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Reducing the Unintended Consequence of Overfishing Due to Open Access: Learning from the Zamboanga Experience

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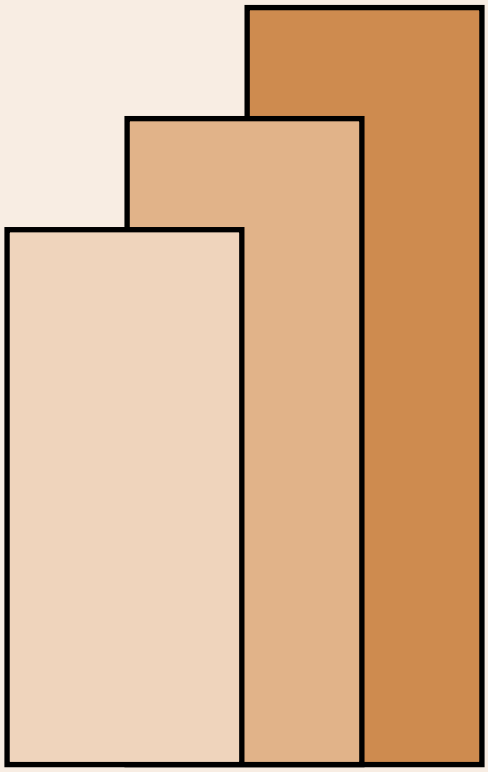

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Abstract

The Philippines is blessed with rich marine fishing grounds that are valuable sources of food and livelihood for the population. Unfortunately, over the years, these fishing grounds have become increasingly less productive and many are in danger of depletion. At the heart of the problem is the generally open-access nature of Philippine fisheries which leads to the unintended consequence of overfishing. This paper reviews the basic theory of overfishing; institutions, laws and policies related to overfishing in the Philippines; and past and current efforts to curb overfishing in the country. As case study, it looks into the sardine industry zeroing in on the Zamboanga Peninsula experience. The paper shows how choosing to act collectively in ways that effectively minimize overfishing can keep the sardine industry profitable and sustainable for its participants in the long haul. It also provides some recommendations on how to potentially improve the current situation and make the sardine industry even more effective in addressing overfishing.

Keywords

Sardine, Zamboanga Peninsula, Unintended consequence, Overfishing, Open access, Closed season

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Danilo C. Israel, Milva Lunod-Carinan and Vicente B. Paqueo[1]

I. Introduction

Being an archipelago surrounded by vast marine water areas, the Philippines has the fisheries sector as one of the most important sources of food and livelihoods of its population. Domestically, the sector supplies 26 to 27 kilograms to the national per capita requirement of 36 kilograms of fish per year (BFAR Various Years). Furthermore, approximately 70 percent of Filipinos live in coastal areas and many are employed in the fisheries sector. In addition, the seas of the country host aquatic flora and fauna populations which are some of the most biologically diverse in the world

Because of the need to maintain food security and provide jobs to its fast rising population, the Philippine government has resorted in the past to the full development of the fisheries sector and a generally open access approach in the exploitation of fisheries resources. Over time, this strategy has resulted to more and more fishermen and fishing vessels catching fish in Philippine waters. Initially, this resulted to increasing overall catch as the vast Philippine seas were able to accommodate the more intense fishing. Eventually, however, fisheries resources were unable to continue to sustain the increase in fishermen and boats resulting to overfishing.

Although several studies have already been conducted on overfishing in the Philippines, relevant laws and regulations have been passed, and programs and projects have been implemented, the problem continues to persist today. At its heart is the generally open-access nature of Philippine fishing grounds and the lack of management mechanisms to effectively manage it eventually resulting to the unintended consequence of overfishing in many marine grounds of the country. In light of this, this paper reviews the basic theory of overfishing; institutions, laws and policies related to overfishing in the Philippines; and past and current efforts to curb overfishing in the country. As case study, it looks into the sardine industry zeroing in on the Zamboanga Peninsula experience. The paper is relevant in that it highlights tried solutions and provide some recommendations to further improve on them towards a potential wider application in the country.

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II. Brief background of the Philippine fisheries sector

The economic contribution of the fisheries sector to the Philippine economy over time has been modest. From 2008 to 2014, the share of fisheries to the Gross Domestic Product (GDP) was only 1.8 % on average annually in constant prices (BFAR 2016). During the same period, fisheries accounted for 18.2 % of the Gross Value Added (GVA) in agriculture, fishery and forestry on average yearly in constant prices. While the aforementioned shares of fisheries were small, however, the value of fisheries exports has consistently exceeded that of imports during the same period. In 2014, in particular, fisheries showed a trade surplus of PhP41.6 billion, an indication that the industry has been beneficial in terms of earning positive net foreign exchange for the country.

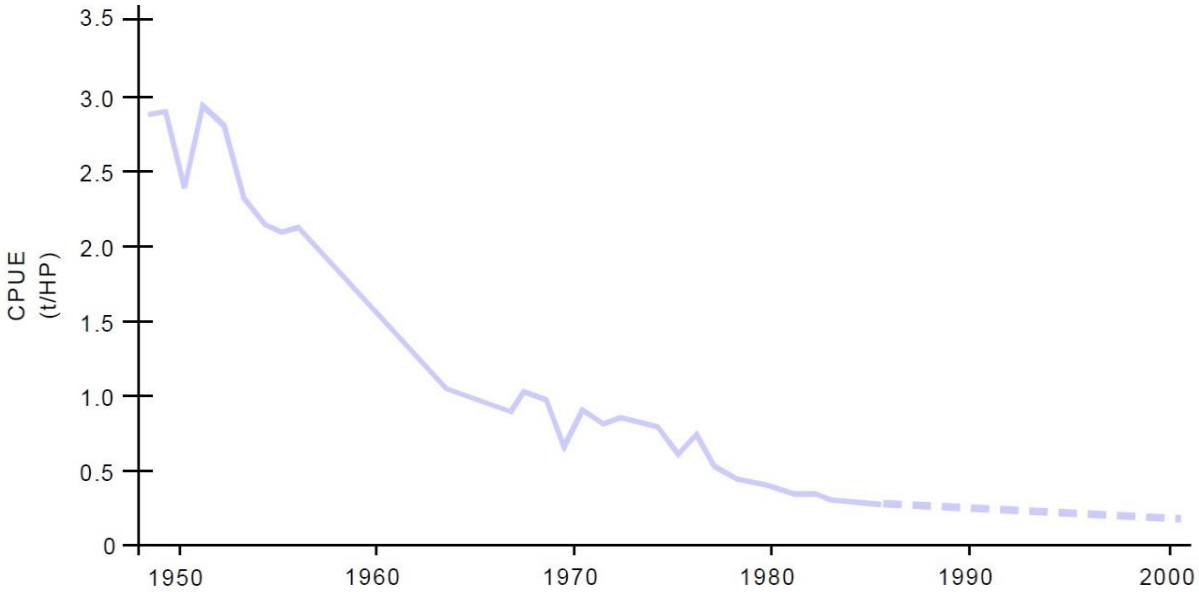
Most of the fisheries employment in the Philippines has been in municipal fisheries, accounting for about 85 percent of the total fisheries employment. On the other hand, aquaculture and commercial fisheries provide 14 percent and 1 percent, respectively (BFAR Various Years). Overall, fisheries is an important supplier of jobs in the country, particularly in the coastal areas where fisheries activities are conducted. In terms of population coverage, fisheries is a critical sector as well. In 2005, the population in coastal areas was estimated 42.9 million, with a population density of 315 persons per square kilometer (BFAR 2016). For 2020, population density in the coastal areas is projected at 405 persons per square kilometers with the population rising to 55.1 million. In addition, compared to non-coastal areas, coastal areas also have a higher population density with the difference in 2020 of as much as 81 persons more per square kilometer.

III. Brief review of literature on overfishing in the Philippines

Because of the need to maintain food security given a fast rising population, the Philippine government has resorted to the full development of its fisheries industry in the past. Over time, however, this strategy has resulted to the unintended and serious negative consequence of overfishing as mentioned.

The existing fisheries literature in the Philippines has well-chronicled the overfishing problem. In summary, studies have found that as early as in the 1960s, except in some areas, the country has reached Maximum Economic Yield (MEY) of it demersal or bottom dwelling fish stocks (Green et al. 2003). They also found that except in some areas, small pelagic or middle water dwelling fish species have been overfished with Catch per Unit Effort (CPUE) falling since the 1950s. ICLARM (2001) estimated using 1998 to 2001 data that the fish stock in the Philippines has been harvested 30% higher than they should be. The study conservatively measured the economic losses of overfishing at about P6.25 billion or P125 million in foregone catch annually. Green et al. (2003) also showed that Philippine small pelagic municipal fisheries, such as scads and sardines, indicated overfishing and generally declining CPUE since 1948 to 2000 (Figure 1).

Figure 1: Trend of Catch per Unit Effort (CPUE) (Ton/HP) for Municipal Small Pelagic fisheries in the Philippines since 1948



Source: Green et al. (2003)

There have been several reasons why overfishing has been occurring in the Philippines and many other parts of the world for that matter. These include the following (e.g. Green et al. 2003): a) open access nature of fishing (lack of management, regulation and enforcement); b) widespread technological advances (more efficient gears, stronger and larger nets, electronic fishing devices like sonar, increased ability to fish all over the world, even in the most isolated places); c) economic development policies of governments, especially those providing subsidies to keep inefficient boats running and encouraging even more investment in fishing technology and boats; d) growing human population; and e) Large increase in prices of fish for a glowing global market.

In the Philippines, in particular, the lack of fisheries management, regulation and enforcement mentioned above which helped bring about open access and consequently overfishing are due to several underlying reasons including limited available government resources for the implementation of fisheries regulations, high cost of implementation given the vast coverage of Philippine marine waters, absence of government inter-agency coordination, limited private sector involvement, and limited public-private sector cooperation, among others.

IV. Theory of Overfishing

In general, overfishing can be classified into four categories (see e.g. Pauly 1987). One is growth overfishing which occurs when the fish are caught even before they have a chance to grow. Another is recruitment overfishing which happens when the adult fish

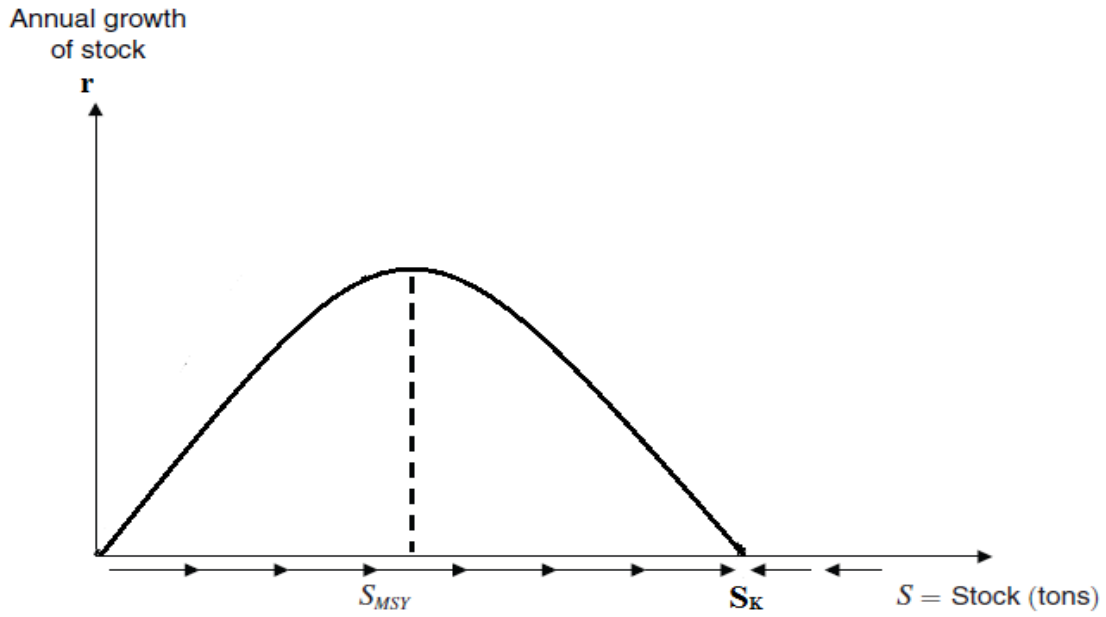
population is caught in large numbers so that reproduction is impaired. The third is ecosystem overfishing which takes place when the decline in a once abundant fish stock due to fishing is not compensated for by an increase in the stocks of other species. The fourth is economic overfishing which occurs when increases in the fishing effort leads to profit levels which are below the desired maximum. Of the above categories of overfishing, economic overfishing may be of most interest to fisheries managers. This is because fisheries resources are primarily viewed as economic resources, e.g. as generators of food and employment.

The basic theory of overfishing is well discussed in the literature (e.g. Stavins 2011, Schatz 1991). In summary, it starts with the notion of a fishery resource, the sea, that is owned by no one and whose exploitation is non-excludable or free to everyone. Before the entrance of man into the fishery, the stock of fish, S, is assumed to grow at a natural rate, r, between two time periods (Figure 2). This r is equal to the recruitment of young fish joining the stock plus the growth of original fish in the stock less the natural fish mortality. As the size of the stock increases, its rate of growth increases until scarce food supplies and other consequences of crowding lead to decreasing growth rates. The maximum growth rate is achieved at SMSy, where the "maximum sustainable yield" (MSy) occurs.

As man enters the fishery and catches fish, the situation evolves. By definition, r is now also the volume of fish, Y, which can be caught by man in a sustained way without affecting the size of the stock S. Y is called a sustainable catch because with all of the growth in the stock captured by man, total stock will not grow but remains constant over time. To continue, as man catches fish, he also exerts fishing effort E. By examination, E also has an inverted U-shaped relationship with r or Y. Initially, at lower levels of E, Y is increasing as r is rising given the still abundant food for the fish stock to live and grow on. At higher effort levels, however, Y is decreasing as r is declining with lesser food now for fish to consume. In this relationship between E and r or Y, the point at which the level of effort yields the maximum r is the maximum sustainable point.

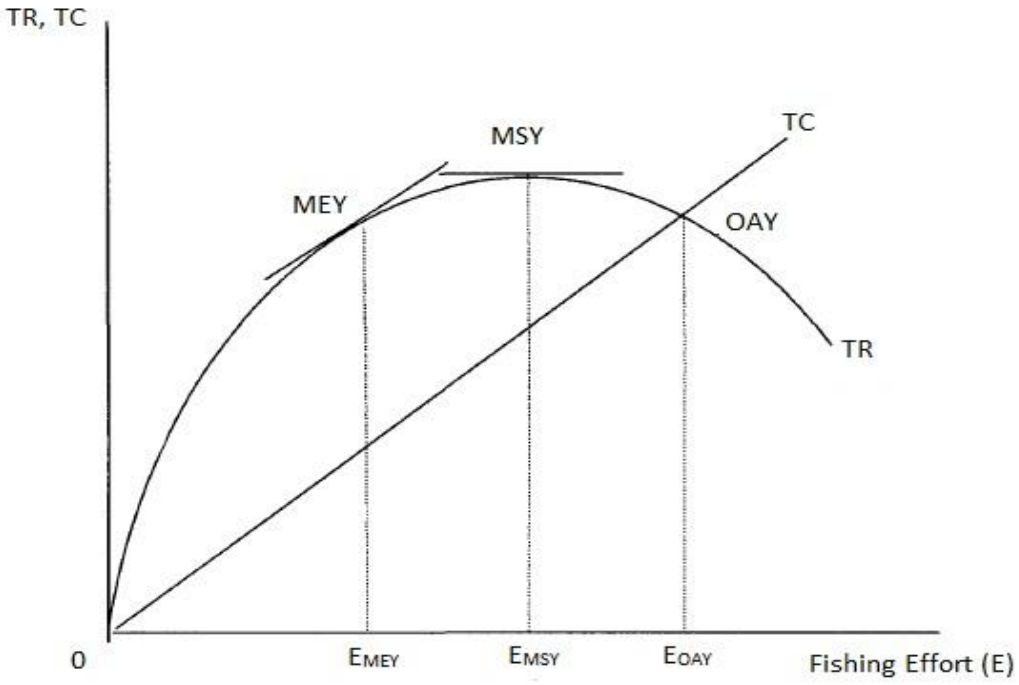
The biological theory summarized above, however, will not be a sufficient basis for marine resource planning and management where, as mentioned, economic concerns are important. Hence, the biological theory has to be transformed into an economic theory. This transformation is facilitated by incorporating prices for fish catch and fishing effort to tum the biological parameters into economic parameters. In brief, to illustrate the economic theory, the total revenue, or TR, is first generated by multiplying fish catch by the price of fish and the total cost, or TC, is derived by multiplying fishing effort by the price of effort per unit of time. If the prices of fish and effort are assumed constant, the resulting TR curve will be inverted U-shaped while the TC curve is a straight line sloping upward (Figure 3). Initially, the economic theory explains that as E increases, TR also increases but at a decreasing rate. Thus, continued increases in E bring the level of TR first to the economic optimum, the maximum economic yield or MEY. At MEY, the standard economic condition for profit maximization is met. Hence, from the economic standpoint, MEY is the most desirable exploitation level for the fishery.

Figure 2: The Basic Biological Theory of Overfishing



Source: Modified from Stavins (2011)

Figure 3: The Basic Economic Theory of Overfishing



Source: Modified from Stavins (2011)

If the fishery is efficiently run, fishing should stop at MEY where profits are at maximum. However, with complete open-access, fishing continues beyond MEY as more and more fishermen, motivated by the existence of profits, get into the fishery. This situation pushes the level of fishing past the economic optimum into the next optimum, the MSY, which was already mentioned is the biological optimum of the fishery. At the MSY level, positive profit still exists as TR remains greater than TC. This profit induces further fishing until, finally, the open access yield, or OAY, is reached. At this point, positive profits are gone and, without any incentive to continue fishing, further human predation stops. The OAY is the long-run equilibrium point of the ·fishery. From the aforementioned basic model of overfishing, more complicated models have been developed over time in the literature. For a detailed review of said models, one may refer to Nguyen (2012).

V. Institutions, laws and policies relevant to overfishing

Fisheries governance in the Philippines is done jointly by the Bureau of Fisheries and Aquatic Resources (BFAR) and the Local Government Units (LGUs) as mandated by the Local Government Code (LGC). In addition to these two institutions, there are Fisheries and Aquatic Resources Management Councils (FARMCs) at the national, provincial and municipal levels composed of relevant stakeholders which assist in the development and management of fisheries. BFAR manages all fisheries resources except those in municipal waters which are managed by the LGUs.

The main legal instruments for the management of the fisheries sector at present are the Philippine Fisheries Code of 1998 (Republic Act No. 8550) and the Agriculture and Fisheries Modernization Act of 1997 or AFMA (R.A. 8435). These two laws consolidated, repealed and modified all past related laws, decrees, executive orders, and other legal issuances pertaining to fisheries. In general, the Fisheries Code is more resource conservation and management-oriented than AFMA which is development-oriented. As objective, the former law emphasizes conservation, protection and sustained management of the country's fisheries and aquatic resources.

In terms of overfishing, the Fisheries code contains provisions specifically aimed to address it. Those that are relevant for the purpose of this paper include Section 7 which required the government to issue licenses and permits for the conduct of fishery activities subject to the limits of the Maximum Sustainable Yield (MSY) of the resource also based on best available evidence. Sections 8 and 9 also stipulated that the government can declare closed seasons and catch ceilings for conservation and ecological purposes and based on available evidence. Furthermore, Section 95 declared that it is unlawful to fish in overfished area and during closed season.

Pursuant to the Fisheries Code, the Comprehensive National Fisheries Industry Development Plan (CNFIDP) was also released and adopted in 2006. This plan provided strategic directions for fisheries from 2006 to 2025, as well as priority projects for implementation. It

identified the main development challenge as unsustainable management of fisheries which causes among others the depletion of fishery resources, degradation of fishery habitats, and intensified resource use competition and conflict. In the case of overfishing, an objective of the plan is the rationalized utilization of fisheries resources and their harvesting within sustainable levels with the core thrust of limiting entry through appropriate licensing schemes (Section 3.4.2)[2].

In 2011, the government prepared the Philippine Development Plan (PDP) to charter the course of development during the administration of President Benigno Aquino III. This plan recognized that the productivity of municipal fisheries has been declining due partly to overfishing and poor enforcement of fishery laws but did not specify any strategy or program to address the problem. However, under the plan, a major program which can be related to the overfishing problem is the improvement of climate change resilience of fisheries through the restoration of fishing grounds, stocks and habitats as well as through investment in sustainable and climate change-responsive fishing technologies and products (Chapter 4, Strategy 2.1.a).

In 2015, Republic Act (RA) 10654 amended the Philippine Fisheries Code of 1998 to enhance law implementation[3]. An important provision of RA 10654 related to overfishing is the raising to significant levels of the penalties for commercial fishing violators, poachers and other fisheries offenders (Chapter 4). Another major feature is the creation of an Adjudication Committee under the BFAR which would speed up the determination of liability of violators and imposition of penalties (Chapter VII).

In 2016, CNFIDP 2016-2026 was drafted to serve as the successor plan of the CNFRDP (BFAR 2016). Compared to the original plan, this new plan provides more modest targets in increases in fish production as a result of new fisheries management practices that acknowledges the importance of habitat preservation among other objectives. The new plan specifically targets only a one percent annual growth in municipal capture fisheries with consideration to proper management interventions. Furthermore, a five percent annual growth in commercial capture fisheries is projected where growth is programmed to come from exploitation of new fishing grounds or conditioned on positive results of management interventions including closed seasons (Section 2.1).

In retrospect, the foregoing show that with the implementation of the Philippine Fisheries Code and other more recent laws and plans, there has been a gradual shift in fisheries policy from the full development approach of the past to the conservation, protection and sustained management of fisheries resources at present. While this has been the trend, the problem of overfishing in the Philippines remains. In 2015, for instance, it was mentioned in the popular press that overfishing remains in 75 percent of the country's fishing grounds (JO 2015). It was

[2] However, since its commencement up to the present the CNFIDP was only partially implemented (BFAR 2016).

[3] It has been reported that the Philippine government amended the Fisheries Code largely because of the yellow card warning slapped by the European Union (EU) in June 2014 over alleged insufficient action to curb illegal fishing (Valencia 2015).

also reported based on two scientific studies[4] that a number of species of fish are already slowly disappearing due to overfishing, illegal fishing and other factors in Philippine waters (TMT 2015).

VI. Past and current efforts to curb overfishing

At least two studies in the 2000s (DA-BFAR 2004, Green et al. 2003) and one in the 2010s (PSU-CSPG 2011) reviewed fisheries programs and projects in the Philippines. These studies indicated that in general, fisheries programs and projects have been integrated and/or ecosystem-based with multiple objectives. Addressing overfishing has been only one of the objectives of the programs and projects. Being so, the impacts of these efforts in terms of addressing overfishing specifically have been difficult to measure and determine with some certainty.

BFAR (2016) explained that at present, some management interventions in important fishing grounds have actually helped reduce overfishing and the regeneration of fish stocks in some areas. In particular, in 2011, a closed season was commenced in the waters off Zamboanga Peninsula. In 2012, a fishing ban was also imposed in the Visayan Seas. Then, in 2013 a fishing ban was implemented in the Davao Gulf. Preliminary reports on the effect of the fishing ban in the Zamboanga Peninsula indicated an increase of landed catch by fishermen of up to 30%. Reports for the Visayan Sea also showed an increase in landed catch and fish biomass of up to 80%. For Davao Gulf, preliminary data indicated observed increases in sizes of certain landed fishes such as small tunas (Tulingan) and moonfishes (Chabeta). It was not clear from the reports, however, how much of the improvements in catch were actually due to the imposed fisheries regulations or otherwise.

VII. Rethinking Current Strategy

Despite some reported preliminary successes, overfishing clearly still persists in Philippine fisheries. As mentioned earlier, among the underlying reasons behind open access and consequently overfishing are the limited government resources for implementation of regulations, high cost of implementation, absence of government inter-agency coordination, limited private sector involvement, and the lack of public-private coordination, among others.

In this paper, we hypothesize, that the key to effectively implementing fisheries regulations towards helping address the unintended consequence of overfishing of fisheries resources lie in confronting the underlying constraints through the following approaches: a) the active involvement of the private stakeholders in fisheries management to help reduce the high costs of enforcement of regulations on the government and share the burden of enforcement; and b) the promotion and enabling of effective collective actions by the private sector in

[4] The first study was conducted by Haribon Foundation for the Conservation of Natural Resources Inc. in collaboration with Newcastle University in the United Kingdom. The is a soon-to-be released paper by Dr. Margarita Lavides, Prof. Nicholas Polunin, Erina Pauline Molina, Gregorio de la Rosa Jr., Dr. Aileen Mill, Profl Steven Rushton and Prof. Selina Stead.

partnership with government agencies and other stakeholders to promote multi-sectoral ownership responsibility in management. The main argument put forward is that improved participation and collection action of all stakeholders would provide the missing stimulus for instituting more effective enforcement and coordination mechanism necessary to minimize the unintended consequence of overfishing in Philippine waters.

VIII. The sardine fishing industry of the Philippines

Sardine species and fishing grounds

Philippine sardine biodiversity is among the highest in the world and includes the only known fresh water sardine species, which is the tawilis (Willete et al. 2011, Hoeksema 2007). There are nine (9) known species of sardines found in the Philippine waters, the highest reported anywhere else in the world (Whitehead 1985). Table 1 indicates the said species including their scientific name, common English name, common name in Tagalog and the standard length of each species.

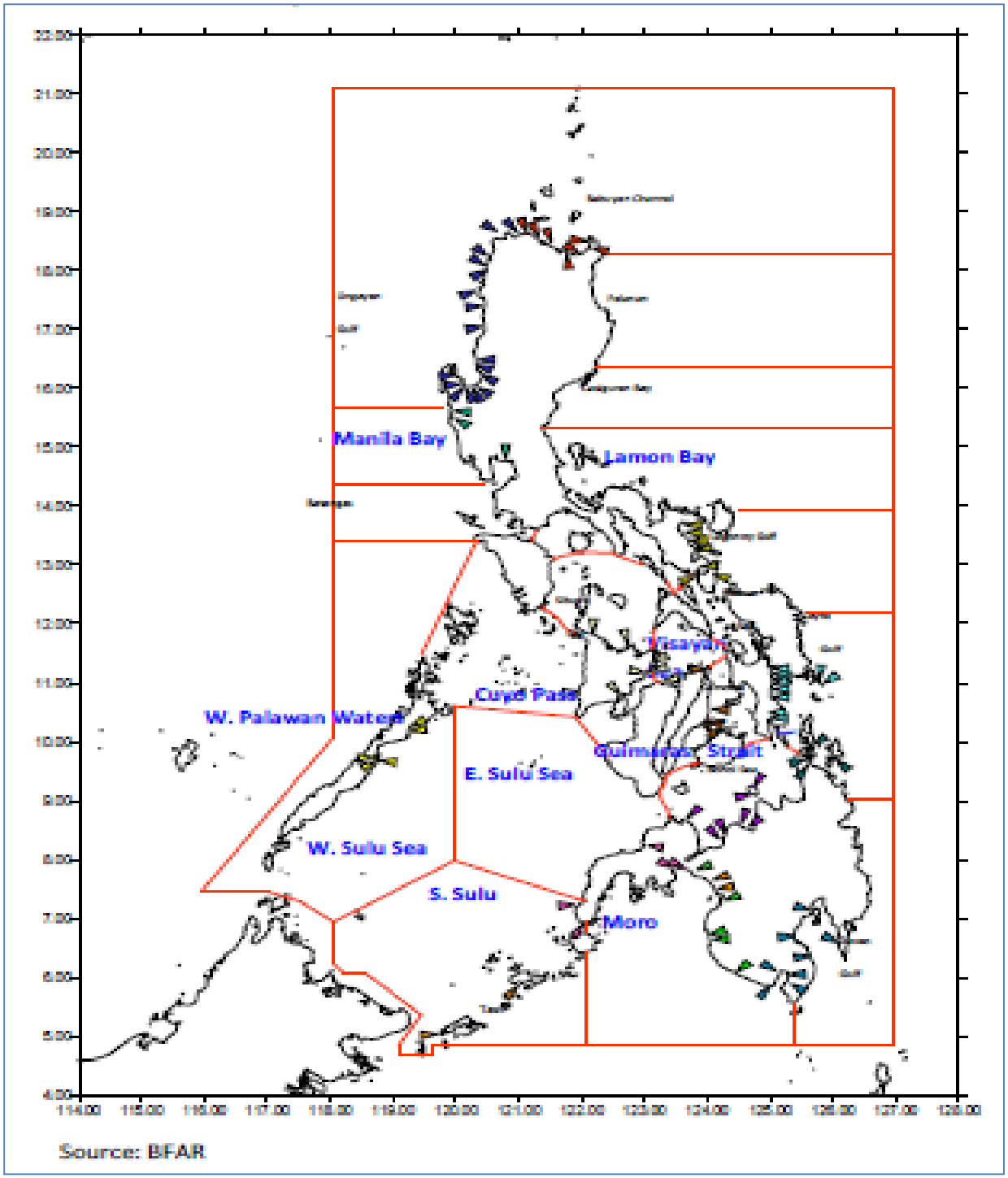
Sardines belong long to the category of small pelagic fishes. Figure 4 shows the most important fishing grounds for small pelagics in the Philippines including the Sulu Sea, Visayan Sea, Moro Gulf, Lamon Bay, Cuyo Pass, Guimaras Strait, Western Palawan waters and Manila Bay (Zaragosa et al. 2004). The whole of Sulu Sea, along with Cuyo Pass, is the most productive fishing ground for sardines in particular (Ronquillo 1975). The East Sulu Sea serves as the major fishing ground of the commercial sardine fishers in Zambonga City while mackerels abound in the Visayan Sea. Zamboanga City is very proximate to Sulu Sea.

Table 1. List of sardine species in the Philippines

Scientific Name	Common Name	Name in Tagalog	Standard Length
Amblygaster sirm	Spotted sardinella	Tamban	20 cm
Escualosa thoracata	White sardine	-	8 cm
Herklotsichthys dipilonotus	Blacksaddle herring	Dilat	7 cm
Herklotsichthys quadrimaculatus	Bluestripe herring	Dilat	10 cm
Sardinella albella	White sardinella	Tunsoy	10 cm
Sardinella fimbriata	Fringescale sardinella	Tunsoy	11 cm
Sardinella gibbosa	Goldstrip sardinella	Tunsoy	15 cm
Sardinella lemuru	Bali sardinella	Tunsoy (tamban in Zamboanga)	20 cm
Sardinella tawilis	Fresh water sardine	Tawilis	10 cm

Source of data: Willette et al. (2011) and Ganaden and Lavapie-Gonzales (1999)

Figure 4. Map of the Philippines showing the different statistical fishing grounds, sampling sites and major fishing grounds for small pelagics (in bold and blue font)



Source: Resma et al. 2009

Economic importance of sardines

Sardine is among the commercially important fish species in the country over the years (Lunod-Carinan and Narvaez 2016, Narvaez and Gangan 2014). From 2002 to 2014, in terms of value, it ranked fifth nationally next to roundscad, skipjack, yellowfin tuna and frigate tuna. In terms of volume, it ranked 2nd next to roundscad. Furthermore, given its relative affordability, together with anchovies, sardines are a main source of inexpensive animal protein for lower income groups in the Philippines. While un-estimated, the employment in sardine fishing in the country is also considered substantial which includes both municipal fishermen who supplies fresh fish in local markets and commercial fishermen who provide the basic fish input into the sardine canneries.

National production of sardines

In terms of subsector, sardine fishing is done by both municipal fishermen using fishing vessels of three gross tons or less and commercial fishermen using vessels of more than three gross tons. For the 10-year period from 2006 to 2015, Sardine production in the Philippines has been composed mainly of commercial fishing which contributed 67 percent in volume and 63 percent in value of production (Appendix Table 1). These data imply that production-wise, sardine fishing is more of a commercial industry than a municipal industry. Furthermore, Average annual growth rate (AAGR) in the production of sardine during the period was higher in commercial fishing (5 percent in volume and 7 percent in value) was higher than in municipal fishing (1 percent in volume and 5 percent in value).

In terms of species, for the 10-year period from 2006 to 2015, sardine production in the Philippines has been composed of Spotted sardinella (Tamban) which contributed 70 percent in volume and 66 percent in value of production followed by Fimbriated Sardines (Tunsoy) which added 28 percent and 32 percent and Round Herring (Tulis) which shared 2 percent and 4 percent, respectively (Appendix Table 2). In volume, Tamban has been the fastest growing with an average annual growth rate (AAGR) of 5 percent compared to Tunsoy and Tulis with 0 and -5% percent, respectively. In value, Tamban still has been the fastest growing at 7% followed by Tunsoy at 6 percent while Tulis had no growth at all. For total sardines, production was at 3.6 million metric tons valued at P97.28 billion during the period.

In terms of international trade, during the 2005 to 2015 period, volume of imports of sardine products of the Philippines had generally been increasing as it rose from 2006 to 2012 and declined thereafter. Imports were highest in 2012 and lowest in 2006 (Appendix Figure 1). On the other hand, exports had been generally erratic increasing in some years and decreasing in others. Exports were highest in 2011 and lowest in 2005. Positive net exports in terms of volume were experienced from 2006 to 2011 while negative net exports occurred from 2005 and in 2012 onwards. Mirroring volume, value of imports of sardine products in the Philippines had generally been increasing from 2006 to 2012 and declined thereafter for the period from 2006 to 2015 (Appendix Figure 2). Imports were also highest in 2012 and lowest in 2006. Also similar to volume, value of exports had been generally erratic increasing in some years and decreasing

in others. Exports were highest in 2011 and lowest in 2005. Positive net exports in terms of value were experienced from 2005 to 2011 while negative net exports occurred from 2012 onwards.

In terms of region, Zamboanga Peninula (Region 9) contributed most to total sardine production of the Philippines sharing 50 percent in volume and 42 percent in value of output in 2015 (Appendix Table 3). The Bicol Region (Region 5) was the only other region which contributed more than 10 percent of sardine production in that year. Other than the Cordillera Autonomous Region (CAR) which is totally landlocked, many regions contributed one percent or less to total production in volume and value including the Ilocos Region (Region 1), Cagayan Valley (Region 2), Central Luzon (Region 3), Central Visayas (Region 7), Davao Region (Region 11), and SOCCSKSARGEN (Region 12).

IX. The sardine industry in Zamboanga Peninsula

Background of Zamboanga Peninsula

Zamboanga Peninsula (Region IX) is located in Mindanao in Southern Philippines (Figure 5). It consists of the three provinces of Zamboanga del Norte, Zamboanga del Sur, and Zamboanga Sibugay and the two independent cities of Isabela and Zamboanga City. Along the water boundaries are numerous bays and other marine bodies where sardines are known to grown. The region is also close to the island provinces of Basilan and Sulu where fish including sardines are abundant.

Figure 5: Maps of the Philippines showing Zamboanga Peninsula and its provinces

Source:
https://www.google.com.ph/?gfe_rd=cr&ei=nWtaV7DeG8uLmwWH2ZuABQ&gws_rd=ssl#q=map+of+the+Philippines+and+zamboanga+peninsula

Background of the sardine industry in Zamboanga Peninsula

Sardine is the most important commercially important fish species in the Philippines and more so in Southern Philippines. Seventy two percent of the total sardine landings in the country are caught and landed in Mindanao (PSA-BAS 2014). The Zamboanga Peninsula (Region IX) contributes about 58 percent of the national sardine harvest. Of the total landed catch in the region, 83.81% are landed in Zamboanga City making it the sardine capital of the country. About 80% of the total catch in the Zamboanga Peninsula is supplied to canned and bottled sardines processors while the remaining 20% is supplied to the wet market and dried fish sectors (Narvaez and Gangan 2014).

Most sardine fishing fleets and canning factories have located in Zamboanga City due to its proximity to the rich fishing grounds of the Sulu Sea. To date, a total of 26 registered commercial fishing companies operating 87 sardine purse seine fleets and 569 boats of different classifications and fishing in Zamboanga and Sulu waters are based in Zamboanga City (BFAR IX 2015). Zamboanga City is also home to 11 canned sardine corporations operating 12 manufacturing plants; four tin can manufacturers; and, 4 ship construction and ship repair companies. The city supplies approximately 85-90% of the country's canned sardine requirements and the canned sardines sector contributes at least USD 16 million in annual export earnings to the City.

In terms of employment contribution, the sardine industry in the Zamboanga Peninsula employs approximately 30,000 - 35,000 workers per year, excluding those in the allied industries (Lunod-Carinan and Narvaez 2016). The industry likewise provides additional jobs in the region through the allied/ancillary industries including ship repair, shipping, stevedoring, forwarders, transport operators, cold storage, dried tamban operators, among others. Thus, the sardine industry's socio-economic contribution to Zamboanga City, the Zamboanga Peninsula, Mindanao and the country cannot be understated.

Production of sardines in Zamboanga Peninsula

From 2006 to 2015, Zamboanga Peninsula contributed significantly to total sardine production of the Philippines sharing an annual average of 47 percent in volume and 39 percent in value of output (Appendix Table 4). In terms of volume, the share of sardine production of Zamboanga Peninsula to national production grew at an annual average of 3 percent. The share was highest at 55 percent in 2009 and lowest at 36 percent in 2007. In terms of value, the share of sardine production of Zamboanga Peninsula to national production also grew at an annual average of 3 percent. The share was highest at 44 percent in 2008 and 2009 and lowest at 29 percent in 2007. Over time, in both volume and value, the trend in national production of sardines generally mirrored that of Zamboanga Peninsula confirming the primary importance of the region in national sardine production (Appendix Figures 3 and 4).

As in the case nationally, sardine fishing is also done by both municipal and commercial fishermen in the Zamboanga Peninsula. From 2006 to 2015, Sardine production in the region has

been composed mainly of commercial fishing which contributed 84 percent in volume and 85 percent in value of production on average annually (Appendix Table 5). These figures are higher than those registered for the Philippines as a whole (see Appendix Table 1). Thus, production-wise, sardine fishing is more of a commercial industry in the region than in the Philippines. Furthermore, Average annual growth rate (AAGR) in the production of sardine during the period was higher in commercial fishing in the region (11 percent in volume and 14 percent in value) than in the Philippines (see Appendix Table 1). Hence, the sardine industry is more of a growth industry in the region than nationally.

From 2006 to 2015, sardine production in the Zamboanga Peninsula has been composed of Spotted sardinella (Tamban) which contributed 89.2 percent in volume and 88.8 percent in value of production followed by Fimbriated Sardines (Tunsoy) which added 10.5 percent and 10.9 percent and Round Herring (Tulis) which shared 0.3 percent and 0.3 percent, respectively (Appendix Table 6). Hence, the contribution of Tamban to total sardine production is much more in the region than in the Philippines as a whole (see Appendix Table 2). Furthermore, the production of Tamban is growing at higher annual rates in the region (9.6 percent in volume and 11.9 percent in value) than in the country (see Appendix Table 2). Hence, it can be argued that Tamban is more of a growth species in the region than nationally.

The Closed season strategy

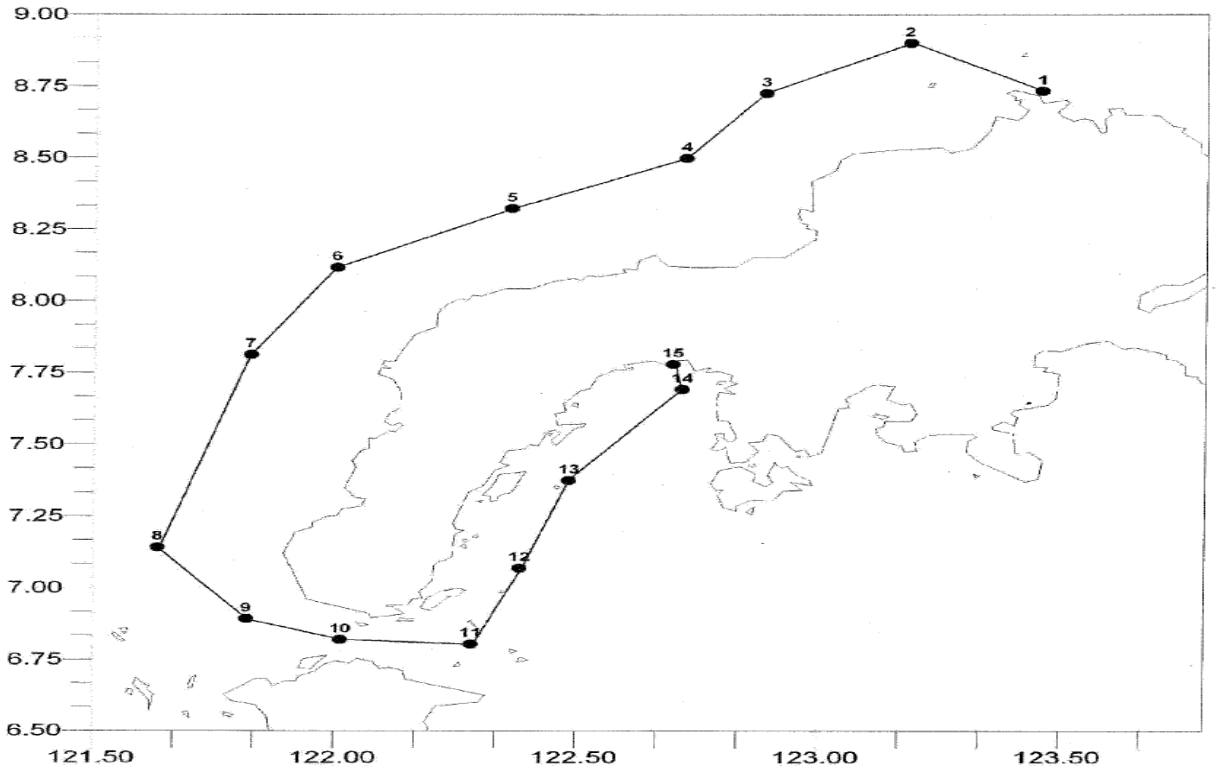
While the contribution of the Zamboanga sardine industry to the local and national economies is significant, the sardine catch steadily declined over the last decade of the 2000s due to overfishing. This observation has been cited in some recent works (e.g. Lunod-Carinan and Narvaez 2016, Espejo 2013)[5] as well as in the media and is mentioned as a major constraining factor in the sustainable development of the sardine industry. To help address the problem, in 2010, the government and sardines producers agreed to close the sardine fishing area to commercial fishing[6] during the spawning season in order to allow the stocks to recover. Consequently, by virtue of Joint Administrative Order (JAO) No. 1 of the Department of Agriculture (DA) and the Department of Interior and Local Governments (DILG), a three-month closed season for the conservation of sardine in East Sulu Sea, Basilan Strait and Sibugay Bay covering an area of approximately 22,260 square kilometers, was implemented starting December 2011 to 1 March 2012 (Figure 6)[7].

[5] No detailed empirical and quantitative modelling work, however, has been encountered which dealt specifically on the overfishing of sardines in the Zamboanga Peninsula.

[6] Municipal fishing was not covered by the ban so as not to deprive them of their livelihood. Besides, municipal catch of sardines was considered marginal compared to commercial catch.

[7] The JAO was supposed to take effect from 1 November 2011 to 1 February 2012 and every year thereafter for three years, but a win-win compromise with the sardine industry stakeholders moved the implementation to 1 December 2011 to 1 March 2014 (De Guzman 2014).

Figure 6: Area covered by the closed season for commercial sardine operation in the Zamboanga Peninsula



Source: De Guzman (2014)

One of the developments which hastened the implementation of the closed season in Zamboanga was the decision of the commercial sardine fishing operators in the area, particularly that of the Southern Philippines Deep Sea Fishing Association (SOPHIL), to go into voluntary closed season themselves even if the government does not decide to impose one. In addition, studies[8] revealed that the sardine stock was already overfished and that the peak months for sardine spawning are from November to January, a time when the spawners and their eggs need protection. Furthermore, the seasonal ban is a result of recommendations from the Sulu-Celebes Sea-Sustainable Fisheries Management Project (SCS-SFMP) which is the first regional collaborative project of the Sulu-Sulawesi Marine Ecoregion (BM 2014). The closed season specifically prohibits commercial fishing of sardines in the said area to allow mature sardines to reproduce and their young to grow. The penalty for violators are imprisonment of six months and one day to six years, or fine of P6,000 and forfeiture of the catch, with administrative penalty of cancelation of fishing boat and gear license.

Although many in the private sector supported the closed season, its imposition was initially met with skepticism by others before its implementation. Protesters from both the fisherfolk sector and the canning industries went in troops to oppose the closed season (Remate

[8] An important study which served as basis was the BFAR-NFRDI Regional Assessment of Small Pelagic Fisheries in Region IX.

2013). On its second year, however, a hundred percent compliance has been observed from the stakeholders due to the positive results yield in the previous year. In particular, data from the Bureau of Agricultural Statistics (BAS) showed a significant increase of captured sardines in the Zamboanga Region with a total of 156,153.51 metric tons in 2012 compared to 2011's 146,835.66 metric tons. The highly favorable rate of compliance to the fishing ban among the private sector can also be attributed to strict law enforcement undertaken by BFAR and other relevant government agencies.

In 2004, after three years of the closed season, the sardine industry in Zamboanga itself recommended for its continued implementation. The then JAO became BFAR Administrative Circular (BAC) 255[9] after it was deliberated and approved by the National Fisheries Aquatic Resources Management Council (NFARMC). BAC 255 provided for the creation of a Technical Working Group (TWG) to conduct research and peer review of the closed season and provide recommendations to the BFAR Director and the NFARMC for purposes of policy adjustments. Being a multi-stakeholder forum, the TWG is composed of representatives from the provincial fishing industries of Zamboanga del Norte, Zamboanga del Sur, Zamboanga Sibugay, and the Autonomous Region for Muslim Mindanao (ARMM); canning industry; bottled sardines industry; village type processors; academe; DOST; DTI; DOLE; PNP-Maritime Group; PCG; local government units of Zamboanga Peninsula and ARMM; BFAR-CO; BFAR-NFRDI; BFAR 9; BFAR-ARMM; Industrial Group of Zamboanga (IGZI); and, labor sector. Thus, practically all of the stakeholders in the sardine industry are presented.

Among the significant outcomes of the closed season are as follows: increased sardine production in general during the years it was implemented; increased number and sizes of spawners and sardine eggs; increased catches of high-priced fish species like talakitok (*Caranx sp.*) and tuna in Zamboanga Del Norte and in Labuan, Zamboanga City; and, spill-over effects of increased sardine catches in Tawi-Tawi, Panguil Bay, Palawan and Davao (De Guzman 2014). According to key informants in the industry, while 2011 was the worst, they had noted an improvement and recovery in catch in 2013. In 2014, however, they observed that while catch is abundant at the start of the fishing season (March), they are relatively smaller in size compared to what the canneries require. The year 2015 is the best so far, according to the industry. Canneries also cited that they no longer resort to importing raw sardines to augment supply starting 2015.

The successful implementation of the closed season in the Zamboanga Peninsula inspired other local government units (LGUs) to follow suit. For instance, a similar three-month closed season strategy for sardines, herrings and mackerels was implemented in the Visayan Sea starting 2012 as earlier mentioned. The Davao Gulf followed suit in 2013 when it declared a closed season

[9] Section 2 of BAC 255 prohibits "any person, association, or corporation to kill or catch, or cause to be killed or caught or taken, any sardines as defined in section 1(a) in the conservation area using purse seine, ringnet, bagnet and scoopnet, or to purchase, sell, offer or expose for sale, or have in possession or under his control any sardines caught in the conservation area, during the closed season from December 1, 2014 to March 1, 2015 and every such period thereafter subject to the annual review by the NFARMC."

for small pelagic species every June to August annually. Another related recent development is the implementation of a three-month closed fishing season for galunggong fishery in Northeastern Palawan starting November 2015. Still another recent positive development in this regard is the implementation of fishing bans in Cebu and Iloilo (Espejo 2015).

Closed season challenges

From a long term ecological point of view, the imposition of closed season allows for the recovery of the fishery resource as the fish ban protects the sardine spawners and allows the little ones to grow. Looking into the human well-being aspect as espoused in the ecosystem approach to fisheries management (EAFM), however, there are some critical challenges that need to be considered.

One important challenge is the loss of jobs among commercial fishermen, cannery workers, and tin can manufacturers during the three months duration of the closed season. The commercial fishing sector makes use of the close season as the time for ship repair while retaining only 5% of their work force. For their part, canning plant reduce capacity or stop operations during the closed season. Only about 10% of cannery workers are retained to do maintenance work and accomplish year-end reports. The rest go home to their respective provinces, jobless for three months. The other half are coming from the nearby provinces of the Zamboanga Peninsula. The same fate happens to the workers of tin can manufacturers as operations are reduced, minimal stocking is practiced.

Some of the aforementioned laid-off workers and their families returned to their homes during close season. About half of them have homes located outside Zamboanga City which makes the relocation costly. These workers have to find their new source of living either in their home towns or in cities otherwise they stay idle and hard-up during the entire closed season. Those who found a new job in other places, however, usually no longer go back to their old jobs in the sardine industry creating shortage of workers during the opening of operation that the industry direly need to fill.

To help address the problem of unemployment during the closed season, the Department of Labor and Employment is implementing the DOLE Integrated Livelihood and Emergency Employment Programs or DILEEP, which has the goal to generate jobs and reduce poverty through transitional emergency employment and promotion of entrepreneurship and community enterprises (BD 2016). On the other hand, BFAR is assisting fisherfolks with their fishing gears and paraphernalia, distribution of different farm inputs such as seaweed seedlings and fingerlings, establishment of post-harvest facilities, and the availability of trainings and technical assistance for fishers. The effectiveness of these programs for alleviating the problem of unemployment, however, needs to be assessed in the case of workers of the sardine industry in Zamboanga. The fact that the unemployment problem remains at present indicates that these programs are only partially successful at best.

Another potential problem that may be related to the closed season is that the prices of sardine in the local markets might significantly increase during the 3 months that the ban is implemented. In this case, the poor would suffer because sardine is a cheap source of protein. It

was noted, for instance, that in 2011, when the ban was first implemented, some sardine manufacturing companies have raised their prices before the early closing of fishing season (FOODRECAP 2011). It was not known, however, if the price increase was due to sardine scarcity or simply the profit-maximizing objectives of oligopolistic sardine companies. At any rate, although the evidence on this issue of rising sardine prices are anecdotal at present, it is potentially critical because of the important of sardines to the protein needs and food security of the poor population.

Thirdly, the costs and benefits of the implementation of the closed season in Zamboanga needs to be considered. While there are observable benefits in terms of increased sardine productivity due to the closed season, there are also real costs in terms of lost employment not only within the industry itself but also in its backward and forward linkage industries as well as increases in sardine price that need to be studied. The total costs of administering the ban also need to be considered, including those borne by government, the private sector and other relevant stakeholders. Knowing the costs attributable to each sector would highlight the importance of cost-sharing as an important ingredient to the success of the imposition of the closed season.

X. Summary and recommendations

Summary and recommendations

This paper looked into the issue of overfishing in the Philippines zeroing in on the case of the sardine industry in the Zamboanga Peninsula experience. It hypothesized that the key to effectively implementing overfishing regulations, particularly a closed season, are the active involvement of the private stakeholders in fisheries management and the promotion and enabling of effective collective actions by private stakeholders in partnership with government agencies and other relevant stakeholders to promote multi-sectoral ownership responsibility in management. The main argument put forward is that improved stakeholder participation and collection action would provide the missing stimulus for instituting more effective enforcement and coordination mechanism necessary to minimize the unintended consequence of overfishing.

To summarize, it can be argued that indeed, the effectiveness of the closed season in Zamboanga so far is brought about to a significant extent by the active involvement of the private stakeholders in fisheries management and the promotion and enabling of effective collective actions by all involved parties. Firstly, the recommendations from the SCS-SFMP and the support of BFAR provided a firm scientific basis for the implementation of the closed season. Secondly, the high compliance rate among commercial sardine fishers was brought about by the fact that at SOPHIL was among those who strongly and voluntarily pushed it even before implementation and the realization of the sardine stakeholders after the first year that the closed season works. Thirdly, the participation of both public and private stakeholders in the TWG has also enhanced the participation and involvement of all not only in the conduct research and peer review but perhaps more importantly in the policy-making and adjustment processes. Fourthly, while BFAR deploys its patrol boats to do monitoring and surveillance in the conservation area other composite teams of personnel from the PNP-Maritime Unit IX, Naval Forces Western Mindanao,

and Philippine Coast Guard (PCG) IX also assist BFAR in patrolling the area. Finally, it can be said that aside from the foregoing, the monitoring and surveillance function has been enforced with the private sector policing their own ranks as well.

As caveat, it is emphasized that the sardine industry in Zamboanga is just a case in point and the aforementioned conclusions must not be taken to hold true for many other kinds of fisheries in general. Obviously, the closed season would have a higher chance of success where there are a limited number of commercial fishermen exploiting a confined and clearly defined fishing ground, as in Zamboanga. However, it may not succeed in other fisheries wherein there are a large number of fishermen, commercial and municipal, exploiting an expansive and not clearly defined fishing ground, among others. In such case and for one, the transaction costs of a closed season may be too high to offset whatever gains that can be generated from it. Enough said that the findings here may only apply to other closely similar cases and not in a general sense.

Recommendations

On the issue of unemployment caused by the closed season, one option that can be considered is to impose a tax on the sardine harvest, the proceeds of which can then be used in the development of employment programs for displaced fishermen and other workers in the sardine industry. The appropriate tax to be imposed needs a separate study but this should be at a level that is equitable but at the same time does discourage the efficient functioning of the industry. Over the long-term, the use of the system of individually transferable quotas (ITQs) should also be studied seriously and considered for application. Here, the government sets the overall, annual allowable catch, equal to the efficient catch, for the fishery, and allocates this catch to fishermen in the form of quotas that entitle holders to catch a specified quantity of fish per year, and allows the fishermen to buy and sell the quotas (Stavins 2011). The ITQ system has been shown to work in other countries and could work as will in the Philippine Sardine industry.

On the issue that the prices of sardine in the domestic markets might significantly rise during the months that the closed season is implemented, further studies are needed to determine if this is indeed true. In the case that it is, fish substitutes for sardines in the market can be developed, perhaps through aquaculture. The culture of cheap fish species like tilapia and even milkfish can be promoted in the areas affected by the ban to replace the lost supply from sardines due to the closed season. The primary processing of sardines and other fish species into dried or salted products which last longer may also be promoted in communities so the steady supply of cheap fish protein is assured even during the closed season. Thirdly, Municipal fishermen who are not covered by the closed season should be continuously supported by appropriate incentives by the local governments so that their catch of sardines and other species are enhanced.

Needless to say, it would be important that government programs, including the closed season in the Zamboanga Peninsula, be evaluated in terms of their costs and benefits to determine their net contributions to the sardine industry and the economy. Over a reasonable

amount of time, the closed season strategy can undergo and impact assessment that looks into the economic, social, environmental, institutional and other important effects of the program. It is by determining the net benefits and impacts of the program that the government and the local communities can determine with certainly whether it is indeed pursuing as a long-term approach to the problem of overfishing in the country. This is particularly important because the closed season strategy may not be the optimal solution of overfishing over the long term (Stavins 2012).

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Appendices

Tables

Table 1: Volume and Value of Commercial, Municipal and Total Sardine Production in the Philippines, 2006-2015

Year	Volume (in metric tons)			Value (in thousand pesos)		
	Commercial	Municipal	Total	Commercial	Municipal	Total
2006	196,483.39	112,557.61	309,041	4,241,038.78	2,595,451.9	6,836,490.68
2007	192,078.98	126,137.67	318,216.65	4,046,103.4	2,928,566.23	6,974,669.63
2008	238,781.69	136,200.4	374,982.09	5,902,851.2	3,675,540.21	9,578,391.41
2009	340,086.46	132,220.55	472,307.01	7,460,620.37	3,991,411.45	11,452,031.82
2010	324,636.75	127,586.87	452,223.62	7,477,898.24	3,626,459.93	11,104,358.17
2011	221,860	120,571.14	342,431.14	6,863,794.95	3,886,188.44	10,749,983.39
2012	225,153.4	123,619.71	348,773.11	6,504,743.68	4,106,492.93	10,611,236.61
2013	208,087.47	117,592.26	325,679.73	5,955,897.73	4,043,355.56	9,999,253.29
2014	245,226.18	110,837.36	356,063.54	7,063,050.23	3,910,799.62	10,973,849.85
2015	261,871.78	118,438.81	380,310.59	7,046,350.09	3,962,635.84	11,008,985.93
Total	**2,454,266.1**	**1,225,762.38**	**3,680,028.48**	**62,562,348.67**	**36,726,902.11**	**99,289,250.78**
Percent share	**67%**	**33%**	**100%**	**63%**	**37%**	**100%**
AAGR	**5%**	**1%**	**3%**	**7%**	**5%**	**6%**

Source of data: PSA

Table 2: Volume and Value of Sardine Production in the Philippines, by Species, 2006-2015

	Volume (in metric tons)			
Year	**Fimbriated sardines (Tunsoy)**	**Spotted sardinella (Tamban)**	**Round herring (Tulis)**	**Total**
2006	89,164.93	209,644.63	10,231.44	309,041.00
2007	100,410.70	206,910.74	10,895.21	318,216.65

2008	137,564.51	235,670.49	11,425.60	384,660.60
2009	137,564.51	324,128.27	10,614.23	472,307.01
2010	108,015.46	334,030.26	10,177.90	452,223.62
2011	98,794.12	232,907.42	10,729.60	342,431.14
2012	95,528.76	246,057.94	7,186.41	348,773.11
2013	89,136.27	229,234.88	7,308.58	325,679.73
2014	93,269.83	256,096.49	6,697.22	356,063.54
2015	83,842.34	290,654.57	5,813.68	380,310.59
Total	**1,033,291.43**	**2,565,335.69**	**91,079.87**	**3,689,706.99**
Percent share	**28%**	**70%**	**2%**	**100%**
AAGR	**0%**	**5%**	**-5%**	**3%**
	Value (in thousand pesos)			
Year	**Fimbriated sardines (Tunsoy)**	**Spotted sardinella (Tamban)**	**Round herring (Tulis)**	**Total**
2006	2,014,691.79	4,467,856.44	353,942.45	4,821,798.89
2007	2,313,947.94	4,283,810.89	376,910.80	6,974,669.63
2008	3,287,105.12	5,845,894.16	445,392.13	9,578,391.41
2009	3,842,307.49	7,116,128.33	499,648.62	11,458,084.44
2010	2,991,525.60	7,623,608.74	489,223.83	11,104,358.17
2011	3,151,683.62	7,055,765.58	542,534.19	10,749,983.39
2012	3,256,771.42	6,996,836.17	357,629.02	10,611,236.61
2013	3,221,273.87	6,406,950.51	371,028.91	9,999,253.29
2014	3,566,960.42	7,051,548.97	355,340.46	10,973,849.85
2015	3,015,976.81	7,664,279.23	328,729.89	11,008,985.93
Total	**30,662,244.08**	**64,512,679.02**	**4,120,380.30**	**97,280,611.61**
Percent share	**32%**	**66%**	**4%**	**100%**
AAGR	**6%**	**7%**	**0%**	**11%**

Note: Spotted sardinella is also called Indian sardine in some data sources and literature.
Source of data: PSA

Table 3: Volume and Value of Sardine Production in the Philippines, by Species, by Region, 2015

	Volume (in metric tons)				
Region	**Fimbriated sardines (Tunsoy)**	**Spotted sardines (Tamban)**	**Round herring (Tulis)**	**Total**	**Percent to total**
CAR	0	0	0	0	0%
R1	54.18	2,19.83	101.36	375.37	0%

R2	729.26	799.1	88.27	1,616.63	0%
R3	2,922.18	255.5	64.58	3,242.26	1%
R4A	6,303.75	7,118.58	77.5	13,499.83	4%
R4B	5,130.42	9,988.84	656.84	15,776.1	4%
R5	23,890.89	11,436.06	1568.85	36,895.8	10%
R6	7,971.96	4,206.29	1703.11	13,881.36	4%
R7	1,927.42	2,342.09	46.29	4,315.8	1%
NIR (R18)	4,695.64	2,716.77	488.82	7,901.23	2%
R8	4,174.67	4,945.96	141.31	9,261.94	2%
R9	9,491.25	181,918.51	240.37	191,650.13	50%
R10	3,180.83	21,298.99	132.01	24,611.83	6%
R11	195.07	1,888.92	2.97	20,86.96	1%
R12	1,267.08	968.59	9.78	2,245.45	1%
R13	1,587.46	4,637.91	39.17	6,264.54	2%
ARMM	7,352.66	13,323.97	452.45	21,129.08	6%
NCR	2,967.62	22,588.66	0	25,556.28	7%
Total	**83,842.34**	**290,654.57**	**5813.68**	**380,310.59**	**100%**
Percent share	**22%**	**76%**	**2%**	**100%**	
	Value (in thousand pesos)				
Region	**Fimbriated sardines (Tunsoy)**	**Spotted sardines (Tamban)**	**Round herring (Tulis)**	**Total**	**Percent to total**
CAR	0	0	0	0	0%
R1	3,597.69	15,375.16	7,257.14	26,229.99	0%
R2	46,306.74	50,155.27	5,531.04	101,993.05	1%
R3	132,958.41	17,809.54	5,072.19	155,840.14	1%
R4A	196,200.07	234,221.43	5,801.4	436,222.9	4%
R4B	181,375.95	346,377.74	23,899.49	551,653.18	5%
R5	861,097.87	338,943.93	73,910.15	1,273,951.95	12%
R6	340,371.44	162,797.71	126,569.52	629,738.67	6%
R7	57,001.25	94,045.82	2,523.73	153,570.8	1%
NIR (R18)	211,740.72	139,841.36	30,003.08	381,585.16	3%
R8	172,676.13	232,900.36	8,460.07	414,036.56	4%
R9	216,329.19	4,354,055.85	8,564.65	4,578,949.69	42%
R10	116,459.77	558,168.64	11,304.56	685,932.97	6%
R11	7,138.93	65,718.18	282.6	731,39.71	1%
R12	29,786.29	47,222.69	477.91	77,486.89	1%
R13	102,167.97	143,834.83	2,368.75	248,371.55	2%
ARMM	199,190.1	387,711.67	16,703.61	603,605.38	5%
NCR	141,578.29	475,099.05	0	616,677.34	6%

Total	**3,015,976.81**	**7,664,279.23**	**328,729.89**	**11,008,985.93**	**100%**
Percent share	**27%**	**70%**	**3%**	**100%**	

Note: NIR is Negros Island Region.
Source of data: PSA

Table 4: Volume and Value of Sardine Production in the Philippines and Zamboanga Peninsula, 2006-2015

	Volume (in metric tons)			Value (in thousand pesos)		
Year	**Philippines**	**Zamboanga Peninsula**	**Percent to Philippines**	**Philippines**	**Zamboanga Peninsula**	**Percent to Philippines**
2006	309,041.00	125,469.69	41	6,836,490.68	2,277,704.75	33
2007	318,216.65	113,563.02	36	6,974,669.63	2,047,170.87	29
2008	374,982.09	161,905.97	43	9,578,391.41	3,546,937.60	37
2009	472,307.01	261,420.03	55	11,452,031.82	4,982,945.54	44
2010	452,223.62	241,542.28	53	11,104,358.17	4,882,762.60	44
2011	342,431.14	146,835.66	43	10,749,983.39	4,276,424.45	40
2012	348,773.11	156,143.01	45	10,611,236.61	3,917,217.45	37
2013	325,679.73	151,720.32	47	9,999,253.29	3,563,659.94	36
2014	356,063.54	173,712.61	49	10,973,849.85	4,206,830.88	38
2015	380,310.59	191,650.13	50	11,008,985.93	4,578,949.69	42
Total	**3,680,028.48**	**1,723,962.72**	**47%**	**99,289,250.78**	**38,280,603.77**	**39%**
AAGR	**3%**	**8%**	**3%**	**6%**	**11%**	**3%**

Source: PSA

Table 5: Volume and Value of Sardine Production in Zamboanga Peninsula, by Subsector, per Year, 2006-2015

Year	Volume (in metric tons)			Value (in thousand pesos)		
	Commercial	**Municipal**	**Total**	**Commercial**	**Municipal**	**Total**
2006	98,247.3	27,222.39	125,469.69	1,758,208.47	519,496.28	2,277,704.75
2007	87,929.6	25,633.42	113,563.02	1,514,906.13	532,264.74	2,047,170.87
2008	135,340.08	26,565.89	161,905.97	2,944,094.2	602,843.4	3,546,937.6

2009	237,165.62	24,254.41	261,420.03	4,361,759.82	621,185.72	4,982,945.54
2010	216,596.66	24,945.62	241,542.28	4,395,955.24	486,807.36	4,882,762.6
2011	122,927.82	23,907.84	146,835.66	3,725,971.3	550,453.15	4,276,424.45
2012	130,297.99	25,845.02	156,143.01	3,342,459.29	574,758.16	3,917,217.45
2013	120,676.41	31,043.91	151,720.32	2,945,607.64	618,052.3	3,563,659.94
2014	144,937.99	28,774.62	173,712.61	3,627,314.34	579,516.54	4,206,830.88
2015	159,814.67	31,835.46	191,650.13	3,987,410.53	591,539.16	4,578,949.69
Total	**1,453,934.14**	**270,028.58**	**1,723,962.72**	**32,603,686.96**	**5,676,916.81**	**38,280,603.77**
Percent share	**84%**	**16%**	**100%**	**85%**	**15%**	**100%**
AAGR	**11%**	**2%**	**8%**	**14%**	**2%**	**11%**

Source of data: PSA

Table 6: Volume and Value of Sardine Production in Zamboanga Peninsula, by Species, 2006-2015

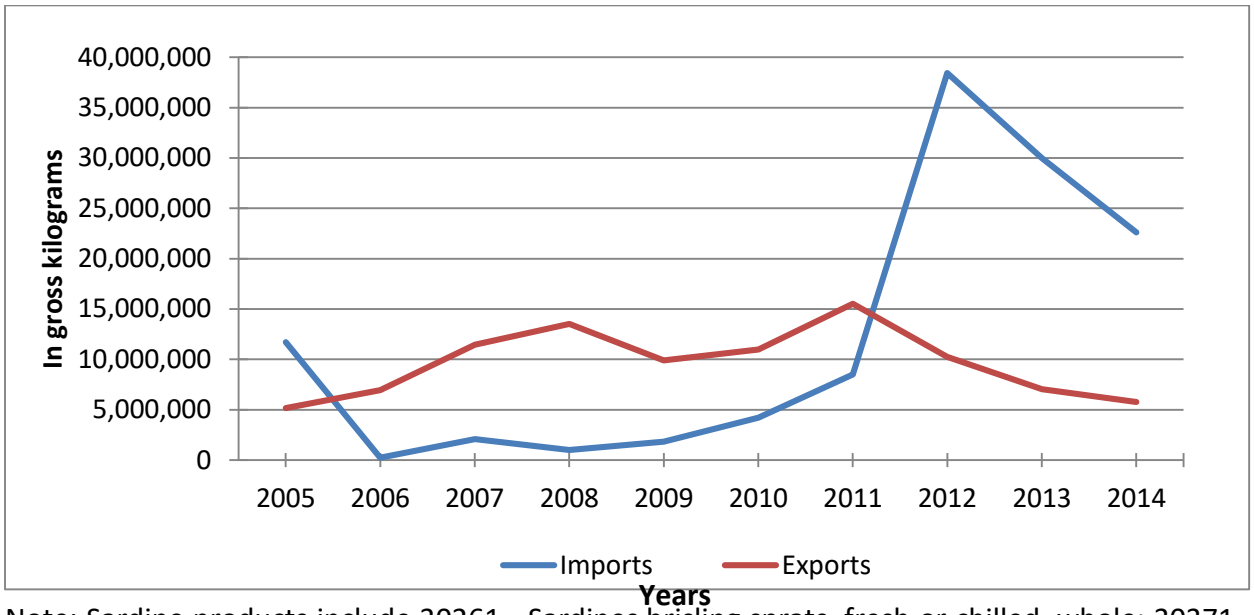
	Volume (in metric tons)			
Year	**Fimbriated sardines (Tunsoy)**	**Indian sardines (Tamban)**	**Round herring (Tulis)**	**Total**
2006	12,543.11	112,057.63	868.95	125,469.69
2007	14,274.47	98,517.15	771.4	113,563.02
2008	35,010.69	126,256.65	638.63	161,905.97
2009	38,792.25	222,271.81	355.97	261,420.03
2010	17,925.3	223,255.82	361.16	241,542.28
2011	13,845.67	132,600.63	389.36	146,835.66
2012	12,434.69	143,319.56	388.76	156,143.01
2013	15,834.38	135,552.23	333.71	151,720.32
2014	11,613.07	161,824.52	275.02	173,712.61
2015	9,491.25	181,918.51	240.37	191,650.13
Total	**181,764.88**	**1,537,574.51**	**4,623.33**	**1,723,962.72**
Percent share	**10.5%**	**89.2%**	**0.3%**	**100.0%**
AAGR	**7.3%**	**9.6%**	**-12.0%**	**8.5%**
	Value (in thousand pesos)			
Year	**Fimbriated sardines (Tunsoy)**	**Indian sardines (Tamban)**	**Round herring (Tulis)**	**Total**
2006	271,410.29	1,990,933.76	15,360.7	2,277,704.75
2007	319,256.13	1,710,017.31	17,897.43	2,047,170.87
2008	785,630.9	2,743,416.16	17,890.54	3,546,937.6
2009	875,526.47	4,097,570.15	9,848.92	4,982,945.54
2010	369,070.55	4,505,334.19	8,357.86	4,882,762.6

2011	379,215.2	3,886,203.78	11,005.47	4,276,424.45
2012	309,668.42	3,594,661.06	12,887.97	3,917,217.45
2013	377,845.52	3,175,618.56	10,195.86	3,563,659.94
2014	277,636.81	3,918,663.08	10,530.99	4,206,830.88
2015	216,329.19	4,354,055.85	8,564.65	4,578,949.69
Total	**4,181,589.48**	**33,976,473.9**	**122,540.39**	**38,280,603.77**
Percent share	**10.9%**	**88.8%**	**0.3%**	**100.0%**
AAGR	**8.3%**	**11.9%**	**-3.5%**	**11.0%**

Source: PSA

Figures

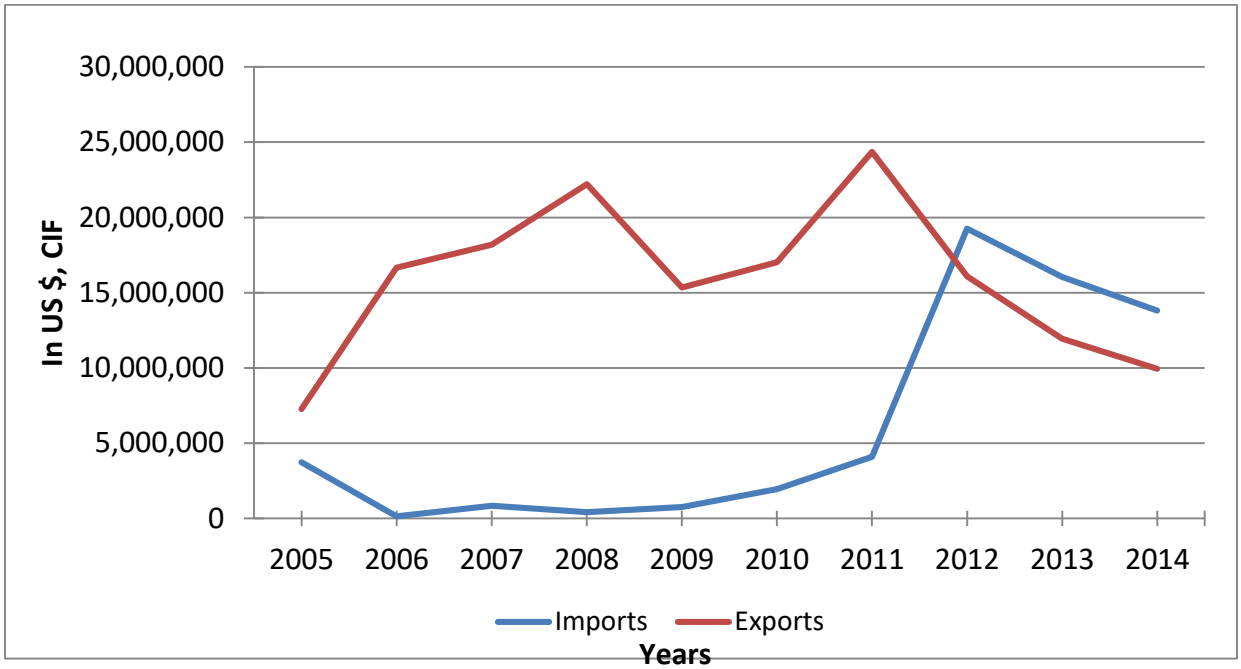
Figure 1: Volume of Imports and Exports of Sardines in the Philippines, 2005-2014



Note: Sardine products include 30261 - Sardines,brisling,sprats, fresh or chilled, whole; 30371 - Sardines,brisling,sprats, frozen, whole 160413 - Sardine, brisling, sprat prepared/preserved,not minced

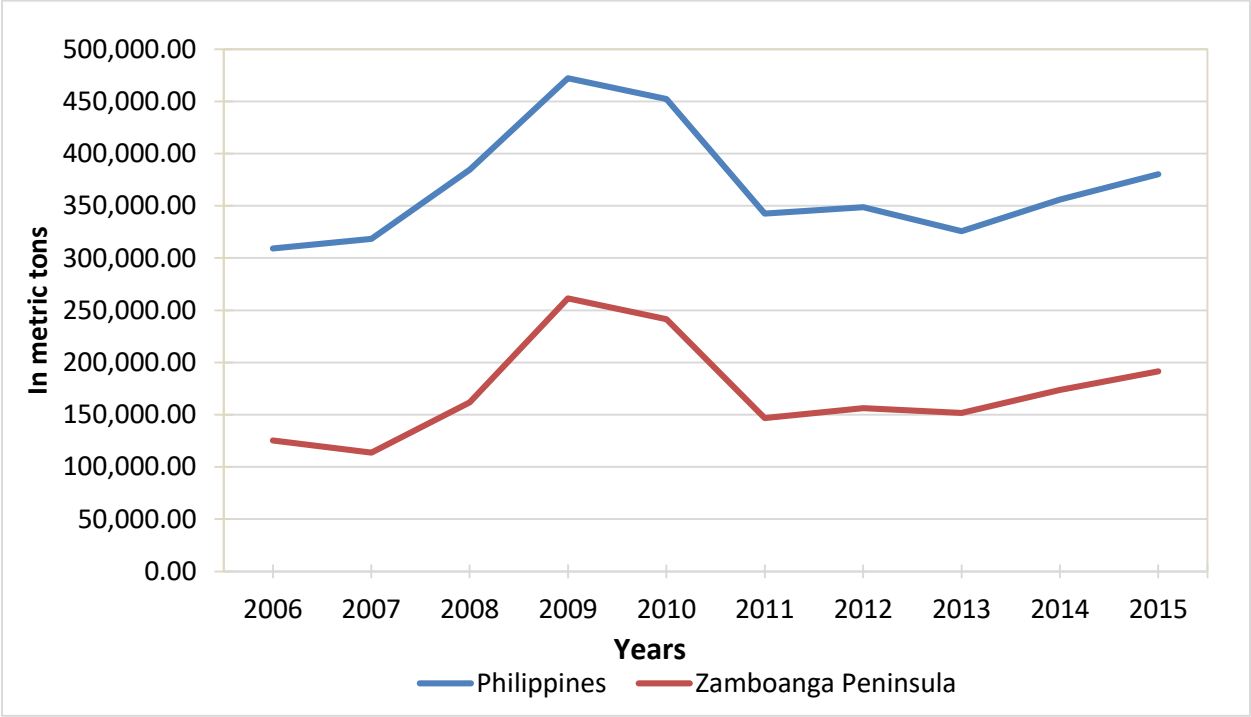
Source of data: FTSP (Various Years)

Figure 2: Value of Imports and Exports of Sardines in the Philippines, 2005-2014



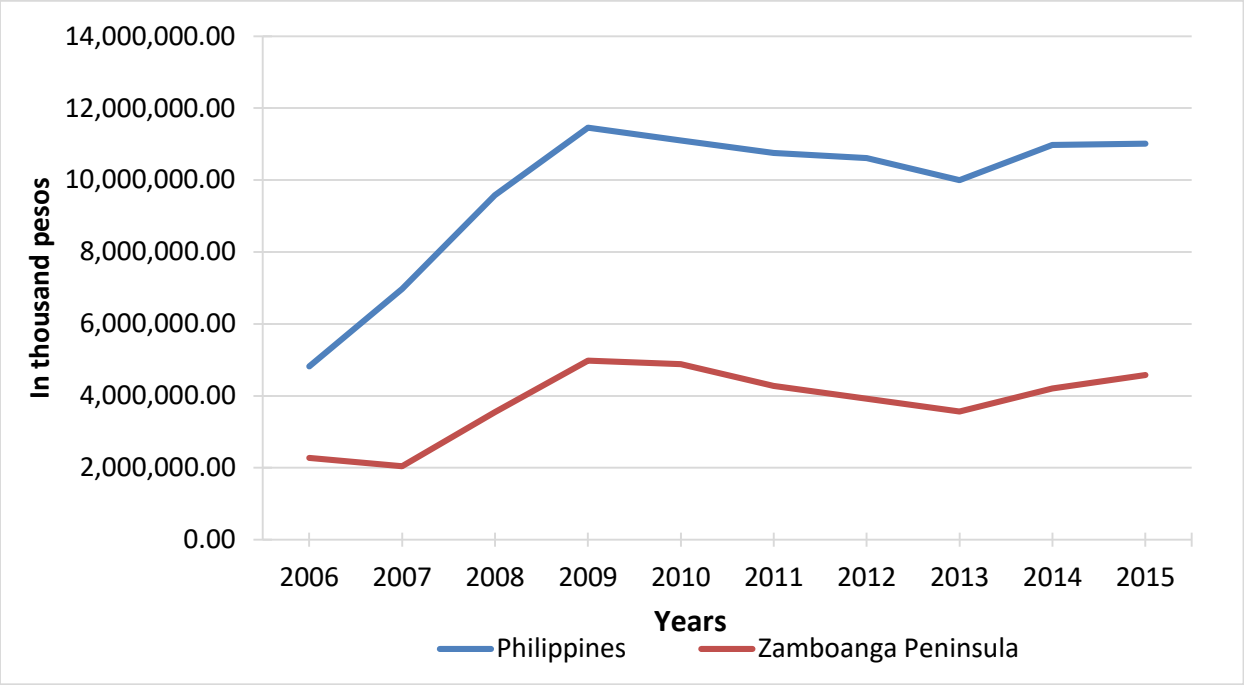
Source of data: FTSP (Various Years)

Figure 3: Volume of Sardine Production in the Philippines and Zamboanga Peninsula, 2006-2015



Source of data: PSA

Figure 4: Value of Sardine Production in the Philippines and Zamboanga Peninsula, 2006-2015



Source of data: PSA