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Fishery Cooperation in the South China Sea: Evaluating the Options

Zhang Hongzhou

Abstract:

Given the complicated nature of the South China Sea (SCS) disputes, resolving the disputes in the foreseeable future remains highly unlikely. Proper management of these disputes to ensure stability in the South China Sea, thus, becomes the top priority. There is a general consensus that the best approach for managing the disputes in the SCS is to set aside the sovereignty disputes and jointly develop and manage the natural resources, such as fishery. While advancing fishery cooperation in the SCS has been increasingly recognized as a political, ecological, socioeconomic and security imperative, two crucial questions remain insufficiently addressed. What objectives should be achieved via fishery cooperation in the SCS? And are the proposed options feasible and effective in achieving these objectives? The author makes the case that there should be three primary objectives that need to be accomplished via fishery cooperation in the SCS, namely, 1) achieving food security and economic development, 2) ensuring sustainable fishery and protecting marine environment, and 3) controlling fishing conflicts and disputes. Using these three key objectives as evaluation criteria, the author then investigates the feasibility and effectiveness of three major fishery cooperation proposals, including marine protection zones, regional fishery management organization, and aquaculture.

1. Introduction

Given the complicated nature of the South China Sea (SCS) disputes which involve multiple parties with disagreements over sovereignty of the islands or rocks, maritime delimitation, resources utilization as well as other matters, resolving the disputes in the foreseeable future remains highly unlikely. Proper management of these disputes to ensure stability in the South China Sea, thus, becomes the top priority for the claimant parties as well as the international community. There is a general consensus that the best approach for managing the disputes in the SCS is for the claimant parties to set aside the sovereignty disputes to focus on joint development and management of the natural resources, which is also the concept promoted by Deng Xiaoping, the late paramount leader of China in the 1980s (Schell, et al., 2017; Wang, 2015; Franckx, 2012; Guilfoyle, 2016; Kao, et al., 2012; Thang, 2012; Zou, 2014; Dutton, 2011; Storey, 2013). For instance, in late April 2017, during an exclusive interview with ahead of his visit to the ASEAN summit, Indonesian President Joko Widodo proposed that joint projects in maritime research and the fishing industry could be a building block for a code of conduct in the South China Sea (Ibrahim, 2017). Similarly, a Task Force on U.S.-China Policy, a group of prominent China specialists from the United States, proposed SCS functional cooperation in fisheries management, resource exploitation, and environmental protection to settle SCS disputes. They believe that functional cooperation can reduce the importance of unilateral claims by creating frameworks for both the shared use of marine resources and joint management of the marine environment upon which all States in the region rely (Schell, et al., 2017). Furthermore, according to Article 123 of the 1982 United Nations Convention on Law of the Seas (UNCLOS),

the States of a semi-closed sea such as the SCS ‘should cooperate’ with one other in the area of fisheries (Franckx, 2012; Hu, 2010).

Theoretical and empirical evidence generally shows that effective cooperation on the issues of low politics, such as fishery cooperation, can generate strategic trust needed for cooperation on matters of high politics, territorial issues in particular (Kao, et al., 2012; Franckx, 2012; Hu, 2010; Kittichaisaree, 2001; Dutton, 2011). It is, therefore, advisable that the states in the SCS region start with issues of low political sensitivity, simple implementation, and common needs. Examples include conservation and management of fisheries resources, protection of the marine environment, and joint marine scientific studies. In fact, in recent years, fishery cooperation at various forms have been undertaken by SCS countries, particularly at the bilateral level. In the aftermath of the SCS arbitration, China is holding talks with Philippines, Indonesia, Malaysia, Vietnam, and other Southeast Asian countries on shared rights to fish and harvest fossil fuels in the disputed South China Sea (Jennings, 2017; Deogracias, 2016). In particular, some sort of provisional fishery agreement appeared to be reached among China, Philippines and Vietnam in the Scarborough-once a synonymous for the South China Sea tension (Petty, 2017).

Although advancing fishery cooperation in the SCS has been increasingly recognized as a political, ecological, socioeconomic and security imperative and various policy options have been proposed by scholars, commentators, and security analysts (Claparols, 2016; Chircop, 2010; McManus, et al., 2010; Hoi & Dang, 2015; Dang, 2014; Zou, 2014; Kao, et al., 2012; Thang, 2012; Wang, 2015; Dutton, 2011), two crucial questions remain insufficiently addressed: what objectives should be achieved via fishery cooperation in the SCS? And are the proposed options feasible and effective in achieving these objectives? To close this gap, the author makes the case that there should be three primary objectives that need to be accomplished via fishery cooperation in the SCS, namely, 1) achieving food security and economic development, 2) ensuring sustainable fishery and protecting marine environment, and 3) controlling fishing conflicts and disputes. Hence, all three objectives should serve as the evaluation criteria for feasibility and effectiveness of these policy options. The rest of the paper is organized as follows. Section two discusses the imperatives of fishery cooperation in the SCS, and section three lists the three key policy objectives for fishery cooperation in the SCS. Using these three key objectives as evaluation criteria, section four investigates the feasibility and effectiveness of three major fishery cooperation proposals, namely marine protection zones, regional fishery management organization, and aquaculture. In the conclusion section, some new ideas are presented.

2. The Prominence of Fishery Cooperation in SCS

Fishery as a potential area for cooperation between the SCS claimant states have attracted growing academic and policy attention because of the great probability of fishery being both a tension diffuser and a problem creator.

2.1 Fishery incidents emerge as a key maritime threat

Illegal, unreported, and unregulated (IUU) fishing has clearly emerged as a key maritime threat to Asian seas, including the SCS (Nankivell, et al., 2017). With annual catch production accounting for over 10 percent of global total, the fishery resources are very important to 190

million populations in the coastal areas of the SCS, where over 77 percent rely on pelagic fishery resources for their daily protein intake and livelihood. However, since the 1980s, IUU fishing has caused overfishing and marine environmental destruction (Li & Amer, 2015). Since October 2014, President Widodo's crackdown on illegal fishing in Indonesian waters resulted in a series of highly-publicized sinking of boats from neighboring countries. In 2016, Indonesia sank more than 230 fishing boats for illegal fishing in Indonesian waters, provoking considerable anger among its neighboring states. According to the Indonesian Minister of Marine Affairs and Fisheries, Susi Pudjiastuti, the eradication of illegal fishing is necessary not only because it costs the country over USD 20 billion annually, but also because illegal fishing is often a vehicle for other crimes, such as people smuggling, drugs smuggling, and slavery" (Chapsos & Malcolm, 2017).

Similarly, Malaysia is very concerned about IUU fishing that occurs within its national jurisdictions and the high seas. IUU fishing results in widespread environmental, social, and economic consequences (Department of Fisheries Malaysia, 2013). In the case of the Philippines, figures released by the country's Bureau of Fisheries and Aquatic Resources, Oceana, showed that illegal fishing caused overfishing in 10 out of 13 major fishing grounds surveyed in the country. As a result, in January 2017, the Philippines' government announced that it will clampdown on illegal fishing in a campaign that is as severe as President Duterte's war on drugs and criminality (ABS-CBN News, 2017).

Apart from IUU fishing, fishery disputes and maritime incidents involving fishermen in the SCS pose acute threats to the maritime security and stability in the SCS. In recent years, as lingering sovereignty and maritime boundary disputes get increasingly entangled with increasing competition for the limited fishery resources, a growing number of maritime incidents involving regional fishermen in the SCS have been reported. Some maritime incidents triggered diplomatic and security tension between China and its neighbors in the SCS. For instance, the Philippine Navy's arrest of eight Chinese fishing vessels in the disputed Scarborough Shoal on 8 April 2012 resulted in the month-long standoff between a Philippine warship and Chinese ships (Teng, 2016). Moreover, the fishing incident off the Natuna islands on 19 March 2016 led to serious diplomatic tensions between China and Indonesia (Suryadinata, 2016).

In fact, illegal fishing and fishery disputes constitute a particularly common pair of issues at the heart of many militarized developed countries. Since the end of World War Two, the "Western world" has been hailed as a community of states approaching the ideal of a zone of democratic peace as no other region. However, there have been several incidents within this community where force was threatened or even used almost always took place in the context of fishery disputes. It is estimated that since the end of World War II, fishing disputes involving a North American or Western European democracy comprised nearly 90 percent of disputes (Mitchell & Prins, 1999). Between the 1950s and 1970s, Iceland and Britain engaged in a series of clashes over fishing rights in Icelandic waters. The peak of the Cod Wars saw armed clashes resulting in several cases of injuries and casualties after 37 Royal Navy warships were dispatched to protect British trawlers fishing in the disputed territory. In the 1980s, Canada and France, for example, fought two militarized disputes over French fishing vessels exceeding the limit on cod catches in a disputed fishing zone near Newfoundland (Hellmann & Herborth, 2008). Another example is the Turbot War, the Canada-Spain dispute over Northwest Atlantic fisheries conservation in 1995. History shows that even though fishing is not the root cause of disputes over sovereignty

in the SCS, it can result in a full-fledged crisis or even an armed conflict in the SCS (Luce & Johnson, 2016).

2.2 Fishery offers great potential for cooperation in the SCS

Contrariwise, fisheries could also be used as a vehicle for trying to further cooperation on both bilateral and regional levels in the SCS. Very often, fisheries are seen as a more “neutral” area which is capable of stimulating co-operation more easily than cooperation in the military field, sovereignty-related issues or even oil and gas exploration. For decades, while joint development has been considered as the most important approach to manage the SCS disputes, previous attempts has been focused mostly on joint development of the hydrocarbon resources. However, due to a variety of reasons previous attempts has been focused on joint development of the hydrocarbon resources has proven to be very difficult, as in the case of the failed tripartite agreement related to joint research of petroleum resource in 2005. Fisheries cooperation is arguably easier than joint oil and gas development in the SCS for several reasons. Fish do not respect borders. Some of the fishery species in the SCS such as tuna and tuna-like fish are highly migratory. Because regional fishermen often target the same groups of fish, regional fishery also faces common threats of overfishing and climate change. Overfishing beyond a country’s borders could also have great impact on the fish stocks within its territorial boundaries. This means in general, fishery cooperation among countries is not a choice but a necessity. As regulations and enforcement increase in one area, fishing pressures would increase in another area (Global Fishing Watch, 2017).

In fact, various forms of fishery cooperation arrangement already exist in the SCS region despite rising tensions. At broader regional level, most of the SCS countries are members of the Asia-Pacific Fishery Commission (APFIC) which was established in 1948 by the Food and Agriculture Organization of the United Nations. At ASEAN level, the Southeast Asian Fisheries Development Center (SEAFDEC), an autonomous inter-governmental body, was established in 1967 with the mandate of developing and managing the potential of fisheries in the region. At the bilateral level, China and Vietnam signed the Gulf of Tonkin Fisheries in 2002 to undertake measures to preserve, manage, and sustain the utilization of the living resources in the common fishing zone. In September 2004, China and Philippines signed the Memorandum of Understanding on Fisheries Cooperation related to fishing, sea water aquaculture, and aquatic product processing.

Furthermore, a fishery arrangement for regulating current activities is better than introducing new activities to an already complicated region. Developing fishery resources can be less costly than undertaking joint oil and gas exploitation (Thang, 2012). Making a decision to engage in a capital-intensive project such as petroleum exploration and exploitation is clearly a time-consuming process which requires a measure of confidence among the parties. According to Lagoni (1984), provisional arrangements on the exploration and/or exploitation of the natural resources of the continental shelf face much greater problems than exploitation of fishing resources. Making use of these resources require considerable time, funds, clear legal circumstances, and political stability. Therefore, in the case of the SCS, fisheries cooperation arrangement may be more feasible, which could then pave the way for more high-profile projects in the future.

3. Three Objectives of Fishery Cooperation in SCS

Thang (2012) argued that as far as fishery cooperation in the SCS is concerned, two objectives—sustainable fisheries and prevention of tension and friction—need to be achieved. However, a third and arguably the most important objective is the safeguarding of food security for ensuring economic development needs.

3.1. Meeting the food security and economic development needs

The socioeconomic importance of fisheries to the SCS countries cannot be overestimated. For starters, fishery products are always an important source of animal protein for countries in the region. Table 1 shows fish as an important source of animal protein for regional consumers. For the Chinese, fishery products accounts for 21 percent of animal protein, higher than the global average of 16 percent. The ASEAN population relies more heavily on fish for food and protein. ASEAN's per capita annual fish consumption in 2013 was the highest in the world at 35.2 kg (Chan, et al., 2017). Fish exceeds half of the animal protein intake in Indonesia and Cambodia, about 38 percent in Malaysia and Philippines, as well as 27 percent and 33 percent respectively in Vietnam and Thailand. As an animal-based protein, fish plays a critical role in maintaining food security in this region because it is more accessible and often cheaper. In addition, fish helps to combat malnutrition in China and ASEAN countries because it provides lipids, micronutrients (fatty acid and vitamins A, B, and D), and minerals (calcium, phosphorus, iodine, zinc, iron, and selenium) (Chan, et al., 2017).

Table 1 Per capita supply of fish in China and ASEAN 2013

Country\Year	Per Capita Fish Supply: Kg/Year			Fish/Animal Protein
	1980	1990	2013	2013
Brunei	37.66	33.37	46.7	22.7%
Cambodia	2.94	20.73	41.43	68.7%
Indonesia	12.07	20.63	28.17	52.7%
Laos	7.38	14.06	19.83	40.4%
Malaysia	42.86	62.37	58.97	38.8%
Myanmar	14.49	17.56	54.39	42.3%
Philippines	32.43	28.83	31.58	37.5%
Thailand	17.03	29.39	24.83	33.6%
Vietnam	10.15	19.92	32.67	27.3%
China	5.17	24.4	34.67	21.2%
World	11.47	15.9	18.98	16.2%

Source: (FAO, 2017)

As populations and economies grow, demand for fish (and the importance of fish for food security) will increase. In the case of China, it was estimated that per capita consumption of fishery products has increased over 10 times, from merely 2 kg in 1980s to 21.1kg in 2010 (see Table 2). With rapid urbanization, the per capita consumption of fishery products will continue to rise as the growing middle class continues to demand for more animal protein (Jennings, et al.,

2016). To counter limited arable land and water resources, China’s “blue granary” strategy for feeding its 1.4 billion population has been implemented since the global food crisis in 2007/08. In June 2013, vice-premier Wang Yang highlighted that China is developing a modern fishing industry to mitigate severe scarcity of land and water resources. Food security is further enhanced by increasing the supply of fishery products to meet rising demand for high-quality animal protein (Zhang & Wu, 2017). Recently, China has taken efforts to domestic fishery consumption to reduce overreliance on pork consumption due which increasingly creates food security and health concerns. The 2016 Chinese Dietary Guidelines, released by the National Health and Family Planning Commission of China, advise Chinese consumers to substitute red meat with fish, poultry, and eggs for protein (Zhang & Wu, 2017). Per capita fish consumption of China could reach 29 and 41 kg in 2020 and 2035 respectively (see Table 2). By 2030, China could account for 38 percent of the world’s total fish consumption (Fabinyi, 2016). As overfishing, pollution, and bilateral fishery agreements continue to deplete fish stocks in China’s coastal waters and inshore waters, an ever-greater share of the future demand will be sought from contested waters of the SCS (Zhang, 2016).

Table 2 China’s per capita consumption of fishery products:

Year	Kg/Per Annum
1980	2.0
2010	21.1
2020	29.0
2035	41.0

(Source: Han Jun, 2014)

The similar trend is being witnessed in the ASEAN countries. Over the past four decades, per capita fish consumption in the region has more than doubled. It is now 1.8 times higher than the world average in 2013 (19.2 kg/person/year) (Chan, et al., 2017). Considering income growth, population expansion, and dietary changes in the ASEAN region, fish consumption is projected to rise from 24.5 million tons in 2015 to 36.9 million tons in 2030, before hitting 47.1 million tons in 2050. Per capita fish consumption is expected to increase from 38.4 kg in 2015 to 51.5 kg in 2030 before reaching 61.5 kg in 2050 (Chan, et al., 2017). Again, as the waters near the coasts are critically overfished, more fishermen from ASEAN countries are venturing into the contested areas of the SCS to compete for remaining fish stocks (Labrosse & Wilson, 2016; Pomeroy, et al., 2009; Pomeroy, et al., 2016; Le, 2016; Christensen & Tull, 2014).

Next, fishery creates jobs for a large number of the coastal populations in the region. China has over 14 million fishermen (25 percent of the world total) (FAO, 2016) while ASEAN countries have 30 million fishermen. With an average of five persons per fishing household, about 150 million people in the ASEAN region are directly dependent on fisheries for food and income. Another 60 million people work in associated industries such as boat building, manufacture of fishing gear, bait preparation, marketing, and processing. Women are mostly employed in processing and constitute a large proportion of such workers (Pomeroy, et al., 2016; Pomeroy, et al., 2007). SCS fishery directly employs over 5 million people (Stratfor, 2016), with millions

more indirectly dependent on SCS fishery for employment.

Furthermore, fishery (the marine catch sector in particular) is the foundation for many other economic sectors in the coastal regions as well as an important source of foreign currency for SCS countries. For instance, with nearly 10,000 processing companies which heavily relies on the marine catch sector for raw materials, China is not only the biggest fishery producer, it also has the largest fishery processing sector in the world. Similarly, marine fishery is important for the development of marine tourism, ship building, and onshore catering sectors not only in China but also in many ASEAN countries.

Table 3 Top exporters of fishery products in the world, 2014

Ranking	Country	USD million
1	China	20,980
3	Viet Nam	8,029
4	Thailand	6,565

(FAO, 2016)

In 2014, Asia contributed a third of global seafood exports. China, Vietnam, and Thailand rank among the top five fishery exporters in the world (see Table 3). China is by far the largest fishery exporter in the world. In 2014, China's exports totalled nearly USD 21 billion, accounting for 12.5 percent of total global exports, up from just 7 percent in 2007. The total value of China's exports grew nearly 200 percent over the same period. For Thailand and Vietnam, fishery exports are one of the key sources of foreign exchange. Indonesia, as the second largest fishery producer in the world, has boosted the country's fishery exports in recent years as well. In 2015, Indonesia's global exports of fishery products in 2015 reached USD 3.6 billion (Ministry of Trade, Indonesia, 2016a).

For China and other SCS countries, fisheries have been (perhaps increasingly more so) a major source of protein and micronutrients, foreign exchange, livelihood, and wellbeing for the hundreds of millions of populations. The continuous development of fishery is thus a matter of political legitimacy. The objective of safeguarding food security to ensure economic development will continue to be top priority for fishery development in the region (Ferraro & Brans, 2012).

3.2. Sustainable fishery and conflict prevention

Despite economic and security risks associated with IUU fishing and fishery conflicts, the SCS, is one of the world's most important fishing areas and one of the most diverse global marine bio-systems. It contributes over 10 percent of global catch production, and hosts 76 percent of the world's coral species and 37 percent of reef-fish species. Over the past few decades, it has been facing a looming ecological and environmental crisis. Fish densities and catch rates in the SCS have plummeted. The reef sits at the center of the crucial region where many coastal fishing stocks are replenished.

Driven by the rising demand for fishery products and limited employment opportunities

elsewhere, the Asian fleet has nearly doubled since the late 1980s while the overall size of the world's fishing fleets stabilized. The Asian fleet had 3.5 million vessels (75 percent of the global fleet). Asia has 80 percent of the reported motorized fleet (FAO, 2016). According to a report by FAO in 2012, of the 3.2 million fishing vessels operating in global marine waters, an estimated 1.77 million (about 55 percent), operated in the SCS, of which 86 percent of these were small-scale vessels (Funge-Smith, et al., 2012). Massive expansion of the fishing fleet inevitably has led to overcapacity which in turn results in overfishing and IUU fishing.

The growth in fishing, the decline in inshore fish stocks, massive government subsidies, and rising consumption of fisheries products at home and abroad are only adding to pressures marine ecology and the frequency of clashes over fishing fleets in the South China Sea (Stratfor, 2016). The human demand is not the only driver though, excess capacity from onshore sector such as fish processing and ship building in China motivates Beijing to subsidise the its fishing fleet to keep searching for diminishing supplies of fish, just to maintain economic growths and jobs. In addition, poaching of engendered species such as giant clam, red coral and sea turtles by regional fishermen, particularly those from China has resulted in devastating impacts on the coral reefs of SCS. McManus estimates that 162 square kilometres of reef have been destroyed (Cyranoski, 2016). And according Wang Xiaoqiang, a deputy director at the State Oceanic Administration of China, noted the severe loss of 80 percent of coral reefs and about 73 percent of mangrove areas in the SCS since the 1970s. (Jie, 2016). At the heart of this destruction is the phenomenal boom of the giant clam handicraft sector of China's Tanmen, a small fishing town in Hainan province.

Parallel to the rising demand for fishery production for food, the increasingly affluent Chinese are also acquiring rarer aquatic products for aesthetics and religious purposes. In Buddhism, red coral and giant claims are considered two of the "seven treasures". Massive expansion of the giant clam sector in Tanmen was driven by high demand and speculation. The price of red coral and giant clams skyrocketed in recent years (Ecns.cn, 2017). Facing growing domestic and international concern and criticism against Chinese fishermen's poaching of giant clams and other endangered marine species, China has begun to crackdown Tanmen's giant clam sector since early 2015. Furthermore, giant clams have been historically harvested both for their meat and their shells throughout Southeast Asia and beyond (Ferse, et al., 2016). With the booming giant clam handicraft sector in China, some of raw materials are sourced from Vietnamese and Filipino fishermen via informal exchange at seas and smuggling across the land borders (Laude, 2014; Li, 2014; Anda, 2014; People's Daily, 2015; Zhang, 2016 b). In this context, China's crackdown on the poaching of giant clams, though critical, will be insufficient.

To make matters worse, fishery issues in the SCS has been heavily politicized and securitized, partly due to the maritime militia policies from the claimant states and discourse by journalists, security analysts, and academic scholars. All the key SCS claimant states view their fishermen as important defenders of their respective claims in the disputed waters of the SCS. Fishermen as civilian instruments of power help stake out legal claims and establish national maritime rights. They also often cite their country's claims to maritime rights in an attempt to justify their presence in disputed waters (Cronin, 2012).

Furthermore, for China and Vietnam, the fishing militia has always been an important part of these two countries' security forces. With rising tension in the SCS, both China and the Vietnam strengthened their fishing militia forces in recent years (Zhang, 2016; Yu & Wen, 2016;

XinhuaNews, 2016; Thayer, 2009; The National Assembly Vietnam, 2009; Holmes, 2012). In the case of the Philippines, armed fishing vessels from the Philippines have been operating in the disputed waters in the SCS for years (State Council, P.R.China, 2016; Teng, 2016; People's Daily, 2014). In 2016, the Philippines has also established the new Area Task Force-North (ATF-North), a maritime militia force in the SCS (Office of the President of the Philippines, 2016; Macatuno, 2016).

The securization of fishery compromises the already-weak regional fishery governance and also intensifies regional conflicts. With rising tension, Tanmen fishermen and local government from China's Hainan province skillfully utilized the SCS disputes as a cover for their poaching activities (masked as "patriotic actions" to lobby for more support from the central government). Hainan has about 500 law enforcement officers in charge of monitoring over 26,000 motorized fishing vessels (Bureau of Fisheries, Ministry of Agriculture, China, 2015). Instead of regulating the actions of Chinese fishermen, most of the limited enforcement resources are devoted to the defence of China's claims in the SCS and crackdown of "illegal fishing activities" of other claimant states, once common illegal fishing incidents or fishery disputes are securitized, countries will be tempted to deploy naval vessels instead of coast guards. Instead of expelling those fishermen, they would prefer to arrest the foreign fishermen and try them under domestic law. Instead of firing water cannons at the foreign fishermen, they would rather fire real shots. Fishing conflicts and tensions, if not properly managed, could spark a South China Sea crisis.

4. Evaluating the options of fishery cooperation in SCS

In view of the three objectives discussed, the most appropriate fishery arrangement should meet all the three objectives in the context of the SCS. In this section, three key options will be assessed, namely (1) Marine Protected Areas (MPA)/Marine Peace Park, (2) Regional Fishery Management Organization/Multilateral Fishery Agreements and (3) Aquaculture.

The proposal of establishing a joint fishery development zone via provisional arrangement will not be discussed due to the following reasons. First, while there are many precedents for the establishment of joint fishery development zones in cases of unresolved territorial disputes (Kittichaisaree, 2001), this kind of provisional fishery arrangement is not feasible for the SCS context where cases are complex (involving more than two parties) (Guilfoyle, 2016; Schofield, 2014). Second, one of the main difficulties in establishing the so-called joint fishery development zone is to define the precise area for joint development. As Beckman (2013) noted, it is often assumed that joint fishery development zone should apply in the "disputed areas" in the SCS. However, there is little agreement on what is meant by the phrase "disputed areas" in the SCS. This is further complicated by the SCS arbitration award, which basically indicates that there is no possible overlapping EEZ entitlements between China and other claimant parties (Guilfoyle, 2016). Third, given the impending ecological crisis in SCS due to IUU fishing and overfishing, the concept of joint development is too narrow. It is necessary to go beyond merely exploiting the fishery resources to sustainably manage the critical fish stocks in the SCS. This aspect is covered under the discussion of Regional Fishery Management Organization.

4.1 Marine Protected Areas/Marine Peace Park

With growing recognition of the impending environmental and ecological catastrophe in the

SCS, one of major approaches to promote fishery cooperation in the SCS is to establish marine protected areas (MPA) in the SCS or to make the SCS a marine peace park (Claparols, 2016; Chircop, 2010; McManus, et al., 2010; Hoi & Dang, 2015; Dang, 2014; Shao, 2017; McManus, 2017). MPA or Marine Peace Park refers to geographically-defined places that attempt to limit fishing activity and promote long-term resource management. Some are strictly “no-take” zones that exist mainly for wilderness protection and scientific research, whereas others are “managed reserves” which promote sustainable use and extraction (Sovacool, 2009).

Chircop (2010) believes that that the SCS states need to place marine conservation cooperation at the center of all development activity in order to enhance the prospects of adaptation to climate change, and to do this on a cooperative basis. Dang (2014) proposes MPA Network in the SCS and discusses legal and political measures to support it. Such a network, if properly developed, would protect the marine environment and resources of the region and also decrease tension between coastal states. Reportedly, Vietnam is seeking regional partners to build an MPA Network in the contentious SCS. Since the 1990s, John McManus, a marine ecologist at the University of Miami in Florida, has advocated a jointly run marine “peace park” in the region. He believes that it is the only way to avert a fisheries collapse (Cyranoski, 2016). Claparols (2016) argues that China and all the other claimants must understand that the Spratly Islands issue is more than a matter of occupation and exploitation. All claimant states should recognize the value of conserving the Spratly Islands, work together to turn it into a marine peace park, and allow the rich marine biodiversity to heal itself. In September 2016, a group of environmentalists presented a motion “Conservation in the SCS” at the Sixth World Conservation Congress in Hawaii, with the aim of creating a marine peace park and sanctuary in the SCS. First, they urged all stakeholders to consult together and cooperate to study the establishment of MPAs in the SCS and Coral Triangle. Second, they recommended that all states and authorities in the region suspend exploitation of natural resources, prospecting, or other activities, pending the study on establishing MPAs in the SCS and Coral Triangle. Third, they requested the World Commission on Environmental Law to collaborate with the World Commission on Protected Areas to study the prospects for establishing extensive MPAs in the SCS (Elisabeth Haub School of Law, 2016).

Creating an MPA or a Marine Peace Park in the SCS will certainly be conducive to marine environment and ecology protection. This proposal, however, has several key weaknesses. Similar to joint fishery exploitation, a major consideration in the negotiation and establishment of creating a restricted fishery zone is the definition of the precise geographical area in the SCS. In absence of a boundary line, many such zones are determined by the limits of competing maritime claims. However, given the overlapping claims in the SCS (further complicated by the SCS arbitration in 2016), reaching such an agreement will be extremely challenging. A country can certainly create MPAs in their own administered waters (In fact, regional countries created 130 MPAs in the SCS which cover roughly 15,600 square miles, but mostly in coastal waters or non-disputed areas). Yet, once a certain area is restricted for fishery operation, fishermen often move to other areas. In the case of SCS, regional countries’ control over fishing in their coastal waters directly contributes to greater fishing intensity in offshore waters of the SCS. When a country’s control of fishing activities take place in the disputed waters (as in the case of China’s SCS summer fishing ban), it immediately became a complex political matter.

Although suggestions for regional countries to shelve differences and make the entire SCS a marine peace park could help to avert the environmental and ecological catastrophe in the SCS, it

is not a practical and politically feasible option. This option fails to address both the underlying demand and supply problems associated with IUU fishing, overfishing, and fishery conflicts in the SCS. A review of China's summer fishing ban shows that while seasonal closures helped to protect several spawning stocks and juveniles, these improvements are offset by heavier-than-usual fishing pressure in the post-closure months as well as greater pressure on women in fishing communities to find alternative income during the closed fishing seasons (Cao, et al., 2017). In many SCS countries, fishing communities often live close to or even below the poverty line. Fisheries may be one of the few sectors of the economy that offer jobs. Not only millions of fishermen and their families will lose their basic income and food source, their suffering will trigger food and economic crises, social unrest, and political turmoil. Placing restrictions on fishing in the SCS can directly undermine community development, living standards, and social well-being (Sovacool, 2009). This can lead to immediate disastrous socioeconomic, political, and even security consequences. As pointed out by Ferraro & Brans (2012), given the fact that fisheries still remain an important component in nutrition and the only possible source of employment for many local communities, fishers' income remains a political priority, especially for coastal local and provincial governments. In this light, not only restricting the entire South China Sea for fishing and adoption of more responsible fisheries policies, such as seasonal fishing bans, but the mere application of high punishment for violations to the existing laws could ignite severe social tensions.

4.2 Regional Fishery Management Organization/Multilateral Fishery Agreements

The absence of a regional governing body or a multilateral agreement to govern fishery issues is considered one of the key contributors to increasing IUU fishing, overfishing, and fishing conflicts in the SCS. For instance, Arif Havas Oegroseno (2016), the Deputy Coordinating Minister of Maritime Affairs and Resources of Indonesia, points out that the non-existence of a regional fisheries management organization (RFMO) in the disputed area has led to the absence of information on the depletion of fish stocks and deterioration of the condition of the sea. Under such circumstances, the establishment of a RFMO or a similar arrangement under a Multilateral Fishery Agreement in the SCS is considered imperative for managing fishery issues (Wang, 2015). In 2004, Wu Shicun, the President of the China National Institute for SCS Studies, proposed to sign a regional fishery cooperation agreement, establish a RFMO, and implement the TAC management measures in the SCS (Zou, 2014). Ambassador-at-large at Singapore's Ministry of Foreign Affairs, Tommy Koh (2016) believes that regional fishery management organisation should be established in the SCS and RFMO should be empowered to make their decisions by majority votes, if necessary. Khemakorn (2006) believes that cooperation through regional institutions should reduce the likelihood of States becoming involved in fisheries disputes and RFMOs should also aim to recover the cost of conservation, management, and research activities from their members. The collaborative agreements may also help to abate active disputes, particularly territorial disputes among the States in the SCS region.

Indeed, lawmakers have erected an elaborate network of innovative accords and conservation instruments to manage fish stocks around the world. At least 22 international treaties aim to protect fish stocks globally. These regimes complement 18 RFMOs and a plethora of local and regional agreements that regulate the fishing activities of states in every region of the world (Sovacool, 2009). The SCS appears to be an exception as there is no exclusive RFMO that deals with fisheries resources (Marashi, 1996). The Asia-Pacific Fishery Commission (APFIC) has a

wide “area of competence” that covers both marine and inland aquatic resources of the Asia-Pacific area. Because the APFIC does not appear to serve a useful purpose, the FAO report in 1996 proposed the termination of the APFIC. In contrast, the Southeast Asian Fisheries Development Center (SEAFDEC) is the only effective multilateral institution which conducts research on pelagic fisheries in the SCS region. However, its projects focus on scientific research, particularly on the biology of pelagic fish resources (Khemakorn, 2006). Another entity Western and Central Pacific Fisheries Commission (WCPFC) was specifically created for the conservation and management of highly migratory fish stocks in the western and central Pacific region. It covers the SCS region only if the regulated or targeted stocks migrate to this region (Hu, 2010). In reality, it has little impact on fisheries’ cooperation in the SCS (Guilfoyle, 2016).

Notwithstanding all the potential benefits associated with RFMOs, the setting up of a RFMO or similar institution is not a panacea. One of the presumptions of establishing a RFMO in the SCS is that RFMO is an effective means of regulating IUU fishing and controlling overfishing. Regrettably, empirical evidences suggest that RFMO has a variety of problems, including poor data provision, failure to adopt appropriate conservation measures, and inadequate compliance with management measures (Sumaila, et al., 2015; Small, 2005; Cullis-Suzuki & Pauly, 2010; Garcia & Rosenberg, 2010). Given the consensus-based decision-making mechanism in the region, particularly the ASEAN way of diplomacy, regional treaties tend to be negotiated, implemented, and revised according to the rule of unanimous consent. Consequently, regional instruments keep their provisions vague and ambiguous. The consensus approach can impel “each negotiating body to search for the lowest common denominator” and complicate negotiations when a single nation can resist the development of a common position and demand concessions for the price of achieving consensus (Sovacool, 2009). Under this approach, the design of a regional agreement for implementation would take years, sometimes decades. This is clearly evidenced by the disappointing content in the Declaration of Document (DOC) and prolonged discussion of the Code of Conduct (COC). The delays inherent in the negotiation and ratification process of regional agreements to protect SCS fishery become especially important concerning the rapid rate of technological change within fishing industry.

Furthermore, political compromises tend to weaken RMFO’s ability to control fishing intensity. One way the RMFO operates is by determining total allowable catch (TAC) for fishery resources in a particular area. This is aimed to stabilize fish stocks to ensure that the current harvest does not trade off future productivity (Sovacool, 2009). Unfortunately, the setting of TAC limits is subject to a considerable uncertainty. Biologists, ecologists, marine biologists, and other scientists cannot confidently determine when stocks are endangered prior to the destruction of fish stocks. Therefore, the TAC limits were set with strong political, economic, and social considerations. Even in Europe, scientists came under pressure to overestimate quotas when interpreting the unpredictability of fish populations to establish a TAC system for demersal fisheries (Sovacool, 2009). In addition, the effectiveness of the RFMO is dependent on the fishery governance capacity of the region. The sheer size of the SCS and magnitude of the fishing industry (based on the number of fishing vessels and fishermen) pose challenges to the establishment of control. According to the Fisheries Management Index that measures a state’s fishery governance capacity, all SCS countries ranked bottom for their standard of research, management, enforcement, socioeconomics, and stock status (Melnichuk, et al., 2016).

Apart from RFMO’s inability to meet the current and future food security and economic

development needs of the regional countries and its difficulties in dealing with overcapacity (excess fishing fleet and fishermen), other factors make it an extremely politically daunting task to reach such an agreement. Besides complications in defining the precise boundary of the water areas to be governed by the RFMO, the more problematic issue is the membership issue of Taiwan. Because Taiwan is a significant global fishing power that possesses one of the largest global fishing fleets, it is critical to include Taiwan in the management decisions and ensure that it complies with fishing regulations adopted by the RFMO. The importance of incorporating Taiwan into international and regional fisheries regulation cannot be understated. By virtue of its unique political status, however, incorporating Taiwan into traditional RFMO legal framework has its challenges (Scanlon, 2017). In the context of strained cross-strait ties since Tsai Ing-wen took office, in addition to China's longstanding unyielding stance towards Taiwan's role in the SCS negotiations, it will be impossible for China to allow Taiwan to participate in the RFMO as a full member. Currently, some RFMOs creatively adopted the concept of "fishing entity" to incorporate Taiwan (Scanlon, 2017; Edeson, 2006; Hu, 2010). In the context of the SCS, while China is not likely to allow Taiwan to participate in RFMOs through the concept of a "fishing entity", it is also very unlikely that the Tsai Ing-wen administration will participate in the RFMO as a "fishing entity", under the name of Chinese Taipei.

4.3 Aquaculture

Aquaculture is often being championed as the sustainable solution to the severe overfishing and exploitation of in the oceans, including the SCS. In theory, aquaculture could meet the three objectives: (1) safeguarding food security and ensuring economic development, (2) promoting sustainable fishery, and (3) preventing fishery disputes.

In Asia, in recognition of the potential effects of diminishing marine-capture fisheries, many countries in the region have turned to aquaculture as a means to reduce overfishing while increasing fish supply, providing employment, and generating foreign income (Funge-Smith, et al., 2005). Currently, Asian countries accounts for the nearly 90 percent of global aquaculture production. In 2014, China produced 45.5 million tonnes of farmed fish, accounting for more than 60 percent of global fish production from aquaculture. Vietnam, Indonesia, and the Philippines are major farmed-fish producers as well (FAO, 2016).

In the context of the SCS disputes, immediately after the reconciliation between China and Philippines during the Duterte administration, the two countries began to embark on aquaculture and other joint projects in the SCS. In November 2016, the assistant director of China's Department of Fisheries, Liu Sinchong visited the fishermen of Zambales, Philippines, and offered aquaculture training to the Filipino fishermen in China to provide a source of livelihood. Shortly after, in January 2017, China hosted a 17-person delegation of Filipino fishermen, officials, and seafood executives, who received training in deep-sea cage-fish farming, feed and nutrition, and seedling preparation. This training trip is considered part of a "consensus" among the leaders of both countries to "restart fishing cooperation" following years of bitter feud in the SCS. Also in January 2017, the China-based Fangyuan Shipbuilding Co made plans to invest RMB 3 billion (USD 437 million) in an aquaculture and processing project in the Philippines intended to supply the Chinese market. Similarly, China offered to develop aquaculture in Malaysia. In September 2016, the two countries signed a RM 2 billion (USD 45 million) deal to develop a 4,046 ha shrimp farm in Johor, Malaysia, with aqua-technology from China, among

others, and to set up a major trading arm to export the seafood. In the meantime, another Chinese company invested RM 3 billion (USD 68 million) to build a fishing terminal in Kuala Kedah, Malaysia and aquaculture development is part of the venture.

In spite of all the optimism and ongoing aquaculture development projects led by China, aquaculture in this current form might not be a promising option for fishery cooperation in the SCS. To begin with, the impact of aquaculture on wild fish stocks remains contentious. While higher aquaculture production might relieve pressure on wild fish stocks, the sector's over dependence on fishmeal and trash fish for feed opens it to ecological risks. With aquaculture providing more than half of all fish consumed globally, another major transition is also underway: Aquaculture's share of global fishmeal and fish oil consumption has expanded phenomenally over the past decades. Taking fishmeal for example, in 1980, aquaculture consumed only 10 percent of the global fishmeal; yet by 2010, this share increased to 73 percent (World Bank, 2013). Certainly, for the aquaculture sector as a whole, the ratio of wild fish-in to farmed fish-out (FIFO) based on feed ingredients has fallen well below one. However, aquaculture's share of global fishmeal and fish oil consumption still increased substantially due to greater amounts of fishmeal fed to carnivorous species, and high levels of fish oil used to provide long-chain omega-3 oils in farmed fish (Naylor, et al., 2009; Merino, et al., 2012). Despite the fact the culture of non-fed animal species in 2014 produced 22.7 million tonnes (30.8 percent of world production of all farmed fish species), growth in production has been faster for fed species than for non-fed species (FAO, 2016). For instance, the culture of carnivorous freshwater finfish over the past decade experienced a growth rate of 6 percent per year between 2000 and 2012. This growth surpasses that of low-value herbivorous and omnivorous freshwater fish in the Asia and the Pacific region. This is largely due to consumers' increasing preference for carnivore species such as salmon and cod that require tons of high quality protein for their quick, optimum development (Asia-Pacific Fishery Commission, 2014). Furthermore, most of the species produced in marine and brackish water are species requiring high feed inputs as they are carnivorous species.

As small-scale nonindustrial aquaculture is being increasingly replaced by large-scale industrialized aquaculture, the aquaculture's demand for fishmeal and fish oil is poised to grow. Many of the intensive and semi-intensive aquaculture systems used 2-5 times more fish protein (in the form of fish meal) than is supplied by the farmed product to feed the farmed species. Owing to the high levels of fish meal and fish oil in aquaculture feeds, many species require more fish biomass as inputs than the farmed fish produced. According to Naylor, et al., (2000), for the ten types of fish most commonly farmed, an average of 1.9 kg of wild fish is required for every kilogram of fish raised on compound feeds. Only three of the ten types of fish—catfish, milkfish and carp—require less fish as inputs than is ultimately harvested. In comparison, carnivorous species, such as Salmon, require 2.5-5 times as much fish biomass as feed as is produced. As a result, there has been a gradual shift in the wild fish capture from large and value carnivorous species, to smaller, less valuable species that feed at lower trophic levels

Considering the finite nature of global marine resources, aquaculture's increasing share of fishmeal and fish oil consumption give rise to two issues. The first issue is that fishmeal and fish oil demand by aquaculture is less responsive to prices than the demand by the livestock industry due to the challenges in finding suitable substitutes. Therefore, growth in the aquaculture sector is likely to increase prices for the relatively fixed level of fishmeal and fish oil production. Higher commodity prices can create incentives for overfishing in poorly-regulated fisheries or

economically-marginal fisheries. The second issue is that globalization of fishmeal and fish oil trade has resulted in lower traceability of the origin of feed and hence reduced accountability by feed consumers for the pressure put on specific forage fisheries (Naylor, et al., 2009). Unless appropriate substitutes are found, aquaculture stops being an alternative to over-fishing and starts contributing to it, turning it into a risk for natural marine ecosystems (Plataforma SINC, 2012).

Being the largest farmed-fish producer in the world, the development of China's aquaculture sector offers striking evidence that aquaculture has not only failed to restore fish stocks domestically but also become a key factor that contributes to diminishing wild fish stocks worldwide. Ever since the 1980s, rapid depletion of fish stocks in its coastal and inshore waters has led China to promote inland and marine fish farming. Inland and marine fish farming promoted the recovery of overfished stocks by reducing fishing pressure and enhancing wild stocks to meet national targets for fish supplies (Cao, et al., 2017; Yang, et al., 2004; Zhang & Wu, 2017). Aquaculture now accounts for roughly three-quarters of China's fish supplies. In China, more than 100 freshwater and 60 marine fish species are being cultivated in habitats and infrastructures which include ponds, cages in lakes and coastal waters, and raft and bottom-sowing systems in shallow seas and mud flats. Among these cultivated species, carps in polyculture, tilapia in monoculture and polyculture, and penaeid shrimp in monoculture are three of the largest subsectors, constituting over half of China's total aquaculture production by volume. China produced over 90 percent of global carp, 50 percent of global penaeid shrimp, and 40 percent of global tilapia. However, the problem is that all of these species, with the exception of filter-feeding carps, rely on formulated feeds in 2012 (Cao, et al., 2015). With scarce land, water, and coastal zone resources, China's aquaculture systems are intensifying as producers seek higher returns. Intensification is reflected in higher stocking densities, more commercial feeds, and more frequent water exchange and aeration. The sector is transitioning from low input, multi-trophic systems to monocultures or polycultures containing high-valued species dependent on feeds (Cao, et al., 2015).

Consequently, China has become the biggest consumer of fishmeal and trash fish. While processing wastes from China's domestic fisheries and its fish re-export industry are used in feed production, wild fisheries contributing to these processing wastes are all fully exploited (overexploited or depleted) and large amounts of trash fish are also used for fishmeal production. China's high-valued marine aquaculture uses around 3 million tonnes of trash fish each year for direct feeding (Cao, et al., 2015). It is suggested that nearly 70 percent of China's trawler and movable stow net catch consists of juveniles of commercially-important species, low-value fish, and other forage fish that are used in aqua feeds (Sun, 2017). China hauls in more fish catch for non-human consumption than any other country in the world (Cashion, et al., 2017). This catch is typically converted into fishmeal and fish oil for feeding aquaculture fish. In natural systems, forage fish play an important role in converting plankton into food for higher trophic-level species including humans, larger fish, marine mammals, and seabirds. Overexploitation of forage fisheries can lead to local stress on these higher trophic species. Therefore, harvesting juveniles and the trash fish perhaps pose a bigger threat to marine ecosystem.

Apart from extracting trash fish and fishmeal from its own waters and recycling fish-processing wastes as feeds, China as the world's largest importer of fishmeal, imports about one-third of the global fishmeal trade in any given year (Cao, et al., 2015). China's fishmeal imports remained around 1.0–1.5 million tonnes per year from 2000 to 2014 (Han, et al., 2016). To secure future

supplies of high-quality fishmeal, Chinese companies and state subsidiaries have purchased fishing rights in foreign countries, including quotas for the Peruvian anchovy fishery. As China commands an increasing global share of high-quality fishmeal, feed companies in other parts of the world are likely to move into the lower-quality fishmeal market, and raise demand for trash fish. China also imports Asian countries' fishmeal derived from non-targeted fisheries such as trash fish.

Hence, it is not surprising that wild fish stocks failed to recover in Chinese waters despite the massive expansion of China's aquaculture sector. Liu and Mitcheson (2008), through a detailed study of the cultivation of croaker in China, found that successful aquaculture, albeit important for food production and livelihoods, might not be a solution to overfishing. Moreover, aquaculture could have compromised fishery recovery by competing for funds, attention, space, and maybe genetic resources. Since the mid-1980s, the Chinese government provided significant funds for aquaculture development of the croaker. Over the last two decades, aquaculture development enhanced food production and livelihoods, and partially solved the problem of overfishing of the species. While the croaker proved to be a highly successful aquaculture species (with approximately 70,000 tonnes produced in 2005, the highest of any marine fish cultured in China), aquaculture and restocking have done nothing to address overfishing and depletion of reproductive fish in the wild (Liu & Mitcheson, 2008). With the increase in aquaculture production and decline in wild catches, following the rules of supply and demand, a large price differential exists between the rarer and preferred wild-caught fish and the widely available, but lower-quality flesh, farmed croakers. The differential, which is about 10-fold, has prevailed over the last decade or so and appears to be levelling (Liu & Mitcheson, 2008).

The negative impact of aquaculture on wild catch goes beyond the use of wild fish to feed farmed fish, thus further straining fisheries resources. It also indirectly diminishes wild fisheries by habitat modification, wild seedstock collection, food web-interaction, nutrient pollution, and the introduction of exotic species and pathogens that harm wild fish population (Naylor, et al., 2000). As small-scale traditional aquaculture is replaced by large-scale industrialized aquaculture, the ecological risks of intensive and semi-intensive aquaculture can be quite severe. Parasites such as sea lice endanger farmed and wild species. Farm effluent also creates significant amounts of pollution (Sovacool, 2009).

Even aquaculture's contribution to food security needs to be revisited. From 1950 to 2010, 27 percent of commercial marine landings were diverted to uses other than direct human consumption. Serious doubts regarding food security emerged as 90 percent of diverted fish were classified as food-grade or prime food-grade. Out of the grand total, 18 million tonnes of fish were used specifically in the production of fishmeal and fish oil, which are commonly fed to aquaculture and livestock species. Cashion, et al. (2017) also discovered that there is an increase in the variety of fish being used for non-direct human consumption. This trend is mostly fuelled by the growth of fed aquaculture in China and Southeast Asian countries and the depletion of overfished stocks of former target species.

While fish are vital sources of micronutrients and are often found in highly bioavailable forms, farmed fish may have lower nutritional value. Fish contains lipids, micronutrients (fatty acid and vitamins A, B, and D) and minerals (calcium, phosphorus, iodine, zinc, iron, and selenium), crucial for combating malnutrition in China and ASEAN countries (Chan, et al., 2017).

Aquaculture species which are most affordable, such as carp, are often not as rich in omega-3 fatty acids as the wild species of sardines and mackerels which are accessible to impoverished communities. Soybeans, distiller's dried grains with solubles (DDGS), and other plant-based feeds are increasingly used as alternatives to fishmeal. One potential consequence is the further alteration of nutritional composition of farmed fish. Aquaculture generally focuses on fewer species than those caught from the wild. A global fish supply dominated by aquaculture, as it is currently practiced, would reduce the diversity and nutritional value of many diets, thus undermining nutritional security (Golden, et al., 2016)

4 Conclusion

Despite all the resourcefulness, advancing fishery cooperation in the SCS will not be easy due to inherent contradictions between the following three key objectives: (1) safeguarding food security and economic development needs of the SCS countries, (2) ensuring sustainable fisheries, and (3) preventing fishing conflict in the disputed waters. With rising population and the growing importance of fish consumption in the region, significant expansion of marine fishery as well as aquaculture, which is linked to marine fishery via fish feed, is necessary to meet rising demand. According a report by the World Fish Center, the total demand for fishery products from ASEAN countries by 2050 will almost double in 2015. It follows that 53 million tonnes of fish supply is needed in the ASEAN region by 2050 (Chan, et al., 2017). Rising demand means more pressure on the fish stocks in the SCS, the most important fishing area in the region. However, to avert the looming environmental and ecological catastrophe caused by IUU fishing and overfishing as well as to prevent fishing conflicts due to growing competitions for the limited fish stocks from regional countries, fishing efforts need to be contained and even reduced. The fundamental challenge faces the SCS fishery is that there are simply too many people relying on the limited fish stocks for food and main sources of income, which is further complicated by the unresolved territory and maritime boundary disputes.

Because rising demand for fishery products and the potential ecological crisis in the SCS are compounded by the threat of climate change, fishery cooperation in the SCS must take priority. Given that no single option can meet the three key objectives at the same time, a concerted approach is vital. First, aquaculture in the region will remain a key part of the solution to the fishery challenges in the SCS. While aquaculture is needed to meet rising domestic and international demand, serious effort is needed to reduce the impact of the region's aquaculture and use of aqua feed on wild fisheries. Considering the fact that aquaculture in the South China Sea region reaching near maximum carrying capacity (Chan, et al., 2017), sustainable fish farming in other regions such as Africa and Latin America, should be promoted. Second, as according to by Sovacool (2009), in contrast to input/output control and effort on the supply side, demand-side measures which reduce incentives for overfishing and illegal fishing may prove to be much more effective. In the case of poaching of corals, giant clams, and sea turtles, measures are required to curb consumer's demand for these products. Otherwise, supply-side measures leading to higher prices will motivate fishermen to disregard severe penalties and continue poaching. As for fish consumption, intervention at the distribution, retail, and consumption stages can minimize fish wastage. The notion that fish is a cheap and sustainable and thus preferred source of protein and nutrients needs to be reconsidered as well. Third, to promote fishery cooperation in the South China Sea, it might be easier to start with some of the low-hanging fruits, such as fishery survey and research, fishery research and rescue, promotion of

intraregional fishery trade, and investments in onshore storage and processing sectors. Fourth, sustainable exploration of fisheries resources in the South China Sea can only be achieved when it is coupled with development of alternative sources of employment on shores and livelihood for millions of the fishermen who still depend on marine fishery. This means that regional efforts are needed to promote economic development in other sectors in the coastal regions.

Bibliography

ABS-CBN News, 2017. *Gov't eyes 'shame campaign' to stop illegal fishing*. [Online] Available at: <http://news.abs-cbn.com/news/01/18/17/govt-eyes-shame-campaign-to-stop-illegal-fishing>

[Accessed 23 March 2017].

Anda, R., 2014. *49 rescued marine turtles released back to sea*. [Online]

Available at: <https://globalnation.inquirer.net/113991/49-rescued-marine-turtles-released-back-to-sea>

[Accessed 23 December 2016].

Asia-Pacific Fishery Commission, 2014. *Regional overview of aquaculture trends in the Asia-Pacific Region 2014*, Bangkok: Asia-Pacific Fishery Commission.

Beckman, R., 2013. *Disputed Areas in the South China Sea*. Hanoi, Diplomatic Academy of Vietnam .

Cao, L. et al., 2017. Opportunity for marine fisheries reform in China. *PNAS*, 114(3), p. 435–442.

Cao, L. et al., 2015. China's aquaculture and the world's wild fisheries. *Science*, 347(6218), pp. 133-135.

Cashion, T., Manach, L., Zeller, D. & Pauly, D., 2017. Most fish destined for fishmeal production are food-grade fish. *Fish and Fisheries*.

Chan, C. Y. et al., 2017. *Fish to 2050 in the ASEAN region*, Penang, Malaysia: WorldFish.

Chapsos, I. & Malcolm, J. A., 2017. Maritime security in Indonesia: Towards a comprehensive agenda?. *Marine Policy*, Volume 76 , p. 178–184.

Chircop, A., 2010. Regional Cooperation in Marine Environmental Protection in the South China Sea: A Reflection on New Directions for Marine Conservation. *Ocean Development & International Law*, 41(4), pp. 334-356.

Christensen, J. & Tull, M., 2014. *Historical Perspectives of Fisheries Exploitation in the Indo-Pacific*. Dordrecht, Netherlands: Springer..

Christian-Albrechts-Universitaet zu Kiel, 2015. Economic development drives world-wide overfishing. *ScienceDaily*, 9 September.

Claparols, A. M., 2016. *An ecological disaster in the making*. [Online]
Available at: <http://www.esp.org.ph/EnvironmentUpdates.html>
[Accessed 23 January 2017].

Cronin, P. M., 2012. *China's Global Quest for Resources and Implications for the United States*, Washington DC: Center for a New American Security.

Cullis-Suzuki, S. & Pauly, D., 2010. Failing the high seas: A global evaluation of regional fisheries management organizations. *Marine Policy*, Volume 34, p. 1036–1042.

Cyranoski, D., 2016. South China Sea ruling sparks conservation fears. *Nature*, July 21, Volume 535, pp. 334-335.

Dang, V. H., 2014. *Marine Protected Areas Network in the South China Sea: Charting a Course for Future Cooperation*. Leiden: Brill.

Deogracias, C., 2016. *Fishery accords during Duterte China visit way forward in South China Sea dispute*. [Online]
Available at: <http://www.philstar.com/headlines/2016/10/19/1635208/fishery-accords-during-duterte-china-visit-way-forward-south-china-sea>
[Accessed 23 December 2016].

Department of Fisheries Malaysia, 2013. *Malaysia's National Plan of action to prevent, deter and eliminate illegal, unreported and unregulated fishing (Malaysia's NPOA-IUU)*, Putrajaya: Department of Fisheries Malaysia.

Dutton, P., 2011. Three dispute and three objectives: China and the South China Sea. *Naval War College Review*, 64(4), pp. 42-67.

Ecns.cn, 2017. *Hainan bans giant clam trade, tens of thousands to lose jobs*. [Online]
Available at: <http://www.ecns.cn/cns-wire/2017/01-05/240291.shtml>
[Accessed 17 January 2017].

Edeson, W., 2006. Some Future Directions for Fishing Entities in Certain Regional Fisheries Management Bodies. *Ocean Development & International Law*, 37(2), pp. 245-264.

Elisabeth Haub School of Law, 2016. *Motion Submitted To The IUCN World Conservation Congress*, New York: Elisabeth Haub School of Law.

Fabinyi, M., 2016. Sustainable seafood consumption in China. *Marine Policy*, Volume 74, p. 85–87.

FAO, 2016. *The State of World Fisheries and Aquaculture 2016*. Rome: FAO.

FAO, 2017. *FAOSTAT: Food Supply - Livestock and Fish Primary Equivalent*, Rome: FAO.

Ferraro, G. & Brans, M., 2012. Trade-offs between environmental protection and economic development in China's fisheries policy: A political analysis on the adoption and implementation

of the Fisheries Law 2000. *Natural Resources Forum*, Volume 36, pp. 38-49.

Ferse, S. C. A., Mumby, P. J. & Ward, S., 2016. *Assessment of the potential environmental consequences of construction activities on seven reefs in the Spratly Islands in the South China Sea*, Hauge: Permanent Court of Arbitration .

Franckx, E., 2012. Fisheries in the South China Sea: A Centrifugal or Centripetal Force?. *Chinese Journal of International Law* , 11(4), pp. 727-747.

Funge-Smith, S., Briggs, M. & Miao, W., 2012. *Regional overview of fisheries and aquaculture in Asia and the Pacific 2012*, Bangkok, Thailand: Asia-Pacific Fishery Commission, FAO Regional Office for Asia and the Pacific.

Funge-Smith, S., Lindebo, E. & Staples, D., 2005. *Asian fisheries today: The production and use of low value/trash fish from marine fisheries in the Asia-Pacific region*, Bangkok: FAO.

Garcia, S. M. & Rosenberg, A. A., 2010. Food security and marine capture fisheries: characteristics, trends, drivers and future perspectives. *Philosophical Transactions B*, 365(1554), pp. 2869-2880.

Global Fishing Watch, 2017. *The Global View of Transshipment: Preliminary Findings*, Shepherdstown: Global Fishing Watch.

Golden, C. D. et al., 2016. Fall in fish catch threatens human health. *Nature*, 534(7607), pp. 317-320.

Guilfoyle, D., 2016. *The South China Sea Case and the Potential Utility of International Law for Conflict Mitigation and/or Resolution*, Canberra: National Asian Security Studies Program (NASSP).

Han, D. et al., 2016. A revisit to fishmeal usage and associated consequences in Chinese aquaculture. *Reviews in Aquaculture*, p. 1–15.

Hellmann, G. & Herborth, B., 2008. Fishing in the mild West: Democratic peace and militarised interstate disputes in the transatlantic community. *Review of International Studies*, Volume 34, pp. 481-506.

Hoi, N. C. & Dang, V. H., 2015. Building a Regional Network and Management Regime of Marine Protected Areas in the South China Sea for Sustainable Development. *Journal of International Wildlife Law & Policy*, 18(2), pp. 128-138.

Holmes, J. R., 2012. Advice on a Vietnamese “Model Maritime Militia Force”. *The Diplomat*, 30 August.

Hornby, L., 2016. *Chinese fishermen caught up in Asian geopolitical conflict*. [Online] Available at: <https://www.ft.com/content/364a5172-5ec5-11e6-bb77-a121aa8abd95> [Accessed 23 December 2016].

Hu, N. T. A., 2010. Semi-enclosed Troubled Waters: A New Thinking on the Application of the 1982 UNCLOS Article 123 to the South China Sea. *Ocean Development & International Law*, 41(3), pp. 281-314.

IANS, 2016. *China revises law on marine environment protection*. [Online]
Available at: <http://indianexpress.com/article/world/world-news/china-revises-law-on-marine-environment-protection-3001909/>
[Accessed 22 September 2016].

Ibrahim, Z., 2017. *EXCLUSIVE: WIDODO'S PEACE FORMULA FOR SOUTH CHINA SEA*. [Online]
Available at: <http://www.scmp.com/week-asia/geopolitics/article/2091549/exclusive-widodos-peace-formula-south-china-sea>
[Accessed 30 April 2017].

Jennings, R., 2017. *China May Offer Aid, Investment, in Talks on South China Sea*. [Online]
Available at: <http://www.voanews.com/a/china-may-offer-aid-investment-in-south-china-sea-talks/3738132.html>
[Accessed 23 March 2017].

Jennings, S. et al., 2016. Aquatic food security: insights into challenges and solutions from an analysis of interactions between fisheries aquaculture, food safety, human health, fish and human welfare, economy and environment. *Fish and Fisheries*, Volume 17, p. 893–938.

Jie, J., 2016. *S.China Sea corals on brink of extinction*. [Online]
Available at: <http://www.globaltimes.cn/content/984745.shtml>
[Accessed 23 March 2017].

Kao, S.-M., Pearre, N. S. & Firestone, J., 2012. Regional Cooperation in the South China Sea: Analysis of Existing Practices and Prospects. *Ocean Development & International Law*, 43(3), pp. 283-295.

Khemakorn, P., 2006. *Sustainable Management of Pelagic Fisheries in the South China Sea Region*, New York: United Nations.

Kittichaisaree, K., 2001. A Code of Conduct for Human and Regional Security Around the South China Sea. *Ocean Development & International Law*, 32(2), pp. 131-147.

Koh, T., 2016. *Peace at Sea*. [Online]
Available at: <http://www.straitstimes.com/opinion/peace-at-sea>
[Accessed 4 February 2017].

Labrosse, V. & Wilson, A., 2016. *Disputes in the South China Sea*, Ottawa: Office of the Honourable Senator Thanh Hai Ngo.

Lagoni, R., 1984. Interim Measures Pending Maritime Delimitation Agreements. *American Journal of International Law*, 78(2), pp. 345-368.

Laude, J., 2014. *Chinese patrols expanded in shoal*. [Online]
Available at: <http://www.philstar.com/headlines/2014/08/12/1356637/chinese-patrols-expanded-shoal>

[Accessed 23 December 2016].

Le, M. T., 2016. *Offshore fishing and Vietnam's sovereignty protection*. [Online]
Available at: <http://english.vietnamnet.vn/fms/marine-sovereignty/165364/offshore-fishing-and-vietnam-s-sovereignty-protection.html>

[Accessed 23 December 2016].

Li, H., 2014. 被扣渔民家属否认捕捞海龟[Family members of the detained fishermen deny prochaing of]. *Beijing Youth Daily*, 9 May.

Li, J. & Amer, R., 2015. Closing the Net Against IUU Fishing in the South China Sea: China's Practice and Way Forward. *Journal of International Wildlife Law & Policy*, 18(2), pp. 139-164.

Liu, M. & Mitcheson, Y. S. d., 2008. Profile of a fishery collapse: why mariculture failed to save the large yellow croaker. *Fish and Fisheries*, Volume 9, pp. 219-242.

Luce, D. D. & Johnson, K., 2016. *Fishing Disputes Could Spark a South China Sea Crisis*. [Online]

Available at: <http://foreignpolicy.com/2016/04/07/fishing-disputes-could-spark-a-south-china-sea-crisis/>

[Accessed 24 June 2016].

Macatuno, A., 2016. *Fishermen won't join sea militia*. [Online]

Available at: <http://newsinfo.inquirer.net/792749/fishermen-wont-join-sea-militia>

[Accessed 23 July 2016].

Marashi, S., 1996. *The Role of FAO Regional Fishery Bodies in the Conservation and Management of Fisheries*, Rome: FAO.

McManus, J. W., 2017. Chapter 10 Offshore Coral Reefs and High-Tide Features of the South China Sea: Orgins, Resources, Recent Damage, and Potential Peace Parks. In: *In the Wake of Arbitration: Papers from the Sixth Annual CSIS South China Sea Conference*. Washington D.C.: CSIS, pp. 124-147.

McManus, J. W., Shao, K.-T. & Lin, S.-Y., 2010. Toward Establishing a Spratly Islands International Marine Peace Park: Ecological Importance and Supportive Collaborative Activities with an Emphasis on the Role of Taiwan. *Ocean Development & International Law*, 41(3), pp. 270-280.

Melnichuk, M. C., Peterson, E., Elliott, M. & Hilborn, R., 2016. Fisheries management impacts on target species status. *Proceedings of the National Academy of Sciences of the United States of America*, pp. 1-6.

Merino, G. et al., 2012. Can marine fisheries and aquaculture meet fish demand from a growing

human population in a changing climate?. *Global Environmental Change*, 22(4), p. 795–806.

Ministry of Trade, Indonesia, 2016a. *SIMP Regulation on Fish Exports to the US Will Soon be Implemented*, Jakarta: Ministry of Trade Indonesia.

Mitchell, S. M. & Prins, B. C., 1999. Beyond Territorial Contiguity: Issues at Stake in Democratic Militarized Interstate Disputes. *International Studies Quarterly*, March, 43(1), pp. 169-183.

Nankivell, K. L., Reeves, J. & Pardo, R. P., 2017. *The Indo-Asia-Pacific's Maritime Future: A Practical Assessment of the State of Asian Seas*, London: King's College London.

Naylor, R. L. et al., 2000. Effect of aquaculture on world fish supplies. *Nature*, 405(1017-1024).

Naylor, R. L. et al., 2009. Feeding aquaculture in an era of finite resources. *PNAS*, 106(36), pp. 15103-15110.

Oegroseno, A. H., 2016. *The South China Sea Tests*. [Online]
Available at: <https://www.cogitasia.com/the-south-china-sea-tests/>
[Accessed 23 March 2017].

Office of the President of the Philippines, 2016. *Memorandum Circular No. 94, s. 2016*. [Online]
Available at: <http://www.gov.ph/2016/03/17/memorandum-circular-no-94-s-2016/>
[Accessed 23 June 2016].

People's Daily, 2014. *zhong guo yi yuchuan zai nansha banyuejiao bei fei fang kongzhi [A Chinese fishing vessel was detained by Philippine in the Half Moon Shoal]*. [Online]
Available at: <http://world.people.com.cn/GB/8212/191606/384874/>
[Accessed 23 June 2016].

People's Daily, 2015. *三沙群岛法院首次在永兴岛开庭[Spratlys Court Opens Trail for the first time on Woody Island]*. [Online]
Available at: <http://society.people.com.cn/n/2015/0608/c1008-27116734.html>
[Accessed 23 December 2016].

Petty, M., 2017. *Exclusive: At strategic shoal, China asserts power through control, and concessions*. [Online]
Available at: <http://www.reuters.com/article/us-southchinasea-china-philippines-exclu-idUSKBN17B124>
[Accessed 12 April 2017].

Plataforma SINC, 2012. Eight species of wild fish have been detected in aquaculture feed. *Science Daily*, 25 April.

Pomeroy, R., Nguyen, K. A. T. & Thong, H. X., 2009. Small-scale marine fisheries policy in Vietnam. *Marine Policy*, Volume 33, p. 419–428.

Pomeroy, R., Parks, J., Courtney, K. & Mattich, N., 2016. Improving marine fisheries

management in Southeast Asia: Results of a regional fisheries stakeholder analysis. *Marine Policy*, Volume 65, p. 20–29.

Pomeroy, R. et al., 2007. Fish wars: Conflict and collaboration in fisheries management in Southeast Asia. *Marine Policy*, Volume 31, p. 645–656.

Quaas, M. F. et al., 2016. It is the economy, stupid! Projecting the fate of fish populations using ecological–economic modeling. *Global Change Biology*, Volume 22, p. 264–270.

Scanlon, Z., 2017. Incorporating Taiwan in International Fisheries Management: The Southern Indian Ocean Fisheries Agreement Experience. *Ocean Development & International Law*, 48(1), pp. 35-51.

Schell, O. et al., 2017. *U.S. Policy Towards China: Recommendations for A New Administration*, New York: Asia Society Center on US-China Relations.

Schofield, C., 2014. Defining areas for joint development in disputed waters. In: *Recent Developments in the South China Sea Dispute: The Prospect of a Joint Development Regime*. London: Routledge, pp. 78-98).

Shao, K.-T., 2017. Chapter 11 Marine Biodiversity at Spratly Islands and Proposal for Establishing Marine Protected Areas. In: *In the Wake of Arbitration: Papers from the Sixth Annual CSIS South China Sea Conference*. Washington D.C.: CSIS, pp. 148-159.

Small, C., 2005. *Regional Fisheries Management Organisations: their duties and performance in reducing bycatch of albatrosses and other species*, Cambridge, UK: BirdLife International.

Sovacool, B. K., 2009. A Game of Cat and Fish: How to Restore the Balance in Sustainable Fisheries Management. *Ocean Development & International Law*, Volume 40, p. 97–125.

State Council, P.R.China, 2016. *Full Text: China Adheres to the Position of Settling Through Negotiation the Relevant Disputes Between China and the Philippines in the South China Sea*. [Online]

Available at:

http://english.gov.cn/state_council/ministries/2016/07/13/content_281475392503075.htm

[Accessed 23 June 2016].

Storey, I., 2013. *Arctic Lessons: What the South China Sea Claimants can Learn from Cooperation in the High North*, Singapore: ISEAS.

Stratfor, 2016. *Fish: The Overlooked Destabilizer in the South China Sea*. [Online]

Available at: <https://www.stratfor.com/analysis/fish-overlooked-destabilizer-south-china-sea>

[Accessed 12 December 2016].

Sumaila, U. R., Bellmann, C. & Tipping, A., 2015. *Fishing for the Future: Trends and Issues in Global Fisheries Trade*, Geneva: International Centre for Trade and Sustainable Development (ICTSD).

Sun, C., 2017. *韩海扫射中国渔船 中国不忍了开始强势回击*[*South Korea Opens fire at Chinese fishing boat; China started to fight back*]. [Online]
Available at:
<http://wap.ifeng.com/house/sharenews.f?aid=117505987&autoFresh=1&channelId=>
[Accessed 23 March 2017].

Suryadinata, L., 2016. Did the Natuna Incident Shake Indonesia-China Relations?. *ISEAS Perspective*, 26 April, Volume 19.

Teng, J., 2016. *Understanding China's maritime policy-21st Century Maritime Silk Road*, Canberra: National Security College – Indo-Pacific Maritime Security Conference.

Thang, N. D., 2012. Fisheries Co-operation in the South China Sea and the (Ir)relevance of the Sovereignty. *Asian Journal of International Law*, Volume 2, p. 59–88.

Thayer, C. A., 2009. *Vietnam People's Army: Development and Modernization*, Brunei: Sultan Haji Bolkuah Institute of Defence and Strategic Studies Ministry of Defence, Bolkuah Garrison, Bandar Seri Begawan, Brunei Darussalam.

The National Assembly Vietnam, 2009. *Law on Militia and Self Defence Force*. [Online]
Available at:
http://moj.gov.vn/vbpq/en/lists/vn%20bn%20php%20lut/view_detail.aspx?itemid=10474
[Accessed 23 June 2016].

Urbina, I., 2016. *Palau vs. the Poachers*. [Online]
Available at: http://www.nytimes.com/2016/02/21/magazine/palau-vs-the-poachers.html?_r=0
[Accessed 23 December 2016].

Wang, K.-H., 2015. Peaceful Settlement of Disputes in the South China Sea through Fisheries Resources Cooperation and Management. *Maryland Series in Contemporary Asian Studies*, 1(3), pp. 1-60.

World Bank, 2013. *Fish to 2030: Prospects for Fisheries and Aquaculture*, Washington D.C.: World Bank.

Xinhua News, 2016. *China's supreme court clarifies maritime jurisdiction*. [Online]
Available at: http://news.xinhuanet.com/english/2016-08/02/c_135557571.htm
[Accessed 5 August 2016].

XinhuaNews, 2016. *三沙民兵：南海长城守卫者*[*Sansha Militia: the Vanguard of South China Sea Great Wall*]. [Online]
Available at: <http://xinhua-rss.zhongguowangshi.com/13694/6003014383535113117/1173675.html>
[Accessed 23 December 2016].

Yang, Y. F. et al., 2004. Development of mariculture and its impacts in Chinese coastal waters. *Reviews in Fish Biology and Fisheries*, 14(1), pp. 1-10.

Yu, D. & Wen, S., 2016. *Feature: Be aware of guns on Vietnamese fishing boats*. [Online] Available at: http://english.chinamil.com.cn/news-channels/pla-daily-commentary/2016-04/14/content_7006595_3.htm [Accessed 23 June 2016].

Zhang, H., 2016 b. Chinese Fishermen at Frontline of Maritime Disputes: An Alternative Explanation. *RSIS Commentary*, 12 June, p. No.152.

Zhang, H., 2016. Chinese fishermen in disputed waters: Not quite a “people’s war”. *Marine Policy*, 68(c), pp. 65-73.

Zhang, H. & Wu, F., 2017. China’s Marine Fishery and Global Ocean Governance. *Global Policy*.

Zou, K., 2014. Realizing Sustainability in the South China Sea. In: S. Wu & K. Zou, eds. *Non-traditional Security Issues and the South China Sea: Shaping a New Framework for Cooperation*. New York: Routledge, pp. 207-223.