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RESEARCH ARTICLE

Catch and Trade of Sea Cucumbers in Getafe, Bohol, Philippines

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Abstract

Objective: To determine the catch and trade of sea cucumbers in Nasingin, Getafe, Bohol. **Methods:** The study utilized a descriptive survey method using a structured questionnaire to gather information from the respondents. Respondents were taken using the snowball sampling method. All the fresh samples were weighed and identified based on their genus and species level using the field guides at the landing sites for two months sampling period. Moreover, catch per unit effort (CPUE) was obtained per catching method, and then a significant difference among them was determined. **Findings:** Results revealed that there were seventeen (17) identified species of sea cucumber. Out of the seventeen (17) recorded species in this study, five (5) species were regarded in a similar study as highly exploited species. Moreover, one (1) species recorded in the survey was just classified under the ”Endangered” list of the International Union for Conservation of Nature and Natural Resources (IUCN). In terms of the catching method, respondents employed: compressor fishing, gleaning, skin diving, and by-catch using beach seine and triple net. It was also shown that compressor use attained the highest CPUE at 1.74 kg/hr. for April and 2.01 kg/hr. for May and triple net during daytime gained the least CPUE at 0 kg/hr. for April and 0.28 kg/hr. for May. Moreover, it was found that more fishers preferred to dispose of their caught sea cucumber fresh by size and or by species to the local assemblers rather than selling it dried or processed. **Novelty:** It is noteworthy that some sea cucumber species recorded in this study are still caught and traded despite their listing in IUCN as ”endangered” and in CITES Appendix II.

Keywords: Descriptive-Survey; Beche-De-Mer; Catch; Getafe; Sea Cucumber; Trade

1 Introduction

Asia's demand for sea cucumbers has constantly expanded worldwide [(1)]. The exploitation of sea cucumber has become a productive activity for exporters to Asian markets [(2)]. Commercially valuable sea cucumber species are prevalent in South Africa and countries in Asia [(3)]. Sea cucumbers are one of the aquatic commodities which many countries are trading [(4)]. Aside from their essential nutrients, sea cucumbers are

therapeutically and medicinally valuable [5]. In addition, few sea cucumber species are reported to have potential use in the cosmetic industry [6]. In addition, there is still a strong market demand for dried sea cucumbers (trepang or beche-de-mer) [7].

Moreover, increasing demand for dried sea cucumbers has been noted. It is known to be transported with other high-value wildlife commodities such as pangolin scales, ivory, abalone, seahorses, among others [8]. The increased exploitation of sea cucumbers is due to the increasing demand for the commodity. Further, sea cucumbers are notably decreasing now and, considerably, one of the marine species known to be endangered [4].

Sea cucumber being sessile and known to occur close in shores, is a financially-significant resource for coastal communities [1]. However, overfishing and smuggling of sea cucumbers have been noted and known to affect the biodiversity and livelihood of fishing communities [9]. The international trade of aquatic commodities is widely and consistently expanding. It is one of the threats to many marine and terrestrial plants and animals worldwide [4]. Furthermore, illegal trade impacts vulnerable communities; it is also a potential source of countries' starving trade revenue and harms international business sustainability [8].

The significance of conserving sea cucumbers was emphasized. A recent study mentioned that the high density of some sea cucumber species like Holothuria scabra could provide protection, conservation, and even enhance the seagrass habitats [10]. Moreover, sea cucumbers are known as the seas' bioturbators and recyclers. However, when their stock declines in intertidal areas, serious consequences such as habitat structure alteration in the ecosystem are likely to occur [11].

The Philippines is a recognized hotspot of sea cucumbers with around 200 species [12]. Sea cucumber fishery is a significant source of income for anglers in the country [13]. Moreover, according to the recent data from FAO (2019), only Indonesia and the Philippines have been consistent and active in sea cucumbers' fishery since 1950 [14]. Further, sea cucumber collection is a livelihood activity for coastal communities in the Philippines [15].

The Philippines was once a top producer of trepang or beche-de-mer [16]. Danajon Bank area has been a source of diverse fish species, marine invertebrates, including sea cucumbers, and coral species in the Philippines. Nasingin island is part of the Danajon Double Barrier reef, located at Northern Bohol Island, and the lone double barrier reef in the Philippines [17]. Moreover, the catch of sea cucumbers in Getafe is very prevalent, especially on the island of Nasingin - one of the islands of Getafe nearest to Cebu City, where the middlemen usually disposed the dried sea cucumbers. Also, a study was conducted outside the marine protected areas (MPAs) in Bohol, and an almost complete absence of sea cucumbers was found, reflecting a rich collection [18].

Focusing on specific areas for improvement, specifically, topics that will result in fishing pressure regulation, thereby increasing returns to fishers, was suggested by research [19]. However, many gaps remain in commercial species' taxonomy, biology, and ecology [20]. Moreover, in Getafe, particularly on Nasingin Island, there is no inventory of the sea cucumbers caught and traded species. Henceforth, a relevant, helpful study to understand the catch and trade of sea cucumbers should arise. Thus, this study generates baseline data of the plight of sea cucumbers' catch and trade in Nasingin, Getafe, Bohol, Philippines.

For two months, this study gathered data on sea cucumbers' catch and trade in Nasingin, Getafe, Bohol. Specifically, this study sought to determine the following: species composition of sea cucumbers; catching profile of sea cucumbers (i.e., catching methods, time observed in capturing, and frequency of using a particular catching method); catch per unit effort (CPUE) of the different catching methods of sea cucumbers; trading of sea cucumber (i.e., method of disposal and selling); and determine the significant difference of the CPUE using the different catching methods.

2 Methodology

2.1 Research Design

To achieve the purpose of the study, the researcher applied the descriptive survey method using a structured questionnaire as a guide in gathering information from the respondents.

2.2 Research Environment and Participants

The study was conducted at Nasingin Island, Getafe, Bohol (10° 10' 47" N, 124° 07' 28" E) (Figure 1). The island is part of the Danajon Bank or Double Barrier Island, located at Northern Bohol Island, is the only double barrier reef in the Philippines, and is one of the three sites in the Indo-Pacific [21]. Danajon Bank area has been noted to be one of the places in the Philippines to have wealthy marine resources [17] and has been recognized as the "center of marine shore fish biodiversity" in the world [22].

Our respondents were the people of Nasingin involved in the catch and trade of sea cucumber on the island. They were taken using the snowball sampling method [23]. A total of 55 respondents were recorded. The sampling and surveys in this method were carried out from April-May.

2.3 Research Instrument

In this study, a structured questionnaire was used to guide the conduct of the interview patterned from the study entitled "Gleaning, Drying and Marketing Practices of Sea Cucumber in Davao del Sur, Philippines"[24]. However, some parts of the questionnaire are revised to fit in with the objectives of this study.

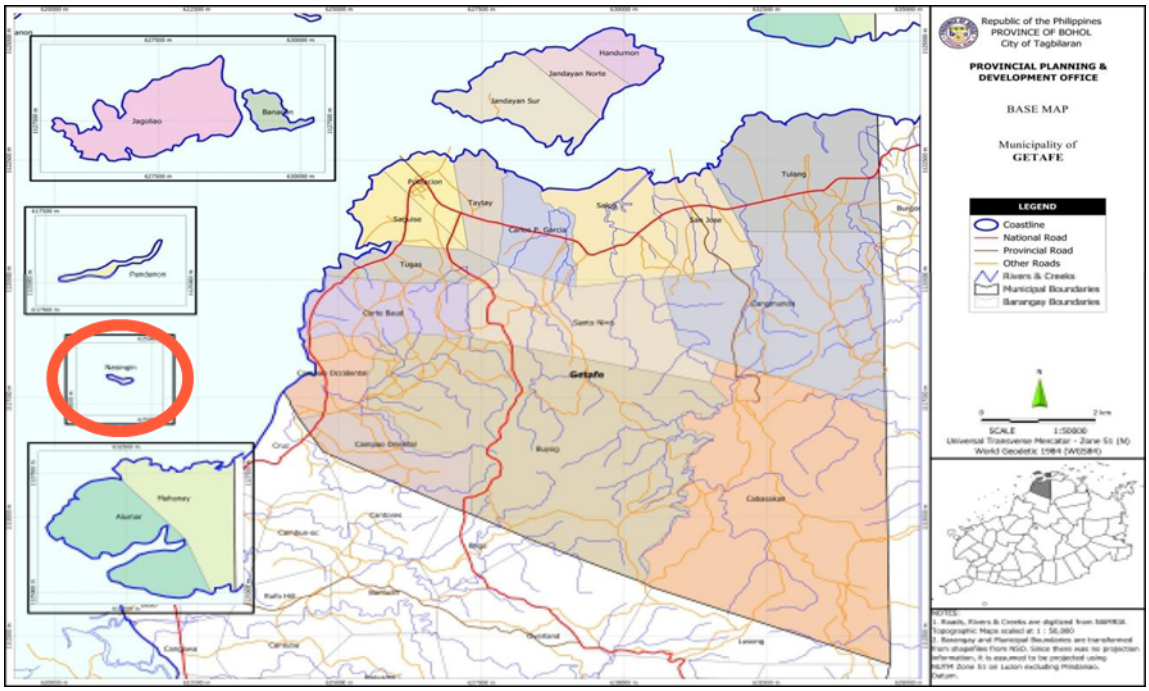

Fig 1. Geographical Map of Getafe, Bohol showing the location of encircled Nasingin Island

2.4 Procedure

The number of possible buyers and sellers of sea cucumbers was determined through the Nasingin Fisherfolk and Mangrove Planters Association (NASFIMPA). Key informants from NASFIMPA were interviewed to identify the people involved in catching and trading sea cucumbers on the island.

All the fresh samples were weighed and identified based on their genus and species level using the guide adopted[4,25,26]. The total catch in kilograms of one person was recorded with the catch species composition mass. Data was gathered by asking the respondents the questionnaire questions and weighing and identifying their fresh-caught sea cucumbers at the landing sites.

2.5 Statistical Analysis

To determine the catch-per-unit effort (CPUE) of the sea cucumbers caught, the researcher used this simple equation:

$$\text{CPUE} = \frac{\text{Volume of catch (kg)}}{\text{No. of Hours in fishing}}$$

The Kruskal-Wallis test determined the significant difference of the CPUE using the various catching methods[27].

3 Results and Discussion

Table 1 shows the species composition of sea cucumbers in Nasingin, Getafe, Bohol. There were seventeen (17) identified species (*Actinopyga echinites, A. miliaris, Bohadschia marmorata, B. similis, B. vitiensis, Holothuria atra, H. difficilis, H. fuscopunctata, H. hilla, H. impatiens, H. inhabilis, H. rigida, H. scabra, H. whitmaei, Stichopus hermanni, S. horrens and Thelenota ananas*) that are commercially important. Of all the identified species, thirteen (13) species (*Actinopyga echnites, A. miliaris, Bohadschia*

marmorata, B. vitiensis, Holothuria atra, H. fuscopunctata, H. hilla, H. impatiens, H. scabra, H. whitmaei, Stichopus herrmanni, S. horrens, and Thelenota ananas) were considered commercially important sea cucumber species in the world by the Food and Agriculture Organization (FAO)[4]. Moreover, species recorded in this study such as *A. echinites, H. scabra, H. whitmaei, S. herrmanni and T. ananas* were also included in a study as highly exploited species in Palawan[28]. Also, a study in the intertidal zone of Aurora, Philippines, revealed that *H. scabra and Stichopus sp.* are present in the area, but their density is critical for repopulation[15]. Furthermore, Sandfish (*Holothuria scabra*) was classified under the "Endangered" list of the International Union for Conservation of Nature and Natural Resources (IUCN)[29]. And Holothuria whitmaei was listed in CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix II[30].

Table 1. Species composition of sea cucumbers caught from April-May sampling period

Species Composition	April	May
Actinopyga echinites	/	/
Actinopyga miliaris	/	/
Bohadschia marmorata	/	/
Bohadschia similis	/	/
Bohadschia vitiensis	/	/
Holothuria atra		/
Holothuria fuscopunctata	/	/
Holothuria difficilis	/	/
Holothuria hilla	/	/
Holothuria impatiens	/	/
Holothuria inhabilis		/
Holothuria rigida		/
Holothuria scabra	/	/
Holothuria whitmae	/	/
Stichopus hermanni	/	/
Stichopus horrens	/	/
Thelenota ananas	/	

Based on the findings (Table 2), the following are the recorded catching methods of sea cucumber: use of compressor fishing, gleaning at day and night, skin diving, and as by-catch using beach seine and triple net. Skin diving is the most used catching method, as yielded by the result. Skin diving is another method of collecting sea cucumbers in deeper sea parts[31]. Gleaning followed next to skin diving in the frequency as a catching method. One study stated that groups of gleaners typically collect shallow-water sea cucumbers in addition to shellfishes, crabs, and seaweeds during low tide in intertidal flats[32]. The least frequently used catching method is the triple net as by-catch.

Table 2. Catching methods, time observed, and the frequency of using a particular catching method of sea cucumbers

Catching Methods	Time Observed	April		May	
		F	%	F	%
Compressor Fishing	Night	8**	12	8**	20
Gleaning	Night	11**	17	4**	10
Gleaning	Day	9	14	8	20
Skin-diving	Day	34**	52	17**	43
Beach-seine (by-catch)	Night	1	2	1	3
Triple net (by-catch)	Day	0	0	2	5
Triple net (by-catch)	Night	2	3	0	0
	TOTAL	65	100%	40	100%

**Multiple Responses

The results in Table 3 show that the compressor has the highest catch-per-unit-effort (CPUE) during the two-month sampling period at 1.74 kg/hr for April and 2.01 kg/hr for May. Since compressor diving was conducted in a deeper part, the result implies more sea cucumbers in the deeper part of the ocean than in the shallow part. Sea cucumbers are primarily found in deeper parts of the sea[33]. Moreover, compressor fishing was done during the nighttime. According to studies, fishers preferred collecting

at night during new or full moons because more sea cucumbers are observed and exposed during the night since they are considered nocturnal organisms [34,35].

On the other hand, triple net during daytime has the lowest CPUE at 0 and 0.28 kg/hr for April and May, respectively. The low CPUE using triple net (a type of artisanal fishing) can be attributed to the reason that sea cucumbers were caught as by-catch only. Sea cucumber as by-catch is generally done by fishers targeting mainly finfish, and sea cucumbers are incidentally caught [36].

Table 3. Catch-Per-Unit EffortOf Different Catching Methods Of Sea Cucumber

Catching Method	Time Observed	CPUE (kg/hr)	
Compressor	Night	1.74	2.01
Gleaning	Night	1.65	1.68
Gleaning	Day	1.21	1.18
Skin diving	Day	1.41	1.45
Beach seine (By-catch)	Night	1.25	1.32
Triple Net (By-catch)	Day	0	0.31
Triple Net (By-catch)	Night	1.58	0

This study showed that most catchers preferred to sell sea cucumber fresh (Table 4). Sea cucumber is traded live, fresh, chilled, dried, or soaked in brine [31]. A 99% of the respondents in Guiuan, Eastern Samar, preferred selling caught sea cucumber fresh [34].In addition, the majority of the gatherers opt to sell wet sea cucumbers since they only see a few and have a problem meeting the standard quality of trepang or dried sea cucumber [33]. Great skill and knowledge are required [37].Furthermore, it can be seen in Table 4 that some catchers sell sea cucumber by the glass and by bol (refers to the empty glass of nata de coco (200 g) used by the sea cucumber processors in measuring the processed sea cucumber before selling.) for pickled sea cucumber.

Sea cucumber is eaten raw, boiled, or pickled. Most catchers sell sea cucumbers fresh to assemblers/processors, while some process the sea cucumber themselves before selling them to assemblers/ processors or other traders. Thus, the middlemen and traders usually process sea cucumbers [31].

Table 4. Trading Of Sea Cucumber

Methods of Disposal	F	%	Rank
a. By species (fresh)	48**	79	4
b. By species (dried)	0		
c. By kilogram (fresh)	0		
d. By kilogram (dried)	9**	15	3
e. By size (fresh)	48**		
f. By size (dried)	0		
g. By glass (processed)	2	3	2
h. By bol (processed)	2	3	1
i. By pail (processed)	0		
Selling Practices			
Sold to consumers	2	3	2
Sold to Local assemblers	48**	81	4
Sold to Local traders	8**	14	3
Exporters	1	2	1

**Multiple Responses

Most respondents have sold their catch to local assemblers (Table 4). Local assemblers are mostly village residents who buy sea cucumbers caught by local anglers. Local processors are mostly village residents who process sea cucumbers collected by divers/collectors from their village. Local traders buy and sell sea cucumber within a given municipality or city. Unlike the assemblers/processors generally located in coastal villages, these traders are usually based in critical towns or cities. In addition, their procurement is limited to dried products, unlike local assemblers/processors who primarily buy fresh sea cucumber [31]

. Based on findings, this study has recorded consumers for both months (Table 4), referring to people who consumed pickled sea cucumbers.

The Kruskal-Wallis test results yield a computed value of −97.12417, much less than the tabular value of 7.82. Thus, the result indicates no significant difference in the CPUE using the different catching methods. As shown in Table 3, the CPUE of the different catching methods yield a value closely similar to each other or has no significant discrepancy when compared.

4 Conclusion

Based on the study's findings, only seventeen (17) sea cucumber species were caught and traded in the site within a two-month sampling period. Out of the seventeen (17) recorded species in this study, thirteen species (13) were recorded as commercially important, and five (5) species were regarded in a similar study as highly exploited species. Moreover, one (1) species recorded in the survey was classified under the "Endangered" list of the International Union for Conservation of Nature and Natural Resources (IUCN), and also one (1) species was listed in CITES Appendix II, implying that there are threatened species of sea cucumbers that are still caught. In terms of the catching method, skin diving was most preferred by the respondents, which is in conjunction with the fact that sea cucumbers are found in the deeper parts of the sea. However, compressor fishing has the highest catch-per-unit effort, supported by studies that sea cucumbers are nocturnal. Moreover, most fishers preferred to sell fresh sea cucumbers by species and size to local assemblers, which is convenient since local assemblers are buyers in the area.

References

1) Allen WL, Shea, Stanley KH. Patterns and dynamics of beche-de-mer trade in Hong Kong and mainland China. *TRAFFIC Bulletin*. 2012;24:65–75. Available from: https://www.researchgate.net/profile/Sapai-Min/publication/344553961_Impacts_of_Wildlife_Trade_on_Conservation_in_Kachin_State_Myanmar/links/5f800562458515b7cf71dd20/Impacts-of-Wildlife-Trade-on-Conservation-in-Kachin-State-Myanmar.pdf#page=29.
2) Ernesto C, Salgado A, Ma R, De Lourdes PN, Julio. Stock assessment of the warty sea cucumber fishery (Parastichopus parvimensis) of NW Baja California. *California Cooperative Oceanic Fisheries Investigations Reports*. 2011;p. 136–147. Available from: https://ipn.elsevierpure.com/en/publications/stock-assessment-of-the-warty-sea-cucumber-fishery-parastichopus-.
3) Mehmet A, Huseyin S, Bekir T, Yilmaz E, Sevim K. Proximate composition and fatty acid profile of three different fresh and dried commercial sea cucumbers from Turkey. *International Journal of Food Science & Technology*. 2011;46(3):500–508. Available from: https://doi.org/10.1111/j.1365-2621.2010.02512.x.
4) Steven P, Yves S, Chantal C. Commercially important sea cucumbers of the world. 2012. Available from: https://www.fao.org/3/i1918e/i1918e.pdf.
5) Mike K, Rana AAEN, Lamis AG, Sara ADN, Naser S, Najat, et al. Anti-proliferative and anti-inflammatory activities of the sea cucumber Holothuria poli aqueous extract. *SAGE Open Medicine*. 2018;6:1–14. Available from: https://doi.org/10.1177/2050312118809541.
6) Amelia PSE, Ratih M, Hendra K, Se-Kwon. Cosmeceuticals properties of sea cucumbers: Prospects and trends. *Cosmetics*. 2017;4(26):1–12. Available from: https://doi.org/10.3390/cosmetics4030026.
7) Steven P, David W, Poasi N. Chinese market prices of beche- de-mer: implications for fisheries and aquaculture. *Marine Policy*. 2018;91:58–65. Available from: https://doi.org/10.1016/j.marpol.2018.02.005.
8) Simone L, Markus B. A rapid assessment of the sea cucumber trade from Africa to Asia. 2020. Available from: https://www.traffic.org/site/assets/files/13496/sea-cucumbers-trade-vfinal.pdf.
9) Richa S. Aphrodisiac of the ocean: how sea cucumbers became gold for organized crime. 2021. Available from: https://www.theguardian.com/environment/2021/apr/12/sea-cucumbers-organised-crime-smuggling-aphrodisiac-biodiversity-sri-lanka-india.
10) Jessica A, Meriwether WA, W, Kitty B, Kyle D, Angelo D, et al. Ecological co-benefits from sea cucumber farming: Holothuria scabra increases the growth rate of seagrass. *Aquaculture Environment Interaction*. 2021;13:301–310. Available from: https://dx.doi.org/10.3354/aei00409.
11) Svea-Mara W, Sven U, Charis B, Timothy S, Roland P. The ecological role of Holothuria scabra (Echinodermata: Holothuroidea) within subtropical seagrass beds. 2010. Available from: https://doi.org/10.1017/S0025315409990518.
12) . . Available from: https://www.hatcheryinternational.com/hatchery-production-the-key-to-philippine-push-into-sea-cuke-1101/.
13) Bernardita Q, G, Pablo R, S, Fabio R, C. Distribution of intertidal holothurian fauna in Lianga Bay. *Surigao del Sur SDSSU Multidisciplinary Research Journal 2013*;1(2):1–10. Available from: https://www.smrj.sdssu.edu.ph/index.php/SMRJ/article/view/68/66.
14) Food and Agriculture Organization of the United Nations (FAO). Fishery and aquaculture statistics on global aquaculture production 1950-2017 (FishstatJ). FAO Fisheries and Aquaculture Department. Rome. FAO. 2019. Available from: https://www.fao.org/fishery/en/statistics.
15) Canada, B MC, no R, A M, V AE. Angara Eusebio V. Species Distribution, Diversity, and Abundance of Sea Cucumbers in Tropical Intertidal Zones of Aurora, Philippines. *Open Journal of Ecology*. 2020;10:768–777. Available from: https://doi.org/10.4236/oje.2020.1012047.
16) Marie AJM. Harnessing S&T for a sustainable and competitive sea cucumber industry. 2016. Available from: http://www.pcaarrd.dost.gov.ph/home/portal/index.php/quick-information-dispatch/2668-harnessing-s-t-for-a-sustainable-and-competitive-sea-cucumber-industry.
17) Patrick C, Nygiel A, Alan GW, Anecita, De D, Homer. Coastal environmental and fisheries profile of Danajon Bank, Bohol, Philippines. In: Fisheries Improved for Sustainable Harvest (FISH) Project;vol. 63. Cebu, Philippines. 2006. Available from: https://tamug-ir.tdl.org/bitstream/handle/1969.3/29267/Pnadi146.pdf?sequence=1.
18) Alexander MK, Kristin N, Gawel A, Marie. Survey of the shallow-water sea cucumbers of the central Philippines. 2006. Available from: https://www.researchgate.net/publication/268346778.
19) Hugh G. A review of sea cucumber fisheries and management in Melanesia. *SPC Fisheries Newsletter*. 2017;154. Available from: https://doi.org/10.13140/RG.2.2.34763.08483.
20) Chantal C. Tropical sea cucumber fisheries: Changes during the last decade. *Marine Pollution Bulletin*. 2018;133:590–594. Available from: https://doi.org/10.1016/j.marpolbul.2018.05.014.

21) Pichon M, Physiography. Morphology and Ecology of the Double Barrier Reef of North Bohol (Philippines). In: Proceedings of the Third International Coral Reef Symposium. 1977;p. 261–267. Available from: https://pascal-francis.inist.fr/vibad/index.php?action=getRecordDetail&idt=PASCALGEODEBRGM7820206588.
22) Kent EC, Victor S, G. The center of the center of marine shore fish biodiversity: The Philippine islands. *Environmental Biology of Fishes*. 2005;72:467–480. Available from: https://doi.org/10.1007/s10641-004-3154-4.
23) Mahin N, Hamideh G, Fereshteh G. Snowball sampling: A purposeful method of sampling in qualitative research. 2017. Available from: https://doi.org/10.5812/sdme.67670.
24) Subaldo MC, Gleaning. Gleaning, Drying and Marketing Practices of Sea Cucumber in Davao Del Sur, Philippines. *JPAIR Multidisciplinary Research*. 2011;6(1):117–125. Available from: https://www.ejournals.ph/article.php?id=7474.
25) Sabine S. Echinoderms of the Philippines and Singapore. . Available from: https://searchworks.stanford.edu/view/4667427.
26) Secretariat of the Pacific Community. Pacific Island sea cucumbers and beche-de-mer identification cards. Noumea. 2004. Available from: https://coastfish.spc.int/component/content/article/345-pacific-island-sea-cucumbers-and-beche-de-mer-identification-cards.html.
27) Brian M, Robert M. Introduction to environmental forensics (3rd Edition). 2015. Available from: https://www.elsevier.com/books/introduction-to-environmental-forensics/murphy/978-0-12-404696-2.
28) Chantal C, Beth P, Annie M, Ruth G, Jean-Francois H, Steven P. The IUCN red list assessment of Aspidochirotid sea cucumbers and its implication. *SPC Bechedemer Information Bulletin*. 2014;34:3–7. Available from: https://www.researchgate.net/publication/262563033_The_IUCN_Red_List_assessment_of_aspidochirotid_sea_cucumbers_and_its_implications.
29) Jean-Francois H, Annie M, Chantal C, Steven P. Holothuria scabra. *IUCN Red List of Threatened Species*. 2013;1. Available from: https://doi.org/10.2305/IUCN.UK.2013-1.RLTS.T180257A1606648.en.
30) Convention on International Trade in Endangered Species of Wild Fauna and Flora). Appendices I, II, and III. *CITES*. 2019;p. 75–75. Available from: https://cites.org/sites/default/files/eng/app/2019/E-Appendices-2019-11-26.pdf.
31) Brown EO, Perez ML, Garces LR, Ragaza RJ, Bassig RA, Zaragoza EC. Value chain analysis for sea cucumber in the Philippines. Studies & Reviews 2120. In: The World Fish Center;vol. 44. Penang, Malaysia. 2010. Available from: https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/1327/WF_2735.pdf?sequence=1&isAllowed=y.
32) Daposala ORD, Asibal ECM, Antonette JMM. Assessment of the sea cucumber resource and fishery in Bolinao-Anda reef system. *Science Diliman*. 2010;22(2):1–12. Available from: https://www.journals.upd.edu.ph/index.php/sciencediliman/article/view/2083.
33) Vlademir S, A, Nobert MR, D, Thaddeus A, R, et al. Supply chains and cost-Benefit analyses. In: Sea cucumber fishery and trade in Sta. Cruz;vol. 3. 2013;p. 836–850. Available from: https://ageconsearch.umn.edu/record/198310/usage?ln=en.
34) Ma GS, Brenda P, Margarita TDLC, Benedict CJ, P, Francel D, et al. The sea cucumber fishery of Samar and Leyte. *Philippines Philippine Journal of Social Sciences and Humanities*. 2011;16(2):35–48. Available from: https://www.researchgate.net/publication/281791870_The_Sea_Cucumber_Fishery_of_Samar_and_Leyte_Philippines.
35) Sea cucumber. 2018. Available from: https://thinkport.org/bayville/printables/sea_cucumber.pdf.
36) Ahminur MR, Md YF. Sea Cucumber Fisheries: Market Potential, Trade, Utilization and Challenges for Expanding the Production in the South-East Asia. *International Journal of Advances in Chemical Engineering and Biological Sciences*. 2017;4(1). Available from: https://doi.org/10.15242/IJACEBS.ER0117033.
37) Marnelle S. A glimpse on the life of sea cucumbers gatherers in Mindanao. 2020. Available from: https://www.msunaawan.edu.ph/seacucumber/publication/mangadlay-02-2020.pdf.