

Overview of the Comparison of Commercial Pelagic Species Fisheries Management in Malaysia and Oregon, United States

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Abstract

The United Nations Food and Agriculture Organization (FAO) in the State of World Fisheries and Aquaculture 2018, has observed that the trend of the world's marine fish stocks has been overexploited, depleted and has exhibited decreasing trend within the fraction of biologically sustainable levels. While these situations are an alarming call proving that some managements were not as effective as they should, there are still grounds for optimism. There has been the success of fisheries management in a few regions in Pacific Ocean. In this paper, using secondary data analysis, a comparison of coastal pelagic fisheries between the two regions is being assessed. Malaysia needs marine resources especially as food security, tourism and economic contribution as well as being an important region for global conservation. Thus, this paper provides a list of proposed sustainable management strategies by referring to the management of commercial pelagic fisheries performed by Oregon, United States.

Introduction

The United Nations Food and Agriculture Organization (FAO) in the State of World Fisheries and Aquaculture 2018 has observed that the trend of the world's marine fish stocks has been overexploited, depleted, and has exhibited decreasing trend within the fraction of biologically sustainable levels. In contrast, the percentage of stocks fished at biologically sustainable significantly reduced from 90.0 percent in 1974 to 66.9 percent in 2015 (FAO, 2018). Many authors have accepted the fact that fisheries worldwide are in a severely poor

state with less than 32% are in good biological states (Costello et al., 2016). While these situations are an alarming call proving that some managements were not as effective as they should, there are still grounds for optimism. There has been a success of fisheries management in a few regions in Pacific Ocean. The fisheries management practice in these regions has helped the resources to be sustainably managed.

Proper management of commercial fisheries is always paired with a sound scientific understanding of the behavior of the exploited stocks. However, a competent knowledge of scientific advice alone is not adequate to tackle the issues in the fisheries world. A management system is defined successful when the relationship between biological, economic, political and social objectives are satisfied (Beddington et al., 2007). Each of these objectives is supposed to be correlated to each other to ensure the long-term sustainability of the fishery. For example, economic and social objectives will not be met if the biological objectives in such the state of fish stock are threatened and depleted. Still, equally, biological objectives cannot be achieved without having support from social and economic objectives. In this paper, a comparison of coastal pelagic fisheries between the two regions is being assessed. The management practice in Oregon, United States (US), is being analyzed to be a model to improve the sustainable management practice in Malaysia.

The coastal waters in Southeast Asia are one of the biodiversity hotspots and among the most productive in the world. Hence, the resources in this region are critical for economic and food security as well as a global conservation priority. The majority of the nations in this region are also in a state of developing, thus adding more factors that are putting enormous pressure on the region's coastal resources. There is also unsettled political issues on the Exclusive

Economic Zones that and significant activity of Illegal, Unreported and Unregulated fishing (IUU) is prevalent to this region (Johns, 2013)

As one of the countries in Southeast Asia, Malaysia is not excluded from the issues that this region is facing. One of the significant problems that are known to be accepted in this region is the overfishing of the nearshore fisheries (Burke, Selig & Spalding, 2002). Besides, it is also recognized that overcapacity in the rate of exploitation relative to the status of the resources is one of the leading causes of overfishing. The result of overfishing and overcapacity are the major reasons in reduction and collapse of essential fishery populations. This still does not include other non-human induced issues, including habitat destruction due to the rapidly increasing tourism industry and ineffective in marine resource management. With these accumulating conflicts that are happening at once, Malaysia is susceptible to high levels of disputes among different ocean users over remaining stocks, which could lead to reduced income food security and a lower standard of living

The purpose of this paper is to assess and provide an overview of Coastal Pelagic Species (CPS) fishery management in Malaysia and Oregon, US. By comparing these two management systems, a list of proposed strategies is discussed to improve sustainable management in Malaysia.

A. Pelagic Fisheries

Pelagic fish is defined as species that inhabit the pelagic zone, an area near the surface of the ocean – neither close to the bottom nor the shore - in contrast to demersal species and

coral reef-associated species (Lal & Fortune, 2000). The pelagic zone is the largest aquatic habitat on earth and is the habitat for 11% known fish species. Pelagic fish have high oil content and travel in school and tend to form large shoals. As a result, these features have contributed to the exploitation of pelagic fisheries in the majority of the country in the world.

Marine pelagic species can be divided into coastal pelagic species and oceanic or offshore pelagic species based on the distance they inhabit from the shore (McLintock et al., 1966). Coastal pelagic fish occupies the area from the surface down to about 655 feet above the continental shelf. Examples of species include anchovies, sardines, mackerel, scads, and other fish species that feed on them. The offshore pelagic species typically colonize deeper water beyond the continental shelf. While there is no distinct boundary between coastal to offshore water, true offshore species spend most of their life in the open ocean with the exception of their spawning habitat for some species. Examples of offshore pelagic species include swordfish, tuna, some species of mackerel and even sharks. Pelagic species feeds mainly on planktonic crustaceans and larval fishes which are the bottom feeder in the food chain.

Globally, the pelagic species represent the largest landed species group in the world total capture fisheries landing. The small pelagic forage fish species which include finfish species that serve as prey for other marine predators and that serve as food for human consumption such as anchovies, herring, mackerel, and sardines had contributed 29.7% of total landing in 2006 (Tacon & Metian, 2009). Catches of pelagic species group are essential for many developing countries for food security while other countries utilize them into fishmeal and fish oil. Developed countries in the tropical region that catch pelagic species had shown a

continuously rising trend in catches compared to the other areas in the world (FAO, 2018).

Tropical countries such as Malaysia, typically rely on marine resources, particularly for food security, tourism, and economic contributions.

B. Background

Malaysia — Malaysia is located in the Southeast Asia region and is divided into two geographical parts: Peninsular Malaysia and East Malaysia. The four significant fishing grounds in Malaysia is including the Malacca Straits (west coast of Peninsular Malaysia) and three in the South China Sea (East Coast of Peninsular Malaysia and off Sarawak and Sabah states) (Figure 1). The government defines resources into coastal (30 nautical miles from shore) and offshore for those beyond that. Pelagic species fishery is a major dominant group compares to the demersal fishery in Malaysia and contributes the most in the composition of per capita fish supply for Malaysia (DOFM, 2018).

The fisheries sector contributes significant importance to the Malaysian economy as a valuable source of food and protein, provides gross domestic product (GDP), a primary source of employment and generates foreign exchange earnings (Bako, 2014) In 2018, the total landings of marine fish in the country amounted to 1.5 metric tons. This number includes fish from aquaculture production which contributes about 0.2 million tons. The total number of

licensed fishers in 2018 was estimated to be about 128, 148 fishers from all 4 major fishing areas in Malaysia (DOFM, 2018).

FAO internationally established 27 major fishing areas which comprise eight major inland waters of the continent and 19 major marine fishing areas on the Atlantic, Pacific, Indian and Southern Oceans (Figure 2). For Malaysia, the Malacca Straits falls into the Indian Ocean, Eastern (Area 57) which is according to the FAO major fishing area and the other three Malaysian major fishing grounds are on Area 71, the Pacific, Western Central. Generally, the capture production in the Eastern Indian Ocean (Area 57) shows a steady increasing trend and has reached the maximum in 2016. The major contributors to this area are the small pelagic fish, coastal species and shrimps (FAO, 2018).



Figure 1. Map of Malaysia showing Peninsular Malaysia, Sabah and Sarawak

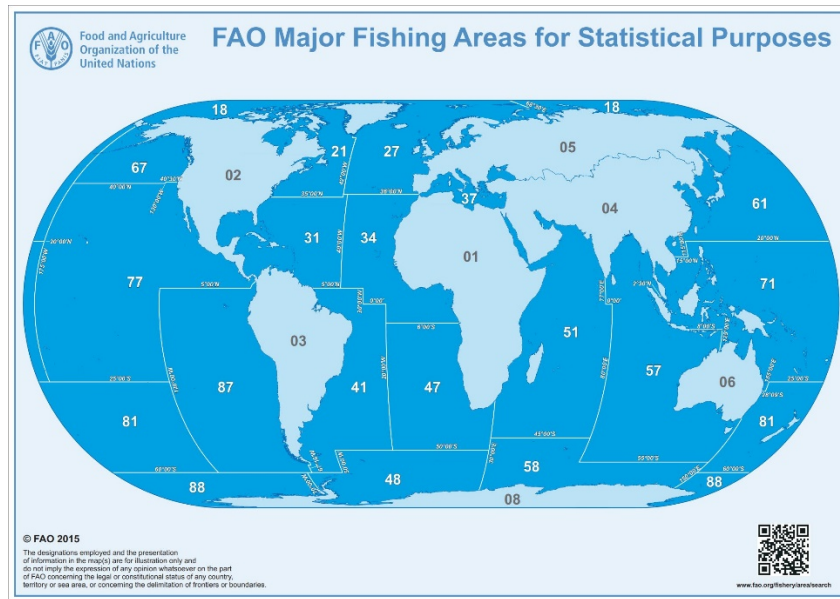


Figure 2. FAO major fishing areas (FAO Fisheries & Aquaculture - FI Fact Sheet Search, 2015)

Oregon — Oregon is a state in the Pacific Northwest region on the West Coast of the United States. Oregon shares its border with California on the South, Idaho on the East, and Washington on the Northern boundary separated by Columbia River (Figure 2) Oregon’s fishery is focusing more on the marine zone rather than the inland water zone. While it is known as one of the largest salmon-fishing industries in the world, the number of fishers in the ocean fisheries have relatively increased recent years (ODFW *Salmon and Steelhead Fishing*, n.d.).

Many coastal communities in Oregon are integrated with commercial fishing as their source of income. The diverse marine resources in Oregon contribute to more than \$500 million in revenue to Oregon (ODFW, 2019). Overall, the total landing of commercial fisheries in Oregon is about 401 million tons in 2017 (ECONorthwest, 2019). Oregon Department of Fisheries and Wildlife (ODFW) manages commercial and recreational fishing in Oregon and

partnering closely on management and research with the Pacific Fishery Management Council, the National Marine Fisheries Service, the Pacific States Marine Fisheries Commission, and the commercial fishing industry.

The Coastal Pelagic Species (CPS) fisheries in Oregon such as Pacific sardine, northern anchovy, jack mackerel and Pacific mackerel, not including Pacific Herring are managed on a partnership with the federal government under the Coastal Pelagic Species Fishery Management Plan. In collaboration with the Pacific Fishery Management Council, these species are monitored closely and being assessed either annually or periodically depending on their harvest management. Fishers in this industry mainly use purse seine gear along with other types of net equipment such as drum seines, lampara nets and dip nets.

The council manages CPS along the California current which includes involvement from Washington, Oregon and California. The primary commercial fishery for west coast CPS is off the coast of California located south of 39 degrees North latitude where all three states harvest in the same area. This area is labeled as area 77, the Pacific Eastern Central based on the FAO major fishing area. In this area, only 17 percent of the assessed fish stocks were fished at biologically unsustainable levels in 2015 which is the lowest among other FAO major fishing areas (Figure 4) (FAO, 2018). This assessment proves that the management in this area is working effectively in managing its fisheries stocks.



Figure 3. Oregon map in the United States

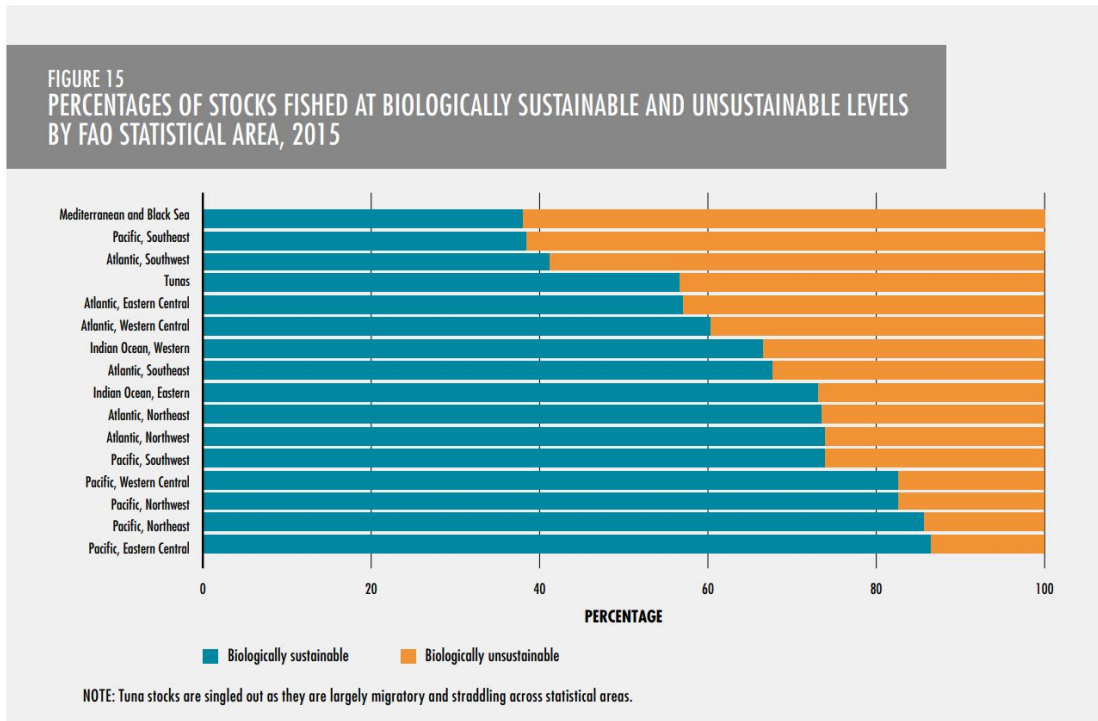


Figure 4. Percentage of stock fished at biologically sustainable and unsustainable level by FAO major fishing area (FAO, 2018)

Methods

Secondary data were used to conduct the assessment of the coastal pelagic species fishery in both regions. The evaluation was done by compiling secondary data through desktop review of materials, published reports, peer-reviewed journal articles, online news articles, relevant grey literature, and relevant fisheries statistics. Secondary data analysis is performed by analyzing the data collected from original sources for another primary purpose (Johnston, 2017). The utilization of this method is a recognized option for researchers who may have limited time and resources.

The data that is compiled for this assessment was being reviewed by following a set of evaluative steps. The following evaluative steps are essential to ensure the appropriateness and quality of the information for the research topic in advance of actual use: (a) what is the purpose of the study; (b) who was responsible for collecting the data; (c) how is the data related to this paper; (d) when was the study published; and (e) what is the source of information. These steps ensure the congruency, quality of the data, and the resulting dataset that matches the purpose of the assessment.

It is essential to determine the purpose of the primary materials for this assessment. The materials that were chosen for this assessment must have a similar general objective, which is to evaluate the fisheries management practice, present fisheries report, or suggest new management practices in fisheries. The FAO provided significant contributions to this assessment through online fisheries data profiles organized at the country level. FAO contains a lot of useful information regarding the world state of fisheries while providing raw data to be

analyzed in this paper. Some data that were collected through the FAO website are the global fisheries capture production, global trends of the world's marine fish stocks, and percentage of biologically sustainable and unsustainable stock fish.

FAO contributes important agricultural information to the world that covers almost all pertinent sectors including fisheries in food and agricultural products. However, it is essential to acknowledge that the quality of the data provided by FAO depends strongly on the database provided by 245 member countries. While the member countries need to give precise and valid data to FAO, unfortunately, the quality of the data provided by the member countries has been deteriorated over time (Dubey, Montero & Aliyeva, 2016). The problem arises when some of the member countries especially the developing countries, lack the capacity to produce and report reliable data. They may not always have the incentives to collect accurate data for every information that is needed by FAO. Because of the possible inconsistent data by FAO, a validation process was established to improve the data quality in this paper.

To refine the data provided by FAO, the information was triangulated from the source country and other viable sources such as peer-reviewed papers. Even though, there is inconsistency in the FAO database, some statistical analyses were done by FAO are useful to understand the trend of the issues, especially on a global scale. This information includes the percentages of stock fished at biologically sustainable and unsustainable levels by the FAO statistical area in 2015 that was used in this paper to compare the management of targeted regions. Data such as total landings of marine fish in Malaysia and the total number of fishers in Malaysia was collected from FAO website FAOSTAT and had been compared to the data from the Department of Fisheries Malaysia (DOFM) to avoid any discrepancy.

Results

A. Malaysia

Pelagic Species Diversity — A great variety of fish species in Malaysia is caught from the warm tropical waters of the country. The species profile of the Malaysian fisheries industry is characterized by a broad spectrum of pelagic stock. The most dominant species in Malaysia is Indian mackerels (*Rastrelliger kanagurta*) with landings of 48, 815 tons in 2018. The landings have come mostly from the purse seine, trawl, and drift nets. Other less dominant species include round scads (*Decapterus sp.*), sardine (*Sardinella sp.*, *Dussumieria sp.*), hardtail (*Megalaspis cordyla*), and small tuna (mainly *Euthynnus affinis*, *Auxis thazard* and *Thunnus tonggol*) (DOFM, 2018). Table 1.1 gives the major dominants species of pelagic species found in Malaysian waters and their total landings in 2018 (DOFM, 2018). Other commonly caught but less dominant are scads (*Atule*, *Alepes*, *Selar*), pomfrets (Pampus and Formio), mullets (Mugil, Valamugil), Spanish mackerel (*Scomberomorus*), threadfin (Eleutheroneme, Polydactylus), wolf herring (*Chirocentrus*) and queenfish (*Scomberoides*).

The Malaysian marine capture fisheries are primarily carried out in the coastal waters within the 0-30-mile limit from the shoreline. Various fishing methods are employed in catching these species ranging from the traditional gear used by small scale fishers including lift net, bag net and push net to modern, highly productive gear such as trawling and purse seining (Yahaya, 1993). The traditional fishery is still prevalent in Malaysia where the capture is not necessarily for commercial use but for household consumption. The majority of the artisanal fishery marine

catch is sold in fresh and chilled form in a traditional wet market or sometimes on the pier of the landing site.

Table 1: Major pelagic fish with total landings (tons) in 2018 (DOFM, 2018)

Fish	Scientific Name	Total Landings (tons)
Indian Mackerel	<i>Rastrelliger kanagurta</i>	48,815
Round Scad	<i>Decapterus sp.</i>	24,251
Sardine	<i>Sardinella sp.</i>	27,042
	<i>Dussumieria sp.</i>	8,389
Hardtail	<i>Megalaspis cordyla</i>	33,183
Small tuna	<i>Euthynnus affinis</i>	24,060
	<i>Thunnus tonggol</i>	30,444

Resource Management and Conservation Regime —

For the purpose of this paper, only particular management will be highlighted. The Ministry of Agriculture and Agro-Based Industry Malaysia is responsible for setting up management policies relating to agriculture and fishery in Malaysia. For fishery management, the two relevant agencies that deal with fisheries issues are the DOFM and the Fisheries Development Authority of Malaysia (FDAM). It is also important to note that there is an

exception to Sabah where the Department of Fisheries Sabah (DOFS) is in charge of fisheries matters in that state. The development of the fishing industry in Malaysia closely followed the latest guidelines of the Fourth National Agro-Food Policy 2011-2020 (NAP). The management goal of NAP that is related to the fisheries sector is outlined in the Strategic Plan of the Department of Fisheries (2011-2020) carrying the objective to manage the fisheries' resources efficiently, innovatively and in an environmentally friendly manner.

The DOFM is responsible for collecting data on the national fisheries statistics. Resource surveys and research are being carried out towards ensuring the effective conservation and management strategies in this sector. Up-to-date information on the sustainability indicators such as the catch rate and exploitation rate, Maximum Sustainable Yield and Optimum effort is vital to formulate relevant management needed for the conservation and sustainable exploitation of fisheries resources. However, DOFM also reported that one of the ongoing issues in the management is the inadequate updated data on fisheries resources. While there are some universities and stakeholders doing research on the fisheries-related sector however, there is still a concern that DOFM is having an issue on the current capacity and capability for monitoring surveillance in this department (DOFM, 2015).

The primary legislation under which management measures are enforced is currently the Fisheries Act 1985 (Amended 1992). Through this Act, regulations about the management and development of fisheries resources are empowered by the Minister of Agriculture and Agro-Based Industry. These regulations include licensing, specification of the fishing vessel, the prohibition of fishing method, marine parks, prohibiting the catch of endangered species and establishing closed seasons for specific areas and species of fish. However, the subsidiary

regulation for Peninsular Malaysia, Sabah and Sarawak are separate. Both Sabah and Sarawak, especially Sabah state authorities have their existing mandate happening together with the Federal authorities. Though many of the existing elements in these regulations are consistent, there is a need for present legislation to be more fully harmonized (Gopinath & Puvanesuri, 2006).

Conservation efforts in Malaysia are currently focused mainly on the establishment of reef based marine parks (Figure 5). Section 65 of the Fisheries Act 1985 provides the initiation of Fisheries Protected Areas where valuable habitat is protected. The primary objective of establishing a marine park is to conserve biodiversity and to protect nursery areas of certain commercial fish and prawns. A total of 42 marine parks have been gazette as Fisheries Protected Areas where collection or marine organism is prohibited in the areas (Department of Marine Park Malaysia, 2018). The shortcoming in this area is the protected area is limited to reef areas. The establishment of a marine park is a globally known approach to protect the biomass of marine life. On average, fully protected areas have the consequences of increasing the total biomass by more than 400 percent (Lester SE et al., 2009). Thus, it is essential for this management to be utilized comprehensively to support depleting resources. Other than that, the Department of Marine Parks Malaysia is assigned to have the responsibility of managing biodiversity within this boundary. However, their power is only within the marine park boundary, although it is also essential to acknowledge that the other significant issues might interfere outside the marine park boundary and affecting the marine park.

Marine parks in Malaysia

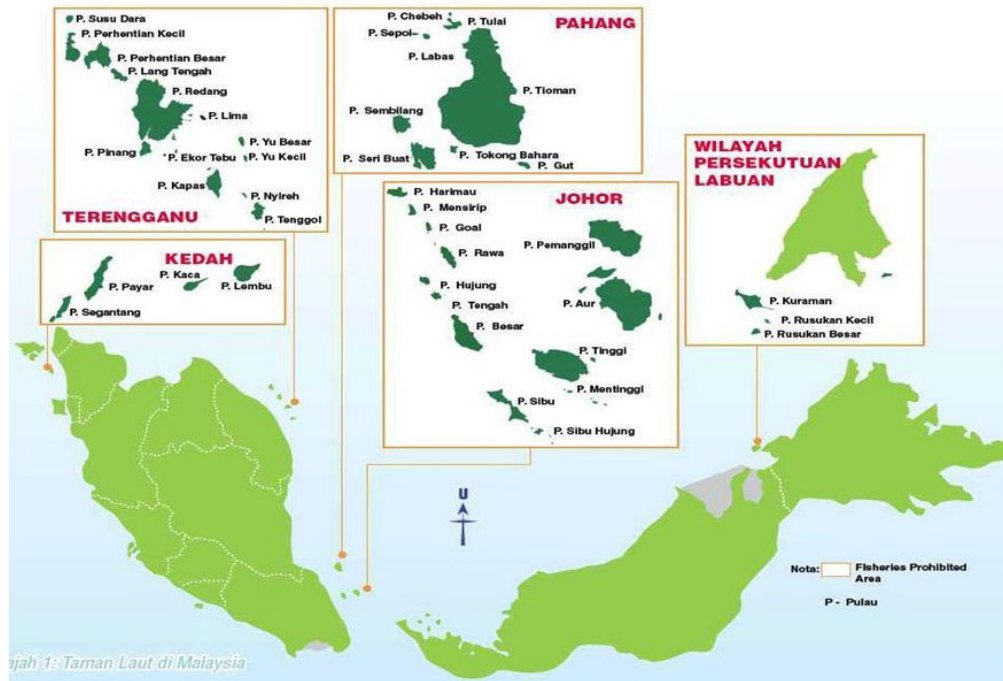


Figure 5. Maps of marine parks in Malaysia (Department of Marine Park Malaysia, 2018)

B. Oregon

Pelagic Species Diversity — In Oregon, dominant pelagic fish species for commercial fisheries include species such as Pacific sardine (*Sardinops sagax caerulea*), northern anchovy (*Engraulis mordax*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), Pacific herring (*Clupea pallasii pallasii*), and Jacksmelt (*Atherinopsis californiensis*). These species are some of the most essential landings in this area.

Most of the Pacific Sardines caught in the US are exported to Japan for human consumption and as bait for longline fisheries. Some of them are also exported to Australia to

feed farmed bluefin tuna and a minimal number of sardines are sold in Portland-area restaurants. Other species like mackerel are exported to Japan, Philippine, and Malta for human consumption.

These species share many common life-history traits, such as schooling behavior, consuming prey that are generally near the base of the food web and having relatively short lives. However, the details vary considerably by species. Commercial fisheries for these species are not consistent in their relative importance over time based on their abundance and socio-economic factors. Currently, Pacific Sardine and Pacific mackerel are “actively managed” and require relatively intense harvest management procedures compared to the three other CPS species.

The Pacific Sardine is currently at low stock and there has not been any landing in US West Coast since 2015 as a part of the management for this species. The status of the Pacific Sardine is monitored under “actively managed” management and not subject to overfishing but was overfished before 2015. The latest population estimate of this species falls below the precautionary level, 150, 000 metric tons which make the managers closed the fishery until further notice (Hill et al., 2019). Other CPS population levels are seeming to be healthy based on their latest population assessment while being sustainably managed and harvested under the Coastal Pelagic Fishery Management Plan (Pacific Fishery Management Council, 2019).

Resource Management and Conservation Regime — Multiple agencies collaborate together in managing commercial fishery in Oregon. The pelagic fishery is federally managed under the

Coastal Pelagic Species Management Plan and federal regulations apply. National Marine Fisheries Service (NMFS) and the Pacific Fishery Management Council (PFMC) oversee this management of CPS in the West Coast's federal waters (from 3 miles offshore to 200 miles offshore) known as the Exclusive Economic Zone for this region (ODFW, 2020). The West Coast NMFS is a branch of the National Oceanic and Atmospheric Administration (NOAA) that regulates fisheries in Oregon, California, Washington, and Idaho. The agency provides a science-based approach to maintain the management measures set by PFMC in their five times annually meeting.

The Council's Fishery Management Plan was developed in January 1977 for northern anchovy, but later was being implemented for CPS fishery in 1998. The CPS fishery management plan is an action plan where the amendments in this plan are dynamic according to the condition of the fishing stock that year. There are 17 amendments and the latest was approved in 2018. Each amendment was initiated to improve the plan depending on the current situation. The latest, amendment 17 addresses fishing on overfished stocks. This amendment modifies the landing requirement for the live bait fishing sector when stocks are overfished. Amendment 17 will require the Council to consider landing limits and management measures at the time a stock is overfished (*Coastal Pelagic Species Fishery Management Plan*, 2019).

For the purpose of this paper, the CPS fishery management plan that will be highlighted is the establishment of three management categories for CPS fish stocks: "Active" management, "Monitored" management, and "Prohibited Harvest" management. The purpose of Active and Monitored management is to recognize CPS that needs the most significant

attention and to use available agency resources most efficiently to manage them. “Active” management is for stocks with biologically substantial levels, or biological or socioeconomic considerations that require concentrated management procedures. “Monitored” stocks do not require intense harvest management but the status of landings and abundance of this species should be considered sufficient levels. The third category “Prohibited Harvest” is for stocks that are prohibited from fishing within the West Coast EEZ. The implementation of these management categories helps resource managers to acknowledge which stocks need more attention while not neglecting other stocks as well (*Coastal Pelagic Species Fishery Management Plan*, 2019).

The Oregon Department of Fish and Wildlife (ODFW) is the authority that is responsible for overseeing the Marine Reserves and Marine Protected Area in Oregon. There is a total of five designated sites that are unique to its ecological and biological benefits (Figure 6). Marine Reserves are areas dedicated to conservation and scientific research. The ODFW Marine Reserves Program uses all five sites in studying both ecology and human dimension. The research in this program includes monitoring the changes in oceanographic conditions in the marine reserves and the influence of marine reserves to coastal communities and the marine species. All removal and ocean development in this area is prohibited. The selection of the reserves was decided by a collaboration between local communities and state officials by choosing a space that would provide ecological benefits while also avoiding negative impacts on both human and non-human ocean users (OR. Exec. Order, 2008).

Discussion

A. Proposed Strategies for Improved Sustainable Management in Malaysia

The current situation of fisheries status in Malaysia is critical and urgently needs to be addressed. Local and governments effort at improving fisheries management have been largely inadequate. Severe depletion and overexploitation of fish stocks have been significant issues known in Malaysia. The leading institutional stakeholder for this case is the DOFM. The annual collection of the annual landings and values are the right initial steps in managing fisheries resources. Still, the statistic does not discuss the health of the fisheries-based ecosystem. This has led to a situation where stocks are only handled for short-term benefits gains but not for long-term benefits. It would clearly be essential to have additional policy and regulatory initiatives that further improve the sustainability of coastal marine resources in Malaysia. The recommendations would include:

Integrated and Dynamic Ocean Policy — The fragmented institutional environment is seeming to be a significant limitation to sustainable management. The Department of Marine Parks for instance do not have the capacity to undertake the power in a mangrove reserve area.

Mangroves reserves come under the state forestry department who have traditionally taken a “hands-off” approach to fisheries management. While mangroves reserves are also a crucial habitat for fish nursery, a lot of their management is excluded from the fisheries management.

The Strategic Plan of the Department of Fisheries is required to be more dynamic. The current

trend of the strategic plan in Malaysian fisheries is 10 years apart before a new implementation of the policy is renewed. The CPS fishery management Plan by the Council in Oregon updates its strategies more regularly in nature to react to the changes in the marine environment.

An integrated Oceans Policy would be helpful to set a policy framework for various stakeholders including government agency in managing the marine environment and the fisheries resources. A more structured approach in managing the fisheries resource is necessary to keep the stocks sustainable. With the unexpected issues that are happening in the marine environment, a more effective plan needs to be layout. Oregon's CPS management categories are one of the good examples where the status of the stocks needs to be classified according to their abundance and harvest rate. The implementation of this plan helps the researchers and managers inspect the vulnerable stock more regularly to provide the required actions.

Extension of protected areas — The establishment of Fisheries Protected Areas is a valuable strategy in protecting an endangered habitat. However, its use so far has been limited to certain areas, mainly reef areas. While it is undeniable that the main reef is an integral part of the ecosystem ecology in the marine environment, however, mangroves, seagrass and mudflat for instance do also contribute to a significant element in fish health. Fisheries resources cannot be managed in isolation of issues. The protected areas have to have a large extent of jurisdiction to manage any possible degradation issues that might be happening. The Department of Marine Park Malaysia has limited control over the problem that is out of the marine park boundaries. For instance, pollution that comes from the inland resources could

affect the water quality hence degrading the habitat in the protected areas. This is one area where the stakeholders especially in the state levels could be encouraged to manage together along with the Department of Marine Park to ensure the protected area is well maintained.

Establishment of more vigorous enforcement —

A factor behind the decline of fish stocks in Malaysia that is worth mentioning is the persistent incident of Illegal, Unreported and Unregulated fishing (IUU) that involve both local and foreign nationals (Johns, 2013). One of the government's initiatives to counter this is by implementing a license and permit to the local fishers. However, there is still a concerning number of unlicensed anglers in this industry. Further complicating on this issue is the EEZ boundary arrangement between the surrounding countries in the Southeast Asian region. Therefore, immediate action is needed to resolve this political issue between other contestant countries to ease the pressure in Malaysian water. Authoritative figures should also reinforce a more reliable policy prohibiting unlicensed fishers and other IUU fishing activities that could affect the health of the stocks.

Conclusion

The success of fisheries management in Malaysia has tended to be measured by the tonnage of fish that is landed yearly. The annual reports from DOFM are lacking the discussion on the status and health of the fisheries but focus entirely on landings and value. This has led to

a short-term economic gain rather than long-term sustainability benefits, leading to skew in their conservation and management efforts. It is ironic for a country that is interwoven intimately to the fishery industry to face such an uncertain future. In the conditions that are no particular direction can be predicted, it is better to take precautions in a more radical tone. The use of scientific knowledge should be incorporated more comprehensively and not only focusing on the analysis of the annual landings. The consequences of not moving in this direction would not only influence the industry, but millions of people who consider fish as their daily staple.

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