Comparative Analysis Of Siganid (Siganus Guttatus) Value Chains From Aquaculture In Regions 1 And 2, Philippines

Rosanna D. Gonzales, Shella S. Parreño, Rosie S. Abalos, Larry A. Santos, Crisanto C. Salayog, Paul Joseph B. Ramirez, Sharon I. Celino

Abstract: Food production is everybody's concern. One of the aspects that can be looked into is the fishing sector that is a good source of livelihood and food, as well. Fishing directly from the rich Philippine natural water resources can't sustain the increasing people's demand on fish. Fish is essential to one's meal due to proteins and nutrients derived from it. To address such concern, aquaculture is deemed necessary. Aquaculture plays a significant role in increasing fish production to sustain the people's need and demand in various life aspects. In the Philippines, Regions 1(Ilocos region) and 2 (Cagayan Valley) are known growers of Siganid (Siganus guttatus). Said species can be claimed as a promising commodity due to its meat quality and taste. Along this study, the aquaculture activities; distinct features of value chains; roles and activities of the intermediate, major support, other linkages; and, the value addition contributed by each player were answered. Industry assessment and surveys were conducted to determine the market distribution of S. guttatus, thus; public officials' assistance and rural folks were tapped to trace the major producing areas. From the identified regions, a value chain map wherein traders (wholesalers) served as the link between chain players was established. Value chain analysis (VCA) framework was used in data analysis. Results of the survey were presented and validated in a focus group discussion (FGD) with the participants representing different actors of the siganid aquaculture chain and support agency enablers. Results showed that the production environments of siganid aquaculture, farming systems and distinct features of value chains vary in both regions, however; they do not differ on farming technology and production scale. There was a significant interplay between and among the intermediate suppliers, key role players, support services and other linkages in both regions. The product flow showed that market distribution was limited since it was just within the provinces of identified regions. With regards to value addition, grow-out operators S. guttatus contributed most in region one (1) while fry collectors added more than half of the total share in Cagayan Valley.

IndexTerms: Analysis, Aquaculture, Philippines, Siganid, Value chains

1 INTRODUCTION

FISHING is a global industry [1], but small-scale fisheries and aquaculture make critical contributions to development employing over 41 million people worldwide, the vast majority of whom live in developing countries. Concerning food security and nutrition, fish is a source of nutrients for the poor and is animal protein [2]. Fish is among the most widely traded foodstuff in the world with 37 percent of fish produced (live weight equivalent) sold internationally [3]. In 2006, exports of fish valued at USD 85.9 billion [3], more than half of which originated in developing countries [4]. In 2002, net exports of fish generated more foreign exchange earnings for developing countries than rice, coffee, sugar, and tea combined [5]. Aquaculture has grown by 6.9 percent per annum since 1970 [3] and now provides half of global fish supply [4],[5]. In a thematic paper [6] proposed that as global demand continues to grow, there are opportunities for poverty reduction within the sector if the supply of fish caught in the wild. It will help and can promote sustainability in aquaculture areas [9].

- *Rosanna D. Gonzales_Shella S. Parreño, Rosie S. Abalos and Larry A. Santos are faculty members of Pangasinan State University.*
- *Crisanto C. Salayog is a faculty member of Colegio de San Juan de Letran-Manaoag.*
- *Paul Joseph B. Ramirez is a WorldFish research fellow and a faculty member of the University of the Philippines-Los Banos (UPLB), Laguna.*
- *Sharon I. Celino is an employee from the Bureau of Fisheries and Aquatic Resources (BFAR) of Region 2.*

On the other hand, Aquaculture Steering Committee of the Fisheries Department of the Food and Agriculture Organization (FAO) of the United Nations defined aquaculture as the farming of aquatic organisms, including fish, mollusks, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also involves individual or corporate ownership of the stock cultivation. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture appropriate licences, are the harvest of fisheries [10]. Aquaculture in the Philippines is carried out in three major aquatic environments: brackishwater, freshwater, and marine. Brackishwater aquaculture is limited to intertidal flats, mangrove swamps, and estuarine areas [9]. It is the largest regarding extent and value of production. Average annual production of brackishwater fishponds, pens, and cages from 2003 to 2005 reached 265,000 tons representing 16% of total aquaculture production and more than half of the food-fish output [11]-[12]. Aquaculture is as diverse as agriculture. Table 1 indicates that at least 18 species with only 6 commodity groups or species are farmed contributing substantially either by volume or value terms to total production: seaweeds, milkfish, tilapia, penaeid shrimps (principally the black tiger shrimp, Penaeus monodon), mussels and mud crabs (Scylla spp.). However, one of the species that are becoming important in the fisheries sector are siganids (Table 1), which are captured [13] or cultured [14]. They are olive-green in color with characteristic small white spots on its sides. Some of the most common species in the Philippines, particularly in Region 1 and Region 2 are Siganus canaliculatus and Siganus guttatus. Traditionally, S. guttatus and S. vermiculatus are cultured in brackishwater ponds. Reports showed that they attain a marketable size of 150 grams (g) within 5–7 months. These species are preferred for culture

because of their herbivorous food habits, fairly good growth, and economic value [15].

Table 1. *Volume and Value Terms of Species*

Species	Volume		Value	
	Quantity (t)	Share (%)	Amount ('000 P)	Share (%)
ALL SPECIES	**1,895,847**	**100**	**49,169,788**	**100**
Seaweeds	1,338,597	70.6	6,040,899	12.28
Milkfish	289, 153	15.25	17,577,207	35.74
Tilapia	163,003	8.59	8,900,613	18.1
Black Tiger Shrimp	37,721	1.98	13, 623,435	27.7
Mussels	20,159	1.06	138,863	0.28
Carps	17,228	0.9	365,705	0.74
Oysters	16,495	0.87	105,974	0.21
Mud Crab	6,861	0.36	1,694,588	3.44
Catfish	2,355	0.12	146,546	0.29
White Shrimp	1,519	0.08	158,357	0.32
Groupers	273	0.01	101,566	0.2
Siganids	151	0.01	22,389	0.04
Other Species	2,334	0.12	293,646	0.59

The lowest production was in 1996, which is considered to be the beginning of siganid aquaculture in the Philippines. Lower siganid aquaculture production was recorded in 2005 (150.89 metric tons) and 2011 (186.20 metric tons). Region 1 dominated siganid production in the country in 2014 (Figure 3), with Pangasinan and Ilocos Norte accounting for about 92 percent of the total (Figure 4). In Region 2, Cagayan dominated production with about 84 percent of the total in 2014. Certain irregularities in the trend of harvest can be noted across provinces in 2012–2014 (Figure 5).

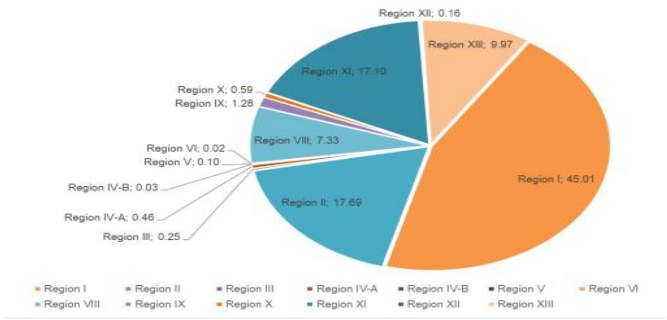

Fig. 3. *Average percentage share in total production by region, Philippines Source: PSA[23]*

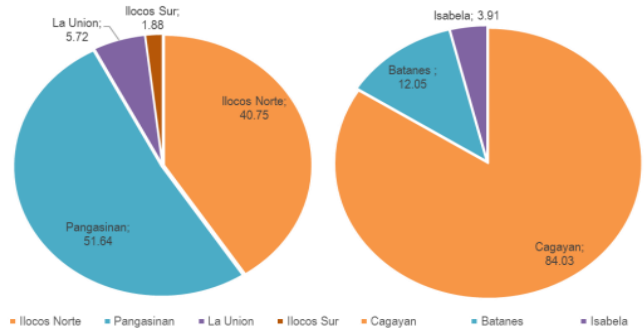

Fig. 4. *Percentage share in siganid production in Region 1 (left) and Region 2 (right), by province (2014) Source: PSA[23]*

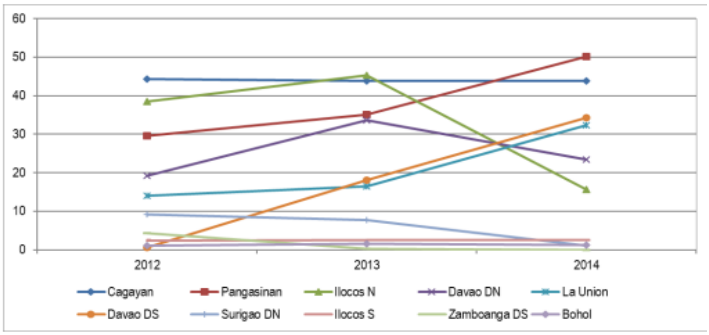

Fig. 5. *The volume of production by major producing province, 2012–2014 Source: PSA[23]*

The Philippine siganid production by culture environment aquaculture in the Philippines that estimated that mangrove areas converted to fishponds in 1950–1973 range from 1,000 to 24,000 hectares (ha) per year. Furthermore, siganids are cultured in either brackishwater ponds or cages since both methods were found to be economically feasible [24]. among others [25]. Philippine aquaculture statistics indicate the culture of 18 species, of which eight species (besides seaweeds) contribute substantially to the total. The primary commodities are milkfish, tilapia, shrimp, mussel, carp, catfish, mudcrab, and oyster. Some products, such as crab, siganid, grouper, and seabass, hold potential for development. The average siganid production in the different provinces of Region 1 and Region 2 show that the bulk of production is from brackish water fishponds. Ilocos Norte has high output from brackish water cages due to the high demand for siganid in the area. Region 1 or Ilocos Region (41.70%) has the highest share followed by Region 2 or Cagayan Valley (16.38%). The two areas are considered the most appropriate study sites because of their contribution to siganid (S. guttatus) production, which contributed positively to aquaculture production of the country. Ilocos Region uses the pond production system while Cagayan Valley uses the cage production system. The volume of production in aquaculture by Region 1 and Region 2. Pangasinan has consistently ranked first in siganid pond production because of the commodity's geographic suitability. Ilocos Norte has gradually increased its production, making the province second in the list which confirms the National Integrated Fisheries Technology Development Center chief's statement in Inquirer Northern Luzon (2012) that "among the many species of fish for aquaculture, Malaga is ideal because it

eats planktons; of all fish, Malaga is just like a goat, just leave it there and it grows. So, even scientists from developed countries now focused on Malaga as an aquaculture species." To date, the Philippines remains the leading S. guttatus (Figure 7) producer in the world, with 226 metric tons of production in 2007. The province of Cagayan ranked first regarding cage production. The cage aquaculture method is an alternative livelihood to reduce the illegal "bule-bule" fishing activity in the area and to conserve their fishing ground [16].

Fig.7. *Cultured Siganus guttatus [26]*

OBJECTIVES OF THE STUDY

The study analyzed the Siganid Value Chains from Aquaculture in Regions 1 and 2, Philippines. It (1) identified the kind of aquaculture activities in regions 1 and 2 along: production environments, farming systems, farming technology, and; production scale; (2) determined the distinct features of value chains; (3) mapped and described the roles and activities of the intermediate, major support, other linkages, and; (4) compared the shares of value addition contributed by each player.

METHODS

The value chain framework was used as the main tool in the study (figure 8) confirmed by barangay officials.

Data Gathering

The first step involved a rapid assessment of the existing aquaculture scenario in both regions wherein some support key institution officials were coordinated and interviewed personally to address the related objectives. An assessment was carried out by organizing the available literature and secondary data related to the said industry to gain an overall picture of the industry and to place the value chain analysis in proper context/ perspective. The next step was value chain mapping which was done by locating the key players at the most downstream end (i.e., exporter, processor, institutional buyer, big wholesaler or retailer) then trace the chain backward to the most upstream end (i.e., fishers, hatchery operators, feed suppliers). From the traders initially interviewed in the market, the harvesters or growers and other key players in the value chain were identified, located and interviewed. Central in the interview proper were the map, roles of intermediate suppliers, major players and other support services and linkages and the estimation of the value-addition that each player has created at each stage of the value chain. Value addition in this study refers to the difference between the sale of siganid at each stage of the value chain and the accompanying cost of all resources used in the process. Value-additions from each of the key players in the chain were estimated using a simple cost and returns analysis. Aquaculture mapping was broader as it involved the production of juveniles from hatcheries and aquaculture production activities instead of just getting the product directly from the sea. In the Philippines, the chain actors usually include the incubator and nursery operators, fishers, assemblers, wholesalers, processors, agents, retailers, and exporters, among others. The initial results of the study were presented and validated in a focus group discussion with participants that represented the different actors of the siganid value chain.

RESULTS AND DISCUSSION

The organization of presentation of results and discussion in this section follows the proper sequence of stated objectives in the study.

On Aquaculture Activities

The production environments of siganid aquaculture (brackish water) are intertidal flats, mangrove swamps, and estuarine areas. For region 1, it was identified that its production environment is on mangrove swamps while region is on estuarine areas; as to farming systems, region 1 is on earthen ponds (land-based system (waterfed ponds, irrigated or floe-throw systems, tanks and race ways) while region 2 is on shallow fish cages (water-based systems-cages and pens); in terms of farming technology and production scale both areas are known to be grow-out and semi-intensive, respectively.

On Distinct Features of Value Chains

The distinct features of value chains established as reflected in Table 3 shows that regions 1 and 2 have the same forms on product, production and distribution/marketing which are the fresh Malaga (S. guttatus) with production site on brackishwater and are distributed through market wholesalers and retailers. Regarding input provision, region 1 has multiple source while region 2 has a single source, which implies that region 1 has more source outlets compared to region 2. in Region 1 is Binmaley, Pangasinan and the most significant market outlet is Dagupan City. Wholesalers are from Pangasinan, La Union, and Ilocos Norte (Fig. 10). The customers' standard size requirement is 8 cm in length, and retailers sell an approximate volume of 10 kg per day.

Fig 10. *Product map of Region 1*

The culture of siganids in fishponds has been practiced in Binmaley, Pangasinan since the 1970's. Fish farmers used an extensive method of culture, stocking S. guttatus and S. vermiculatus at a lower stocking density of 3,000–5,000 pieces/ha and fed with algae and commercial feeds [42]. Fish cage culture at much higher stocking density is being practiced in coastal areas in Western Pangasinan. It consists of the following players: fry collector, fry trader, nursery operator, pond grower, wholesaler, and retailer. Product flow in region 1 shows that the input providers known as the fry collectors were from

Alaminos City, Pangasinan who sell an average volume of 19,500pcs per cycle at an average price of PHP 0.47 to nursery growers at Labrador, Pangasinan who sell an average of 16,800pcs at PHP0.70 to pond growers at Binmaley, Pangasinan while others were sold directly to pond growers at Binmaley, Pangasinan . Other input providers were fry traders from Dasol and Labrador, Pangasinan who sell an average of 48,770pcs/cycle at PHP 2.03 to Binmaley pond owners. Pond farmers of Binmaley, Pangasinan harvest an average of 425kgs per cycle and sold at an average price of

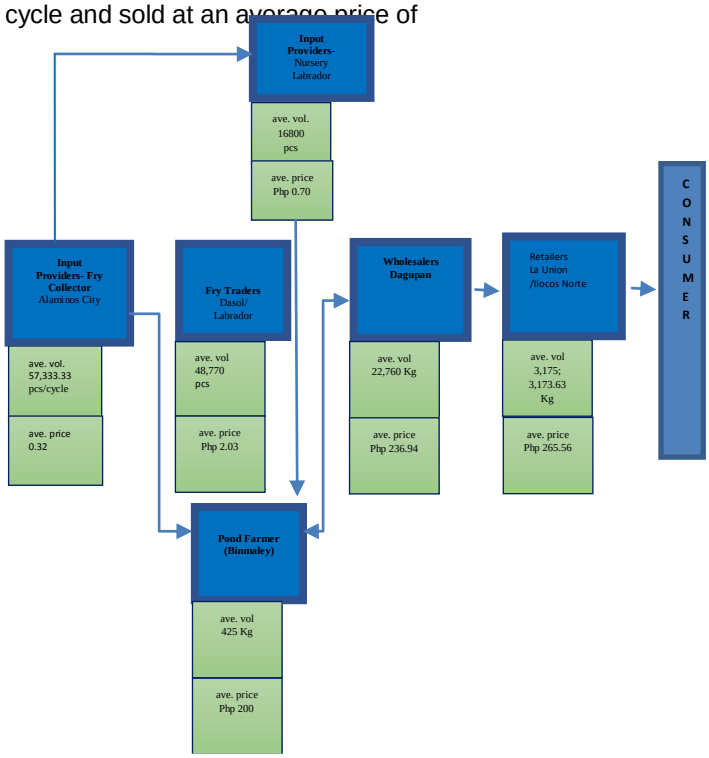

Fig. 12 *Region 1's Product Flow*

Fig. 13. *Product map of Region 2*

There have been studies on the nutritional requirements, digestive system, and food and feeding habits of siganids conducted in the Philippines but there are still no commercially available formulated diets for siganids. Some cage operators stock 100–200 S. guttatus fingerlings in grouper cages to minimize or retard the growth of algae on the nets. The siganids are then harvested with the groupers at the end of the culture period and are an added source of income for the farmers. Culture period and survival rates (Chain 3) In about 5–8 months, siganids (mainly S. guttatus) will reach the marketable size of 200–300 g if the initial stock had an average total length of about 5–6 cm. Survival rates are generally 70–80 percent. Although siganids had been and are being cultured by the private sector, the profitability of commercially culturing them in cages remains to be demonstrated [24]. Product flow in region 2 (fig. 14) shows that the input providers known as the fry collectors were from were from Minanga Weste, Buguey, Cagayan who sell an average volume of 5,733pcs per cycle at an average price of PHP 0.32 to nursery growers of the same place who also sell an average volume of 10,000pcs at PHP 0.25 to cage growers who harvest an average of 515kgs/cycle at an average price of PHP 257.50. Said harvest were sold to wholesalers of Minanga Weste and Este, Buguey, Cagayan who received an average volume of 176.56kgs/cycle and sold at an average price of PHP 274.24 to retailers from Centro and San Isidro, Buguey, Cagayan and Tuguegarao City who sell an average volume of 620.58kgs/cycle and sold at an average price of PHP 310/kg.

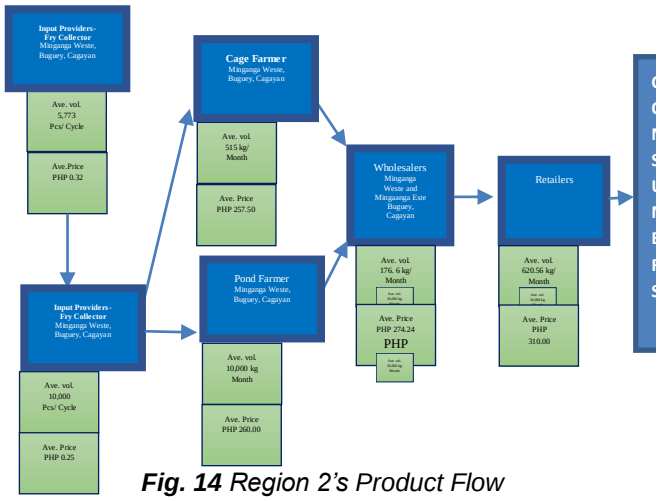

Fig. 14 *Region 2's Product Flow*

Acknowledgment

This study is one of the sub-studies developed from the main Research Project entitled "Climate Change Impacts on Value Chains of Siganid and Tilapia in Vulnerable Regions in Luzon, Philippines" led by Dr. Paul Joseph B. Ramirez (Worldfish Research Fellow) with the technical assistance of Mr. Raymond Asilo, Glaiza B. Zamora and Jheanna Marie Herbosa implemented by Worldfish-Philippine Country Office and funded by DA-BAR. Special thanks to Ms. Gloria Esteban, Mr. John Menes and Ms. Julie Ann

Conclusion and Recommendation

The production environment of siganid aquaculture in region 1 is on mangrove swamps while region 2 is on estuarine areas; as to farming systems, region 1 is through the use of earthen ponds while region 2 is on shallow fish cages. In terms of farming technology and production scale both areas are known to be grow-out and semi-intensive, respectively. On the other hand, the distinct features of value chains in regions 1 and 2 are common. However, different in input provision wherein region 1 is of multiple source while region 2 is of single source. Intermediate, major players and other support services as well as linkages can be can be better enhanced by the commodity

in-charge implementers and supervisors. Males main role in the chain established were as input providers and growers while females are identified as wholesalers and retailers. Product flow in region 1 is more complex than in region 2 due to the presence of fry traders in the chain. Region 1 has a total added value of PHP 158.41 for 1 kilogram of S. guttatus while region 2 has a total of PHP 89.87 value addition created in the production and sale of 1 kg of the same product. The grow-out operator contributed 68 percent share in region 1 while fry collectors contributed more than half (51.65%) of the 83 total share. A more comprehensive follow up study on the good practices of all the key players as well as the roles played by the intermediate and other support services and linkages between the regions in the established map and estimated value added chains can be adapted and subjected to experimental studies to further improve the S. guttatus aquaculture industry. Fisheries Council (IPFC) Working Party of Experts on Aquaculture. Bangkok, Thailand.

REFERENCES

[1]. Fisheries and Oceans Canada. (2016). "Overview." http://www.dfompo.gc.ca/international/issue-enjeu-eng.htm

[2]. Finegold, C. (2009). "The Importance of Fisheries and Aquaculture to Development." In Fisheries, Sustainability, and Development edited by P. Wramner, M. Cullberg, and H. Ackefors, 353–364. Stockholm: The Royal Swedish Academy of Agriculture and Forestry. https://www.worldfishcenter.org/ content/importance fisheries-andaquaculture-development.

[3]. Food and Agriculture Organization. (2009a). The State of World Fisheries and Aquaculture 2008. Rome, Italy: FAO.

[4]. Paquotte, P., and A. Lem. (2008). "Seafood Markets and Trade: A Global Perspective and An Overview of EU Mediterranean Countries." Options Méditerranéenes, Series B 62: 43–55.

[5]. (The) World Bank. (2005). Country Assistance Strategy for the Philippines, 2006–2008.Washington, D.C.:The World Bank.

[6]. Williams, L., and A. Rota. 2010. "Impact of Climate Change on Fisheries and Aquaculture in the Developing World and Opportunities for Adaptation." In Fisheries Thematic Paper: Tool for Project Design. http://www.ifad. org/lrkm/pub/fisheries.pdf

[7]. ———. 2009b. Multi-Agency Brief: Fisheries and Aquaculture in a Changing Climate. Rome, Italy: FAO ftp://ftp.fao.org/FI/brochure/climate_change/policy_ brief.pdf

[8]. Dulvy, N., and E. Allison. (2009). "A Place at the Table?" Nature Reports Climate Change 3: 68–70.

[9]. _____. ( ). Managing Auaculture and Its Impacts: Guidebookfor Local Government. BFAR.

[10]. _____. (1988) Seventh Session of the Indo-Pacific Chain Analysis. Rome: FAO. Accessed December 2016. http://www.fao.org/3/a-bq787e.pdf

[11]. WorldFish and PRIMEX Final Report. 2007. Final Report Submitted to the Asian Development Bank (ADB) and Bureau of Fisheries and Aquatic Resources (BFAR). Strategy for Sustainable Aquaculture Development for Poverty Reduction (ADTA-4708-PHI).

[12]. De Silva, D.A.M. 2011. Value Chain of Fish and Fishery Products: Origin, Functions and Application in Developed and Developing Country Markets. Rome, Italy: Food and Agriculture Organization.

[13]. Aypa S.M. 1995. "Aquaculture in the Philippines." In Towards Sustainable Aquaculture in Southeast Asia and Japan: Proceedings of the Seminar-Workshop on Aquaculture Development in Southeast Asia, Iloilo City, Philippines, 26–28 July 1994 edited by T.U. Bagarinao and E.E.C. Flores, 137–147. Tigbauan, Iloilo, Philippines: SEAFDEC Aquaculture Department. https://repository.seafdec.org.ph/bitstream/handle/ 10862/114/adsea94p137147.pdf?sequence=1&isAllowed=y

[14]. Pacoli, M.E. 1983. The Farming of Siganid in the Philippines. Fish Today 5 (2): 50–52.

[15]. Von Wersternhagen, H., and H. Rosenthal H. 1976. "Some Aspects of the Suitability of Various Philippine Siganid Species for Mariculture." Aquaculture (9): 297–311.

[16]. Von Wersternhagen, H., and H. Rosenthal H. 1976. "Some Aspects of the Suitability of Various Philippine Siganid Species for Mariculture." Aquaculture (9): 297–311.

[17]. Von Wersternhagen, H., and H. Rosenthal H. 1976. "Some Aspects of the Suitability of Various Philippine Siganid Species for Mariculture." Aquaculture (9): 297–311.

[18]. Bwathondi, P.O.J. 1982. "Preliminary investigations on Rabbitfish, Siganus canalicullatus, Cultivation in Tanzania." Aquaculture 27 (3): 205–210.

[19]. Cagiltay, F. 2003. "Culture of the Rabbitfish (Siganus luridus Rueppell, 1828)."Suurunleridergisi/Journal of Fisheries and Aquatic Sciences 20 (1–2)

[20]. Ayson, F., O. Reyes, and E. de Jesus-Ayson. 2014. Seed Production of Rabbitfish Siganus guttatus. Tigbauan, Iloilo, Philippines: SEAFDEC Aquaculture Department.

[21]. Ayson, F., O. Reyes, and E. de Jesus-Ayson. 2014. Seed Production of Rabbitfish Siganus guttatus. Tigbauan, Iloilo, Philippines: SEAFDEC Aquaculture Department.

[22]. BFAR. 2008. Philippine Fisheries Profile 2008. Quezon City, Philippines: Department of Agriculture-BFAR. https://www.bfar.da.gov.ph/files/img/photos/2008.pdf

[23]. PSA (Philippine Statistics Authority). 2007–2016. Fisheries Situationer. Accessed December 1, 2016. https://psa.gov.ph/content/fisheries-situationer-0

[24]. SEAFDEC/AQD (Southeast Asian Fisheries Development Center Aquaculture Department). 2009. “Is It Worth Trying? Siganid Culture.” Accessed December 2016. http://www.fftc.agnet.org/library.php?func=view&id=20110704162636

[25]. Teteilbaum, A. 2009 “Rabbitfish: A candidate for Aquaculture in the Pacific?” Accessed March 2017. https://www.spc.int/aquaculture/ index.php?option=com_ content&view=article&id=20:rabbitfish-a-candidate-for-aquaculture-in-tehpacific&catid=15:articles

[26]. https://www.google.com/search?q=malaga+fish+picture&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjO14SMyurbAhUPeysKHf9CXMQ_AUICigB&biw=1299&bih=702#imgrc=2CWsjFW7eEhYWM

[27]. Porter, Michael E., "Competitive Advantage". 1985, Ch. 1, pp 11-15. The Free Press. New York.

[28]. Kaplinsky, R., and M. Morris. 2001. A Handbook for Value Chain Research Vol. 113. Ottawa: IDRC. Accessed December 2016. http://asiandrivers.open.ac.uk/documents/ Value_chain_Handbook_RKMM_Nov_2001.pdf

[29]. Kaplinsky, R., and M. Morris. 2001. A Handbook for Value Chain Research Vol. 113. Ottawa: IDRC. Accessed December 2016. http://asiandrivers.open.ac.uk/documents/ Value_chain_Handbook_RKMM_Nov_2001.pdf

[30]. Hellin, J., and M. Meijer. 2006. Guidelines for Value Chain Analysis. Rome: FAO. Accessed December 2016. http://www.fao.org/3/a-bq787e.pdf

[31]. Hellin, J., and M. Meijer. 2006. Guidelines for Value Chain Analysis. Rome: FAO. Accessed December 2016. http://www.fao.org/3/a-bq787e.pdf