Establishment and Operation of a Regional System of Fisheries *Refugia* in the South China Sea and Gulf of Thailand

REPORT

FISHERIES LANDING SURVEY MASINLOC, ZAMBALES (2017-2020)

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Abstract

Investigating the fisheries status is a crucial step in understanding how to conserve the available resources. The present study was conducted to illustrate the catch composition, provide an overview of the fisheries status in the municipalities of Bolinao, Coron and Masinloc from 2018-2020, for the identification of priority commodities in support of the establishment of fisheries refugia in the Philippines. The study was carried out to cite fish species in each area to be prioritized for conservation. Results of the study showed the three (3) top species – *Thunnus albacares* (yellowfin tuna), *Spratelloides gracilis* (Silver-stripe round herring), and *Decapterus macarellus* (Mackarel scad) in Bolinao, Coron and Masinloc sites, respectively.

Keywords: Fisheries landing, catch composition, CPUE

I. Introduction

The South China Sea and Gulf of Thailand is a global centre of shallow water marine biological diversity, supporting a significant world fishery that is important to the food security of, and as a source of export income for, Southeast Asian countries. Landings from this area contribute approximately 10 percent of reported global fisheries production per annum and make significant contributions to the economies, of countries bordering the Gulf of Thailand and the South China Sea (UNEP, 2007a). Fish stocks in the South China Sea and Gulf of Thailand are subject to high levels of fishing effort, such that stocks of most economically important species are considered to be fully fished or overexploited. Increasing global demand for fisheries products; and the dependence of coastal communities on fish for food and income results in a continued increase in fishing effort. This has led to "fishing down the marine food chain in the region" (Christensen, 1998).

The South China Sea (SCS) portion of the Philippines is geographically delimited by western Luzon, Palawan, and Mindoro Occidental, covering administrative regions I and III, and parts of Region IV and the National Capital Region (NCR) (SEAFDEC, 2014). Coastal areas in the Philippines are attacked with one of the most critical challenges in the poverty of coastal communities along with the dwindling of natural resources and its habitat resulting to the increase fishing pressure therefore leading to the cumulative degradation of the fisheries resources. With the increasing demand and effort, many have resorted to targeting fish spawning and nursery grounds, despite a dearth of information of its probable location in the country.

Through the initiative of the United Nations Environment Programme (UNEP), funded by the Global Environment Facility (GEF) being administered by the Southeast Asian Fisheries Development Center (SEAFDEC), the project entitled, "Establishment and Operation of a Regional System of Fisheries Refugia in the South China Sea and Gulf of Thailand" was initiated in 2017, in order to improve the management of the fisheries resources and habitat. The fisheries *refugia* concept was defined by the RWG-F as "*Spatial and geographical, marine or coastal areas in which specific management measures are applied to sustain important species [fisheries resources] during critical stages of their life cycle, for their sustainable use*" (UNEP, 2005) and was developed as a novel approach to the identification and designation of priority areas in which to integrate fisheries and habitat management.

The fisheries *refugia* concept focuses on the nature of the particular habitat and its critical significance to the life-history of the fished species. Management of *refugia* therefore focuses on the habitat rather than simply restricting access, either temporally or spatially, to fishing grounds. The process of identifying priority fisheries *refugia* in the Philippines was initiated via a RWG-F review of the above list of sites in relation to: information on the distribution and abundance of fish eggs and larvae in the South China Sea; and the outcomes of country consultations on the identification of fisheries *refugia*.

This assessment presents the most recent data on the status of the landed catch and effort in the West Philippine Sea. The main objective of this study is to assess the fisheries landed catch and effort in the proposed refugia sites in the Philippines in order to establish baseline data for the management of the priority species in the sites.

II. Materials and Methods

Study Site

The three proposed fisheries refugia sites in the Philippines were Bolinao, Pangasinan, Coron, Palawan and Masinloc, Zambales (Figure 1). Identification and selection of the sites involved a series of consultation participated by the representatives from local government units, academe, regional government agencies, law enforcers, fisherfolk organizations, non-governmental organizations, people's organization, and national fishery committee members to create an agreement with the local legislative bodies of each municipalities. For each site, there were both commercial and municipal landing centers which served as the sampling area.

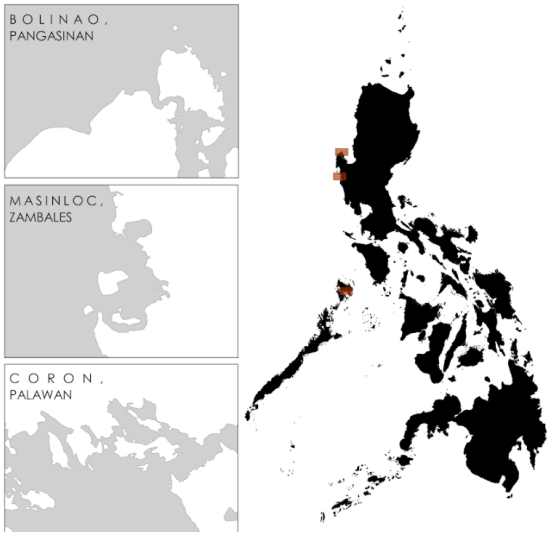

Fig. 1. Fisheries Refugia Sites in the Philippines

Survey Design (adapted from NSAP, 2017)

Catch and fishing effort were gathered by the technical enumerators assigned in each site. The sampling was conducted every other two days, regardless of the time of day, weekends and holidays. A total of twenty (20) sampling days were conducted

throughout the month. Non-sampling days are utilized for report generation validation, and transferring of raw data to four (4) NSAP forms. After a month of sampling, the raw data is submitted to the data analyst for encoding in the NSAP Database.

Data Analysis

Selected performance indicators were analyze using length frequency data of four selected species (*Decapterus macarellus, Spratelloides gracilis, Katsuwonus pelamis, Thunnus albacares*) from the collected data in Coron, Palawan and Masinloc, Zambales. FiSAT II software, Froese, Length average, and processed EDF's tool FISHE (Framework for Integrated Stock and Habitat Evaluation) were also used to determine Key Performance Indictors (KPIs): Average length, Fishing mortality, Percent mature, Length optimum (Lopt), Percent mega-spawners, Exploitation Rate, Catch per unit effort (CPUE). Fishing gear efficiency in terms of catch were used to analyze catch rate in three (3) fisheries refugia sites using catch/boat/year. Handline and spear gun were analyzed in Bolinao, Pangasinan; bagnet in Coron, Palawan, and ring net in Masinloc, Zambales.

III. Results

A. Masinloc, Zambales

a) Landed Catch and Effort Monitoring

A total landed catch of 2189 mt was recorded from the 10 fishing areas in Masinloc Zambales monitored by the Technical Data Enumerators from 2017 to 2020. The highest catch was observed in Scarborough (679 mt) followed by Zambales area with 609 mt then Cabangan area (528 mt) and Baloganon area (262 mt). The other fishing areas with least recorded landed catch was due to the irregular data collection (Figure 2).

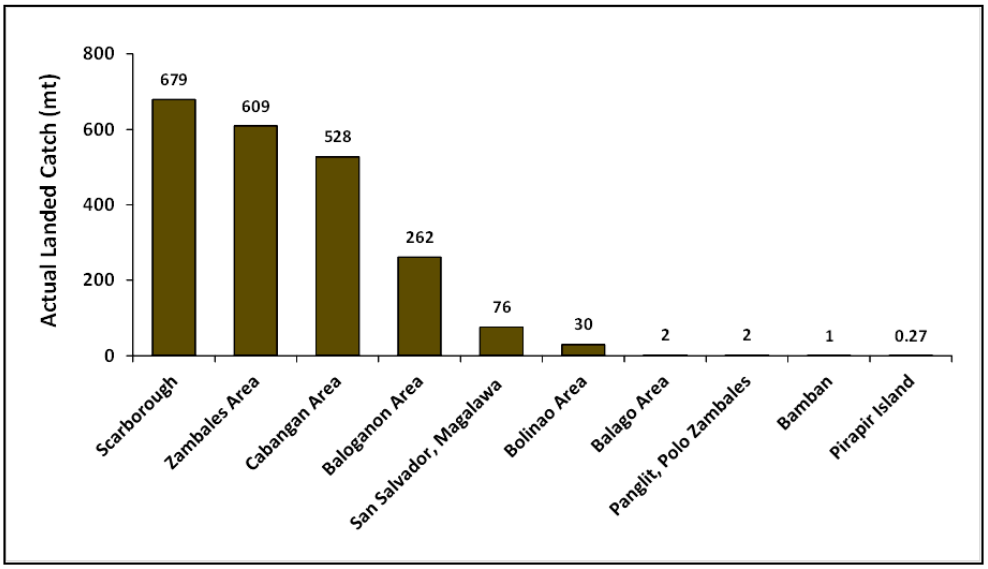

Fig. 2. Annual landed catch by fishing ground in Masinloc, Zambales (2017-2020)

b) Relative Abundance

A total of 9 types of fishing gear were recorded operating in Masinloc, Zambales dominated by ring net (91%) followed by drift gillnet (6%), and bag net (2%) (Figure 3). The other fishing gear composed of gillnets, hand line, spear gun, multiple handline, and beach seine, it only shared about 1% to the total landed catch seemingly not priority fishing gear in the area.

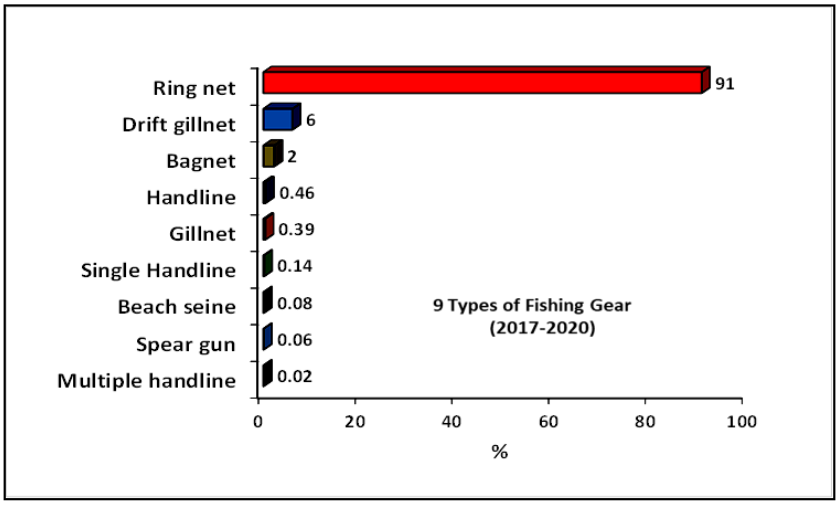

Fig. 3. Catch contribution of different fishing gears in Masinloc, Zambales (2017-2020)

A total of 87 types of species under 5 species group were recorded in the landed catch of Masinloc Zambales dominated by demersal fishes (51%) followed by pelagic fishes (37%) then invertebrates (6%). However in terms of species catches, pelagic species were the most dominant with 3 types included in the top 10 dominant species. It was dominated by *Decapterus macarellus* (mackerel scad) which shared about 31% of the total catch followed by *Katsuwonus pelamis* (Skipjack tuna, 24%), *Thunnus albacares* (yellowfin tuna, 21%). The other top ten species are shown in Figure 4.

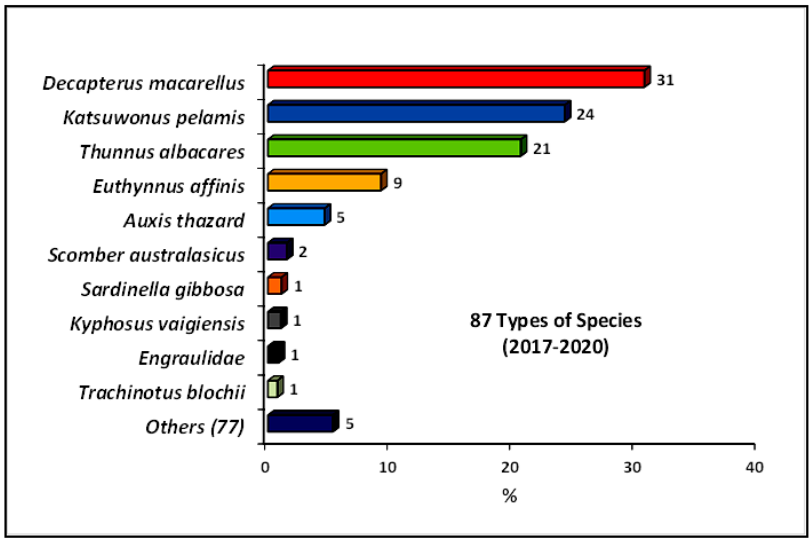

Fig. 4. Relative abundance of major species in Masinloc, Zambales (2017-2020)

c) Catch rate (CPUE)

Ring net recorded an annual average catch per unit effort of 9.61 catch/boat/year (Figure 5). It has an annual average fishing effort of 49 or 1 fishing boat per day. An erratic trend of CPUE was observed for this gear from 2017 to 2020. The abrupt decrease of CPUE in 2018 was due to the low volume of landed catch in particular with tunas and pelagic species which were the main target for this gear. Results show that fishery in Masinloc, Zamables is not stable and experienced unsustainable fishing.

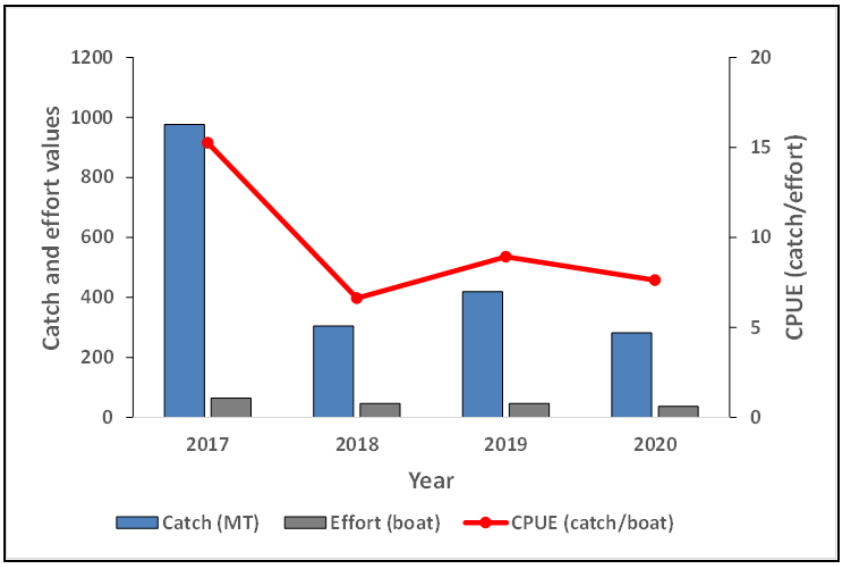

Fig. 5. Catch per unit effort (CPUE) (catch/boat/year) of ring net in Masinloc, Zambales (2017-2020)

4.2 Estimation of Growth, Mortality Parameter and selected Performance Indicators (PIS)

Table 1. Estimation of Growth, Mortality Parameter and selected Performance Indicators (PIS) of *Decapterus macarellus* (Mackerel scad) from 2017-2020 in Masinloc, Zambales.

Performance Indicators	Target Reference Point	Trigger Reference Point	Limit Reference Point	Results				Inter-pretation	Assessment Method
				2017	2018	2019	2020		
Average Length (cm), where Lm=20.6	Above Lm and Increasing	Decreasing	Below Lm and Decreasing	25.84	24.26	24.37	23.17	x	LBAR/LF Data
Fishing Mortality	F=M or F/M ≤ 1		F=M or F/M ≥ 1 or 2	17.24	5.01	6.44	3.64	x	FROESE
Percent Mature	90-100% mature;	51%-89%	50% mature and less;	73.11	82.63	68.00	54.48	x	
±10% of Length Optimum, where Lopt=23.5	100%	81%-99%	80% and less	56.99	21.03	29.83	56.54	x	
Percent Megaspawner	30-40% megaspawner		20% megaspawner	40.45	65.12	47.75	19.98	x	LBAR/LF Data
Exploitation	E = 0.5		E = 0.6	0.95	0.83	0.77	0.65	x	

For *Decapterus macarellus* (Mackerel scad), 16,705 pieces were collected, measured and analyzed from the ring net, gillnet, and handline. The collected samples have a size ranging from 13.5 cm - 32.5 cm. Table 1 shows the results of selected PIs, average length is in desirable condition, however fishing mortalities per year are already in limit RP which indicates high fishing pressure occurred using these gears. Percentage of mature sizes of this species is consistent in target RP which is alarming and needs an immediate response from the management to avoid reaching the limit points. Also, the mega-spawners show undesirable value in 2020 and E-values were consistently exceeding to its optimum level.

Table 2. Estimation of Growth, Mortality Parameter and selected Performance Indicators (PIS) of *Katsuwonus pelamis* (Skipjack Tuna) from 2018-2020 in Masinloc, Zambales.

Performance Indicators	Target Reference	Trigger Reference Point	Limit Reference Point	Results				Inter-pretation	Assessment Method
				2017	2018	2019	2020		
Average Length (cm), where Lm=34.9	Above Lm and Increasing	Decreasing	Below Lm and Decreasing	32.52	33.04	31.48	28.18	x	LBAR/LF Data
Fishing Mortality	F=M or F/M ≤ 1		F=M or F/M ≥ 1 or 2	3.52	1.53	3.53	2.76	x	FROESE
Percent Mature	90-100% mature;	51%-89%	50% mature and less;	4.12	7.77	5.77	2.68	x	
±10% of Length Optimum, where Lopt=40.5 cm	100%	81%-99%	80% and less	9.31	33.82	9.45	11.26	x	
Percent Megaspawner	30-40% megaspawner		20% megaspawner	0.55	0.73	0.26	0.15	x	LBAR/LF Data
Exploitation	E = 0.5		E = 0.6	0.78	0.60	0.78	0.73	x	

A total of 8,278 pieces of *Katsuwonus pelamis* (Skipjack tuna) caught using handline and ring net were measured and analyzed to determine the length-based estimates of growth parameters, mortality estimates and selected performance indicators . The collected samples have a size ranging from 16.5 cm – 49.5 cm. Table 2 shows the results of selected PIs such as average length, fishing mortality, percent mature, length optimum, and exploitation rate were already in limit reference point or in danger zone. The overall results indicate unhealthy stock for this species due to high fishing pressure occurring using ring net and handline, thus immediate fisheries management should undertake.

Table 3. Estimation of Growth, Mortality Parameter and selected Performance Indicators
(PIS) of *Thunnus albacares* (Yellowfin tuna) from 2017-2020 in Masinloc, Zambales.

Performance Indicators	Target Reference Point	Trigger Reference Point	Limit Reference Point	Results				Inter-pretation	Assessment Method
				2017	2018	2019	2020		
Average Length (cm), where Lm=35.5	Above Lm and Increasing	Decreasing	Below Lm and Decreasing	41.64	37.05	34.99	30.87	x	LBAR/LF Data
Fishing Mortality	F=M or F/M ≤ 1		F=M or F/M ≥ 1 or 2	2.78	11.18	6.51	2.83	x	FROESE
Percent Mature	90-100% mature;	51%-89%	50% mature and less;	67.44	23.29	12.10	13.98	x	
±10% of Length Optimum, where Lopt=43.5 cm	100%	81%-99%	80% and less	56.40	23.29	12.10	13.62	x	
Percent Megaspawner	30-40% megaspawner		20% megaspawner	11.04	0.00	0.00	0.36	x	LBAR/LF Data
Exploitation	E = 0.5		E = 0.6	0.74	0.92	0.87	0.74	x	

For *Thunnus albacares* (Yellowfin tuna), 3,445 pieces were collected, measured and analyzed from ring net and handline. The collected samples have a size ranging from 16.5 cm - 58.5 cm. Table 3 shows the results of selected PIS wherein the average length, fishing mortality, percent mature, length optimum, percent mega-spawners, and exploitation rate were all in limit RP which suggest unsustainable or unhealthy stocks for this species.

IV. Documentation