakeholder consultations at fisheries *refugia* sites in Cambodia, Indonesia, Malaysia, Philippines, and Thailand.

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
Cambodia	Kep	Blue swimming crab	Juvenile	• Loss of habitat *(i.e*. sea grass • Illegal fishing • Habitat destruction • Overfishing	• Use of unsustainable fishing gear/practice (*i.e*. Small Mesh elongated collapsible trap) • Destructive fishing gear • Purse seine net trawlers	• High market demand • High price • Unsustainable fishing gear using • Destructive fishing gear	• Strengthening fisheries law enforcement • Fisheries law extension • Establishment of a conservation area • Creating crab bank • Alternative livelihood provision	•
		Blue swimming crab	Spawning (December to January)	• Destruction of spawning habitat • Loss of seagrass • Overfishing	• Illegal fishing • Trawlers with small mesh size net • Use of inappropriate fishing gear • Small Mesh elongated collapsible trap • Purse seine trawlers • Unsustainable fishing gears	• Effort fishing to catch more fish • High price • High market demand	• Conservation area development • Strengthening law enforcement • Fisheries law extension • Creation of conservation area • Strengthening patrolling and monitoring	•
	Kampot	Grouper (*Epinephelus spp.*)	Adult	• Declining fish • Habitat destruction	• Mouse tailed trap	• High demand • High price in market	• Strengthening law enforcement	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
					• Trawler with ball light		• Strengthening patrolling group • Strengthening cooperation with relevant stakeholders • Establishing fisheries refugia	
		Grouper (*Epinephelus spp.*)	Fingerlings (October to December)	• Declining of fingerlings • Habitat destruction such as sea grass, coral reef, and mangrove forest	• Mosquito (Small) net fishing gear • Push net fishing with electric • Mouse tailed trap • Trawler with ball light • Hand Push net	• High Demand from cage culture • High price in market	• Strengthening law enforcement • Strengthening patrolling group • Strengthening cooperation with relevant stakeholders • Establishing fisheries *refugia* • Strengthening the extension to fish seed traders • Replanting flooded forest (Wetland)	•
	Koh Kong	Mackerel	Spawning (November to January at Koh Kapi, Prek 3& 2, Boeung Kachang, Koh Yor, and Koh Nou)	• Habitat loss • Overfishing	• Illegal fishing • Mackerel gill net with small mesh size • Light Luring fishing • Purse seine net and trawlers	• High market demand in neighboring country • Destructive fishing gears	• Establishment of fisheries refugia • Strengthening patrolling group to make MCS • Strengthening law enforcement	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
					from neighboring country • Trawlers with small mesh size net from 2.5 to 3cm	• Illegal fishing from outside area	• Extending fisheries law • Making co-operation with relevant stakeholders • Strengthening transboundary-bilateral operation	
	Preah Sihanouk	Blood Cockle	Will be updated	•	•	•	•	•
Indonesia	West Kalimantan Province	White Prawn (*Penaeus merguiensis*)	Juvenil /pre-recruit	• Loss of habitat (mangrove) • Overfishing •	• conversion of mangrove land to oil palm plantations • destructive and non-selective gear •	• high demand for livelihoods • Effort fishing to catch more fish •	• Mangrove rehabilitation. • rearrangement and limitation of fishing area and fishing time. • Controlling of fishing on the critical habitat and critical phase of the shrimp	•
			Adult/spawning	• Overfishing •	• destructive fishing gear	• High price	• rearrangement and limitation of fishing area and fishing time.	•
	Bangka Belitung Province	Mitre squid	Juvenil /pre-recruit	• Loss of habitat (sea grass and coral reef) • Overfishing	• Sedimentation and high turbidity	• Tin mining activities in coastal area.	• A moratorium on permits for offshore tin mining and regulates the	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
				•	• Non-selective fishing gears (lift net with small mesh size) •	• Effort fishing to catch more fish •	pattern of mining operations based on region. • Rearrangement and limitation of fishing area and fishing time.	
			Adult/spawning	• Overfishing	• The capture of late mature stage of squid (with eggs inside)	• High price and high demand of adult squid and eggs squid.	• Rearrangement and limitation of fishing area and fishing time (open closed season)	•
Malaysia	Kuala Baram, Sarawak	Tiger Prawn (*P. monodon*)	Juvenile	• Deforestation • Deepen the river process • Water pollution	• Destructive fishing gear •	• Overlapped functions of relevant state and federal authorities • Lacking in fisheries conservation awareness	• Strengthening enforcement • Establishment of river conservation • Creating awareness	•
			Pre-recruit	• Shrimp push net & bag net	• Illegal fishing •	• High market demand	• Strengthening fisheries law • Creating awareness	•
			Adult	• Trawl net	• Illegal fishing •	• High market demand	• Strengthening enforcement on fisheries law by Department of Fisheries Malaysia	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
							• Enforce close sessions • Creating awareness	
			Spawning	• Trawl net	• Illegal fishing •	• High market demand •	• Strengthening enforcement on fisheries law by Department of Fisheries Malaysia • Enforce close sessions • Creating awareness	•
	Tanjung Leman, Johor	Lobster (*Panulirus spp.*)	Juvenile	• Overfishing • Habitat loss (coastal development)	• Available market demand of small size lobster •	• Lacking in fisheries conservation awareness • Good price in market •	• Increasing awareness • Promoting participatory approach fisheries management • Empowering the communities on community base fisheries management	•
			Young Adult	• Overfishing	• High market demand •	• High price in market	• Increasing awareness • Promoting participatory approach fisheries management	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
							• Empowering the communities on community base fisheries management	
			Spawning	• Trawl net • Overfishing • Illegal fishing	• Illegal fishing • Invasion of foreign fishing • High market demand	• High price in market • Illegal fishing from foreign vessels	• Increasing awareness • Promoting participatory approach fisheries management • Empowering the communities on community base fisheries management • Strengthening fisheries law enforcement • Establishing fisheries refugia	•
	Kuala Baram, Sarawak	Tiger Prawn (*P. monodon*)	Juvenile	• Deforestation • Deepen the river process • Water pollution	• Destructive fishing gear •	• Overlapped functions of relevant state and federal authorities • Lacking in fisheries conservation awareness	• Strengthening enforcement • Establishment of river conservation • Creating awareness	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
Philippine	Bolinao	Rabbit fish (*Siganus spp.)*	juveniles	• Over harvesting of juveniles	• high demand of fish paste	• Easy source of income for marginal fisherman	• Size regulation on the harvesting of Rabbit fish & provision of supplemental livelihood	•
	Mazinloc	Frigate tuna (*Auxis spp.*)	Pre-recruits / Juvenile	• Overfishing, use of fine mesh nets	• FADs fishing	• Due to high demand	• FAD Management plan, Mesh size regulation	•
	Colon	Fusilier fish		• Overfishing: due to illegal fishing, non-selective gears, recruitment, catching of juvenile • Loss of coral habitat	• Unsustainable fishing practice: • Use of cyanide in the live reef fish industry • Blast fishing • Non-selective fishing gear and practices • Collection of corals as sinker • Solid waste pollution	• High demand of all fish size • Municipal fishery ordinances are not fully implemented • Weak enforcement	• Implementation of fishery law • Strengthening Information dissemination	•
Thailand	Trat	Indo-Pacific mackerel	Whole life cycle	• Overfishing • Destructive fishing gears (e.g. giant trawls)	• Illegal fishing • Invasion of foreign fishing • Fishing by foreigner workers	• Increasing number of small-scale fishing boats altered from the commercial ones	• Strengthening fisheries law enforcement • Creating conservation areas (restricted fishing gear)	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
					• High market demand • Needs of small size for processing	• Non-cooperation of some fishing group • Lacking in fisheries conservation awareness • Insufficiency of public authority • Overlapped functions of relevant public authorities	• Increasing awareness • Promoting participatory approach fisheries management • Empowering the communities on community base fisheries management • Promoting community regulations for fisheries management • Promoting fishing eco-tourism • Establishing aquatic animal banks • Rehabilitating and establishing fisheries habitat • Promoting mesh size restriction	
	Surat Thani	Blue swimming crab	Whole life cycle	• Use of Unsustainable fishing gears • Overfishing	• Illegal fishing • Fishing of small-size crabs in seagrass bed	• Illegal fishing • High market demand • Lacking in fisheries	• Strengthening fisheries law enforcement • Establishing crab bank	•

Country	Site Location	Target Species	Stage of life cycle	Threats	Immediate Cause	Root Cause	Management Action	Remarks
					• Small mesh-size nets	conservation awareness • Low water quality • Climate change	• Creating conservation areas • Creating awareness	
Viet Nam	Bach Long Vi Island	Spiny Lobster	Will be updated	•	•	•	•	•
	Con Dao Island	Spiny Lobster	Will be updated	•	•	•	•	•

IV. CHALLENGES AND SOLUTIONS ON BEST PRACTICES FISHING GEARS AND METHODS

Taking into account the target objectives of the SEAFDEC/UNEP/GEF Project on the Establishment and Operation of a Regional System of Fisheries Refugia in the South China Sea and the Gulf of Thailand, Component 2 aims to strengthen the enabling environment for the formal designation and operational management of refugia. Additionally, the component will lead to considerable stress reduction. Specifically, the demonstrations of best practice fishing methods and practices aimed at addressing key threats to fish stock and critical habitat linkages, and the adoption of supporting laws, will result in a 20% increase in vessels applying improved gear/techniques to safeguard fish stock and critical habitat linkages at priority sites. This component has identified one crucial national-level activity: Targeted demonstration activities stated in activity 2.9. The activities will support, guide, and build up the National lead agency in establishing coastal fisheries management systems in priority fisheries refugia, including creating a trial approach to reducing the effects of non-selective fishing gears on critical habitats.

Unfortunately, the demonstration of responsible fishing practices has been stopped due to the COVID-19 pandemic from 2020 to the present (Q2/2022). In addition, the knowledge on the development and improvement of fishing gear technologies is limited and challenging at national levels, even though the Southeast Asian Fisheries Development Center (SEAFDEC) is leading and supporting the country.

The Southeast Asian Fisheries Development Center (SEAFDEC) has long experience in implementing various projects concerning improving fishing gear and practices for sustainable coastal fisheries management in Southeast Asia, such as:

- The Juvenile and Trash Excluders Devices (JTEDs) to reduce the capture of juvenile and small fish in Trawl fishing,
- Turtle Excluders Devices (TEDs) to release a sea turtle which incidental catch by trawl fishing,
- Circle Hook(C-Hook) to prevent capturing a sea turtle by longline fishing,
- Crab Bank project,
- Enlarging the cod end mesh size for trawl net, traps, gillnet, purse seine net, etc., and
- Deployment of an artificial reef to protect nursery and spawning grounds.

Nevertheless, the Department of Fisheries Thailand has succeeded to convinces fishers and fishing associations to a voluntary approach to releasing the gravid blue swimming crab caught by trawlers [2]from 2019 to the present. In the early days of this program only few trawlers joined, but after 6 months from August to December 2019, 45 trawlers participated in the program in Surat Thani Province and more than 4,000 berried female crabs were returned to the sea for natural spawning in their life cycle and preferred habitat. Taking into account that one female crab depending upon its weight can provide 200,000 to 2 million eggs (average 1 million eggs/one female crab) and considering that almost 4,000 million eggs of blue swimming crabs are naturally hatched in the sea, this has been an impressive practice. To date, this is one of the most successful and effective practices and a game changer resulting in sustainable long-term changes in fisher's attitude now supporting and engaging on conservation and restoration for healthy oceans and sustainable fisheries in their home water.

To support the achievement of project component 2, several fisheries management options are compiled and guided here are based on the FAO technical guidelines [3]for responsible fisheries No. 4 Suppl. 2 (FAO, 2003), the PCU summarized as shown in Table 2.

V. WAYS FORWARD

Considering each country's resulting matrix of CCA, few management actions are defined concerning improving fishing gears and developing responsible fishing practices. Accordingly, this matter will be raised for further discussion at the RTSC6.

[2] https://news.iwlearn.net/changing-attitudes-to-spark-restoration-of-blue-swimming-crabs-in-thailand

[3] FAO Fisheries Department. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2. Rome, FAO. 2003. 112 p.

Table 2: Fishing Management Options, summarized from the FAO technical guidelines for responsible fisheries

1. Technical measures	Gear modifications that improve selectivity	• Gear restriction • Mesh size restrictions • Fishing method control • Non-target species selectivity (TEDs, JTEDs, C-hook, etc.)
	Other gear issues	• Environmental conditions (light level, temperature, current speed, etc.) • Ghost fishing control
	Spatial and temporal controls on fishing	• Seasonal closure • Fisheries *Refugia* • MPA
	Control of the impact from fishing gear on habitats	• Prohibition of certain gear in some habitats (trawling in coral reef and seagrass areas) • Replace a high-impact fishing method with one with less impact on the bottom, *e.g*. trapping, longlining or gillnetting.
	Energy efficiency and pollution	• Reduce of CO2 emissions. • Energy optimization
2. Input (effort) and output (catch) control	Controlling overall fishing mortality	• Capacity limitation spatial/temporal • Access limitations • Effort limitation
	Catch controls	• By-catch controls (such as quotas)
3. Ecosystem manipulation	Habitat modifications	• Preventing habitat degradation • Prohibition of destructive fishing methods in ecologically sensitive habitats (such as seagrass beds); • Prohibition of intentional cleaning of the seafloor to facilitate fishing; and • Reduction of the intensity of fishing in some fishing grounds to ensure that non-target • Providing additional habitat
	Population manipulation	• Restocking and stock enhancement
4. Rights-based management approaches		• User rights • Effort rights • Catch rights • Effort management