The Philippine Journal of Fisheries 26(2): 119-136
DOI: 10.31398/tpjf/26.2.2019-0004
July - December 2019

FULL PAPER

A Ranked Inventory of Commercially-important Mollusks of Panay, West Central Philippines as a Guide to Prioritize Research

Annabelle G.C. del Norte-Campos*, Lorelie A. Burgos, and Karen A. Villarta

Marine Biology Laboratory, Division of Biological Sciences, College of Arts and Sciences, University of the Philippines Visayas 5023 Miagao, Iloilo

ABSTRACT

A first-ever effort to rank commercially-important mollusk species of Panay Island was conducted based on an extensive survey between March and April 2018. Ranking was based on the following criteria, namely: commercial value (40%), catch rates (20%), sources of threats (type of gear, processing plants, and number of fishers) (20%), frequency in the markets and source sites (10%), and literature available (10%), modified to a certain extent. A total of 90 mollusk species categorized into bivalves (49), gastropods (32), and cephalopods (9) were ranked. The comb pen shell *Atrina pectinata* (Pinnidae), Indian squid *Uroteuthis duvaucelii* (Loliginidae), and the scallop *Mimachlamys sanguinea* (formerly *Chlamys senatoria*) (Pectinidae) formed the top three species in the list strongly attributed to their high commercial value and thus catch rates. Squids, in general, are caught by trawls, whereas most of the other species are harvested primarily by gleaning and diving. The study highlights the high diversity of the malaco-fauna of Panay, as well as the multi-gear character of tropical fisheries. This ranked inventory can be used in prioritizing research on mollusks, by identifying target species for more in-depth studies useful for establishing their present status.

E-mail address: *adcampos@up.edu.ph*
Received: *September 23, 2019*
Accepted*: December 12, 2019*

Keywords: *bivalves, cephalopods, gastropods, mollusks, Panay Island, ranked inventory*

1. INTRODUCTION

Phylum Mollusca, the second-largest phylum of animals after the arthropods, is represented by many commercially-important species, primarily belonging to Class Gastropoda, Bivalvia, and Cephalopoda. The Philippine Statistics Authority (PSA) reported for 15 years (2002-2017) a total municipal squid production of 672T metric tons (MT) for the entire Philippines with a corresponding value of approximately PHP 48.5M (PSA 2018). Western Visayas supposedly contributes to this considerably, where production (89.9T MT) and value (PHP 7M) correspond to 13.4% and 14.4% of the total for the entire Philippines, respectively. Based on initial data, however, the values of Western Visayas are gross underestimates (del Norte-Campos et al. in prep.). These statistics also simply lump species together so that the real picture of the commercial importance (amount harvested) of individual species is not accounted for. This generalized picture makes prioritization of research for commercially-important marine mollusks more difficult. An earlier study to mitigate this problem was conducted for the invertebrates in Panay (del Norte-Campos et al. 2000). A set of criteria was used to rank species importance based on their commercial value, catch rate, threats, frequency in markets, and information available. Albeit acknowledged to be incomplete, the study came up with 50 species, 34 (68%) of which are mollusks. Based on this and subsequent studies, mollusks, among other invertebrates, are harvested in Panay using trawls (del Norte-Campos et al. 2003) and by diving (Declarador and del Norte-Campos, 2004). Gleaning, which until recently, remained to be a largely undocumented method of collection, also proves to be a reliably consistent and easily accessible source of income (del Norte-Campos et al. 2003; del Norte-Campos et al. 2005) for coastal populations, especially women. Following to a great extent, the methods of del Norte-Campos et al. (2000), an inventory of the commercially-important mollusks of Panay Island was conducted with the similar aim

of ranking the species to serve as a guide in selecting target species for in-depth studies. These studies include population and reproductive biology, as well as fishery monitoring, which altogether are important in establishing the status of the resource.

2. MATERIALS AND METHOD

The survey was conducted between March and April 2018 in all four provinces of Panay Island (Fig. 1). The number of sampling sites (towns/cities) by province surveyed were as follows: Iloilo (6), Capiz (6), Aklan (3), and Antique (2), with each sampling site having their respective source sites, i.e., barangays (see Table 1). The different sites were visited, and interviews with fishers were conducted using a survey form (Table 2). Assistance in initial identification and selection of target sites for the interview was provided by local municipal agricultural officers (MAO's), faculty members of local fisheries schools and state colleges, as well as barangay captains. Printed images of known species were shown to interviewees to help validate species identity. Type specimens of unknown species were identified in the laboratory using literature such as FAO (1998 a & b) and Laureta (2008), while the rest were sent to the National Museum for Nature and Science (NMNS), Tokyo, for verification of taxonomic identification.

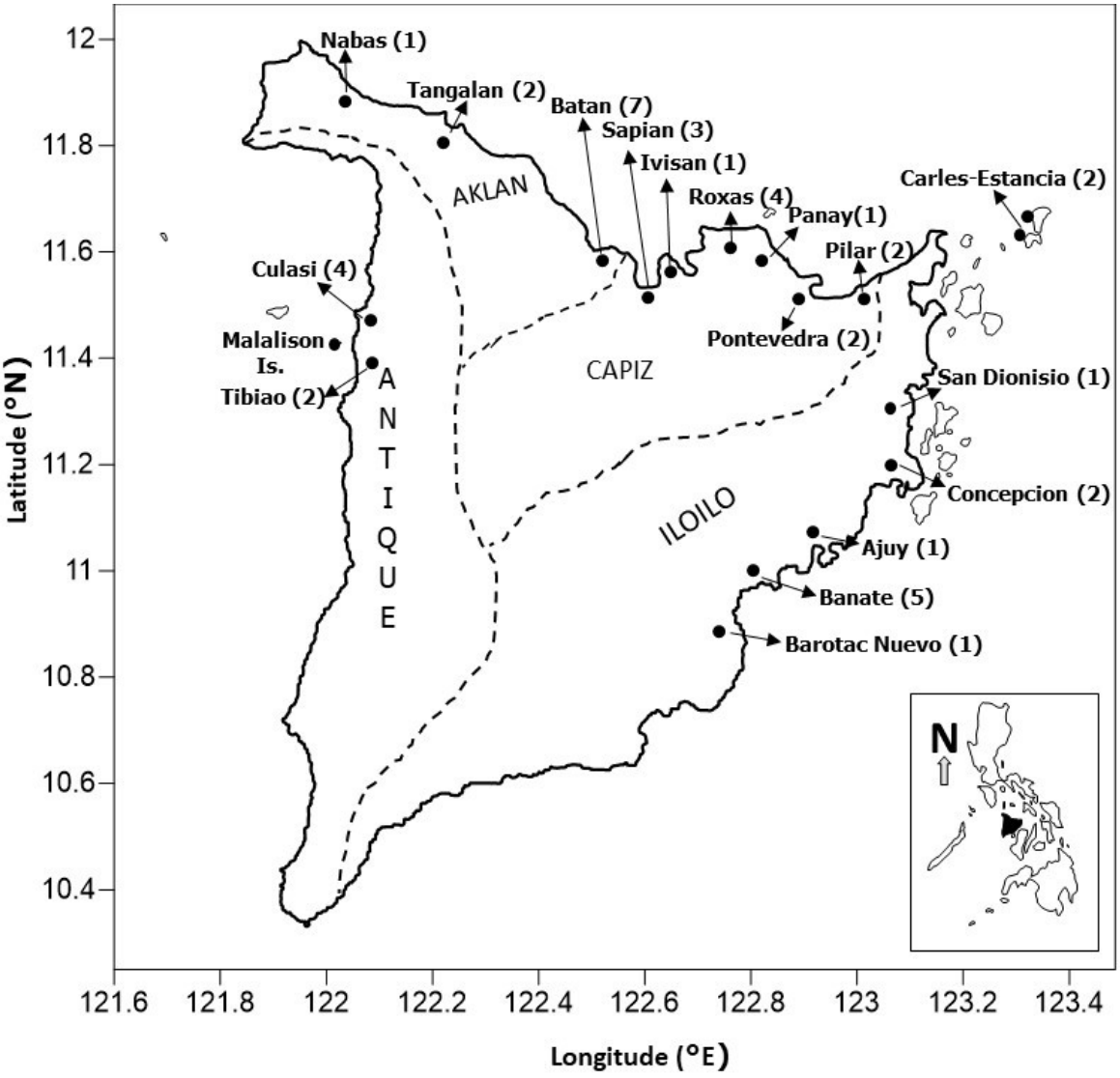

Figure 1. Map showing location of sampled areas during a mollusk inventory survey in the four provinces (Iloilo, Capiz, Aklan, Antique) of Panay Island. The numbers enclosed in parentheses indicate no. of barangay (s) surveyed in each town/municipality.

Table 1. Sampling and source sites in Panay Island where inventory of commercially-important mollusk species was conducted, March-April 2018.

Province	Sampling Sites (Town and Cities)		Source Sites (Barangays)
ILOILO (6)	Barotac Nuevo (1)	Tinurian	
	Banate (4)	Alacaygan	Talokgangan
	Concepcion (2)	Poblacion	San Salvador
		Loong	
	Ajuy (1)	Mangarocoro	
	San Dionisio (1)	Siempreviva	
	Carles/ Estancia (2)	Isla Gigante Norte	
		Isla Gigantes Sur	
AKLAN (3)	Batan (7)	Tabon	Ipil
		Camanci	Poblacion
		Palay	Mapag-ong
		Bay-ang	
	Tangalan (1)		Dumatad
	Nabas (1)	Afga	
		Habana	
ANTIQUE (2)	Tibiao (2)	Natividad	
		Malabor	
	Culasi (4)	Maralison Is.	
		Lipata	
		Naba	
		Centro Norte	
CAPIZ (6)	Roxas (4)	Libas	
		Punta Cogon	
		Talon	
		Cagay	
	Sapian (3)	Guibongan, Lonoy	
		Culasi, Lonoy	
		Agtatacay Norte	
	Ivisan (1)	Agustin Navarra	
	Pilar (2)	Poblacion	
		Binaobawan	
	Pontevedra (2)	Lantangan	
		Hiponia	
	Panay (1)	Buntod	

Table 2. Survey form used during the interviews with fishers/gleaners in the various fishing villages in the four provinces of Panay Island, March-April 2018 (adopted from del Norte-Campos et al. 2000).

Area _____ Collaborator: _____
Date of Survey _____ Time _____ Name of Interviewee_____

Species		Landing Or Trad-ing Site	Gears Used	Estimated Catch Rate (kg hr-1)			Season	Market Or Uses	Price (PHP kg-1)	Marketed Part & Form					
Scientific Name	Local or Common Name			5 Yrs ago	2 Yrs ago	present									
										A	B	C	D	E	F

LEGEND: A = whole organis B = meat only C = shell only D = adductor E = meat w/o adductor FORM: F = fresh Z = frozen

The data were analyzed using a set of criteria (Table 3) adopted and slightly modified from del Norte-Campos et al. (2000). The criteria are meant to highlight species with high commercial value and thus catch rates. Thus, species which score high in this scheme are those: a) with the highest commercial value, especially export value; b) which are processed with a processing plant, and thus high value added; c) which are fished more (i.e., high fishing intensity: high catch rates and more fishers); d) caught using destructive gear; and e) studied less (in terms of number of published literature). In this study, the last criterion was modified by giving a higher rank to species that have received less attention (i.e., relatively undocumented). This conforms more to use the resulting ranked inventory as a basis for selecting target species for more detailed studies, i.e., less studied, more attention needed.

Commercial Value (CV), assigned a total weight of 40%, was assessed using actual prices (in PHP) recorded during the interviews. This was further broken down to Local Commercial Value, LCV (15%), and Export Commercial Value, ECV (25%). Estimated Catch Rate, CR (standardized to kg hr-1) (20%), which served as the proxy for Estimated Volume of Catch, was encoded using averaged fishery monitoring data recorded during the 1st to 2nd quarters of the year (January-June). Sources of Threats (20%) were

Table 3. Criteria used in ranking mollusk species inventoried in Panay Island in March-April 2018 (adopted/modified from del Norte-Campos et al. 2000).

CRITERIA	SCORE ASSIGNED	% WEIGHT (100%)	
1. Commercial value (CV)			**40**
Local value (LCV)	15		
Export value (ECV)	25		
2. Estimated Volume of Catch (Est'd CPUE) (CR)	actual value weighted (kg hr-1 fished)		**20**
3. Threats			**20**
a) presence /absence of processing plants, **(PP)**	presence = 1 absence = 0	8	
b) # of traders (modified to # of gleaners and fishers) **(G/F)**		6	
>150	3		
100-150	2		
<100	1		
c) destructiveness of gears (G)		6	
trawl	6		
Set gill net	5.5		
Encircling net	5.5		
Gleaning w/ trowel	5.5		
Spear	4		
Jigger	3		
Bamboo pots/traps, lift net	2		
4. Frequency			**10**
in the public market **(FPM)**	5		
in the source sites **(FSS)**	5		
5. Info Availability (in PH) (# published studies) (IA)			**10**
>10	1		
5-10	2		
0-5	3		
		TOTAL	**100%**

further broken down into: 1) presence of processing plants, PP (8%); 2) number of traders, herein modified to number of gleaners/fishers, G/F (6%); and 3) destructiveness of gear, G (6%). Species with processing plants were assigned a value of 1 while those without were assigned a value of 0. The number of fishers was further ranked in descending order with a decreasing number of fishers, i.e.,>150 fishers (=3), 100-150 (=2), and <100 (=1). Frequency (10%) was evaluated by assigning the number of days in a week that the species are usually observed in the markets (FPM, 5%) and source sites (FSS, 5%). The degree of the destructiveness of gear (G) was ranked with the highest value of 6 assigned to trawl, deemed as the most destructive gear, down to a value of 2 for passive gears such as traps and lift nets. Lastly, the criterion Information Availability, IA, based on the number of published studies in the Philippines, as mentioned above, deviated totally from del Norte-Campos et al. (2000), i.e., species which had been studied least (0 to 5 studies) were given a higher score (6), highlighting the need for more attention on these lesser-known/documented species. Marketing of collected shells are in most areas conducted on the same day, and this is true in both cases where there are designated buyers, or when the fishers themselves have to sell in local markets.

For each criterion, the mean of individual entries for each species for all areas was computed. These means were divided by the total value of entries for that criterion and weighted by multiplying each with the corresponding percentage value assigned for the said criterion. Individual weighted scores for each species for each criterion were summed to get the final score. The species were then ranked from highest to lowest based on their final scores. To make the procedure for computation clearer, Table 4 illustrates the computation for all species. From here, we can see the input values used for each criterion, the sum of inputs across all species with input values for the specific criterion, and the respective % weight for each criterion. Weighted score for each species is then computed as follows:

Weighted score = (actual input value/total value) x % weight

Thus, for example, the local commercial value (LCV) used for the comb shell *Atrina pectinata* was PHP 105.00 kg^{-1}, which was divided by the total LCV for all species recorded during the survey (PHP 5,427.1) = 0.019 x % weight for LCV 15% = 0.003. The same was done for all criteria, and the sum of all weighted scores taken (= 0.176), which is the final score for this species.

Table 4. Illustration of how ranking score is arrived at for all species using *Atrina pectinata* as an example. (LCV= local commercial value in PHP kg^{-1}; ECV = export commercial value in PHP kg^{-1}; CR = catch rate in kg hr^{-1}; PP = processing plant; G/F = score assigned for number of gleaners/fishers; G = score assigned based on degree of destructiveness of fishing gear/method; FPM = frequency in markets; FPS = frequency in source sites; IA = score assigned based on number of information available). See also Table 3 for scoring scheme.

Atrina pectinata	**LCVt**	**ECV**	**CR**	**PP***	**G/F**	**G**	**FPM**	**FPS**	**IA**	**sum**
input value	105.00	220.00	0.54	0.5	1	5.5	4	6	3	
sum of inputs	5,427.1	620.00	253.1	0.5	96.3	482.8	311.9	359.7	247.9	
% weight	15	25	20	8	6	6	5	5	10	100.0
weighted score	**0.003**	**0.09**	**0.0004**	**0.08**	**0.006**	**0.007**	**0.006**	**0.001**	**0.001**	**0.176**

*input value for PP is the mean value for 2 sites

3. RESULTS AND DISCUSSION

3.1 Species Occurrence

A total of 95 mollusk species were encountered in the survey, of which 90 species belonging to three classes: Bivalvia (49), Gastropoda (32), and Cephalopoda (9) were ranked (Table 5). Figure 2 shows the relative distribution of the three mollusk classes by province. It can be seen here that bivalves predominate in Iloilo and Capiz, while there are more gastropods in Antique and Aklan. Cephalopod's occurrence in Iloilo, Capiz, and Antique is comparable, whereas Aklan's cephalopod resources are poor. Twenty-seven of the 90 species recorded in this survey were also reported in the study conducted by del Norte-Campos et al. (2000), while 62 species are new in the inventory for mollusks of Panay. These differences are likely due to the broader area covered in the present study, as well as the likelihood of some species having been omitted in the past study as they have only gained more considerable attention in the recent years. For example, several scallops (Pectinidae) species, namely *Mimachlamys sanguinea* (formerly *Chlamys senatoria*), Bractechlamys vexillum, *Decatopecten amiculum*, *Annachlamys striatula* are now included in the list due to the addition of Isla Gigantes Norte and Sur (previously excluded) in the present areas surveyed. These four species also ranked 3rd to 6th place, which validates their commercial importance. A few species have gained more attention, such as the granular ark *Tegillarca granosa* (also known as Anadara granosa) over which a stronger interest has increased due to the possibility of foreign markets (Korea). As such, the already high harvest rates (1.68 kg hr^{-1}) in the Batan Bay area are exceeded by even higher catch rates (6.16 kg hr-1) in Capiz.

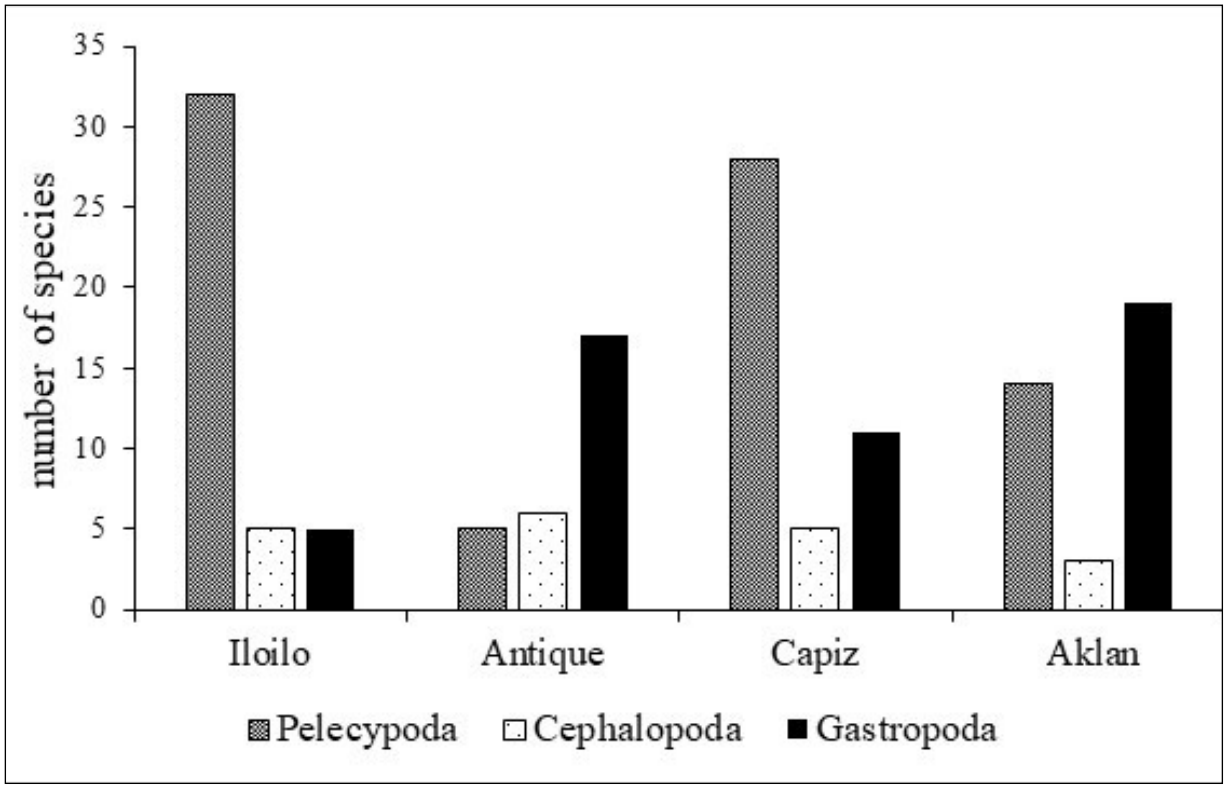

Figure 2. Distribution of mollusk classes by province in Panay Island.

Table 5. Overall ranking of commercially-important mollusks of Panay Island weighted by criterion [**LCV** = local commercial value; **ECV** = export commercial value; **CR** = catch rate; **threats** (**PP** = processing plant, **G/F** = gleaners & fishers, **G** = gears); **frequency** (**FPM** = in public markets, **FSS** = in source sites); **IA** = information available].

RANK	SPECIES	Common Names (FAO, 1998)	LCV	ECV	CR	PP	G/F	G	FPM	FSS	IA	sum
1	Atrina pectinata	Comb pen shell	0.0029	0.0887	0.0004	0.080	0.0006	0.0007	0.0006	0.001	0.001	0.1760
2	Uroteuthis duvaucelii	Indian squid	0.0063	0.1613	0.0013	0	0.0007	0.0005	0.0009	0.001	0.001	0.1729
3	Mimachlamys sanguinea	Senatorial scallop	0.0035	0	0.0253	0	0.0006	0.0007	0.0010	0.001	0.001	0.0331
4	Bractechlamys	Distant scallop	0.0032	0	0.0227	0	0.0006	0.0007	0.0010	0.001	0.001	0.0302
5	Decatopecten amiculum	Cloak scallop	0.0030	0	0.0217	0	0.0006	0.0007	0.0010	0.001	0.001	0.0291
6	Annachlamys striatula	Macassar scallop	0.0030	0	0.0217	0	0.0006	0.0007	0.0002	0.0001	0.001	0.0276
7	Conomurex luhuanus	Strawberry conch	0.0009	0	0.0118	0	0.0006	0.0007	0.0004	0.0004	0.001	0.0160
8	Spondylus butleri	Butler's thorny oyster	0.0030	0	0.0058	0	0.0012	0.0007	0.0011	0.001	0.001	0.0141
9	Pholas orientalis	Oriental angel wing	0.0083	0	0.0017	0	0.0006	0.0007	0.0010	0.001	0.0004	0.0135
10	Nautilus pompilius	Chambered nautilus	0.0099	0	0.0009	0	0.0006	0.0003	0.0006	0.001	0.0004	0.0134
11	Spondylus squamosus	Ducal thorny oyster	0.0030	0	0.0048	0	0.0012	0.0007	0.0011	0.001	0.001	0.0131
12	Telescopium telescopium	telescope snail	0.0005	0	0.0080	0	0.0007	0.0007	0.0008	0.001	0.001	0.0125
13	Uroteuthis edulis	swordtip squid	0.0062	0	0.0007	0	0.0006	0.0006	0.0010	0.001	0.001	0.0112
14	Spondylus barbatus	bearded thorny oyster	0.0030	0	0.0028	0	0.0012	0.0007	0.0011	0.001	0.001	0.0111
15	Sepioteuthis lessoniana	bigfin reef squid	0.0056	0	0.0004	0	0.0007	0.0006	0.0008	0.001	0.001	0.0100
16	Melo broderipii	crowned bailer	0.0014	0	0.0051	0	0.0006	0.0007	0.0005	0.0005	0.001	0.0099
17	Amusium pleuronectes	Asian moon scallop	0.0061	0	0.0003	0	0.0006	0.0007	0.0003	0.0003	0.001	0.0096
18	Sepia latimanus	broadclub cuttlefish	0.0055	0	0.0001	0	0.0006	0.0005	0.0008	0.001	0.001	0.0094
19	Placuna placenta	windowpane oyster	0.0010	0	0.0054	0	0.0006	0.0007	0.0003	0.0003	0.001	0.0090
20	Sepia recurvirostra	curvespine cuttlefish	0.0045	0	0.0010	0	0.0006	0.0005	0.0006	0.001	0.001	0.0090
21	Spondylus versicolor	golden thorny oyster	0.0030	0	0.0010	0	0.0012	0.0007	0.0008	0.001	0.001	0.0087
22	Anadara antiquata	antique ark	0.0007	0	0.0034	0	0.0006	0.0007	0.0010	0.001	0.001	0.0086

RANK	SPECIES	Common Names (FAO, 1998)	LCV	ECV	CR	PP	G/F	G	FPM	FSS	IA	sum
23	Tegillarca granosa	granular ark	0.0011	0	0.0032	0	0.0007	0.0007	0.0008	0.001	0.001	0.0083
24	Sthenoteuthis oualaniensis	purpleback flying squid	0.0029	0	0.0011	0	0.0006	0.0004	0.0010	0.001	0.001	0.0080
25	Octopus cyanea	day octopus	0.0029	0	0.0011	0	0.0006	0.0006	0.0007	0.001	0.001	0.0076
26	Saccostrea cucullata	hooded oyster	0.0002	0	0.0031	0	0.0006	0.0007	0.0009	0.001	0.001	0.0076
27	Geloina expansa	broad geloina	0.0009	0	0.0026	0	0.0007	0.0007	0.0006	0.001	0.001	0.0073
28	Laevistrombus turturella	dog conch	0.0017	0	0.0012	0	0.0006	0.0007	0.0010	0.001	0.001	0.0072
29	Scapharca inaequivalvis	inequivalve ark	0.0008	0	0.0022	0	0.0006	0.0007	0.0008	0.001	0.001	0.0070
30	Trochus radiatus	radiate top shell	0.0017	0	0.0012	0	0.0006	0.0007	0.0008	0.001	0.001	0.0069
31	Octopus nocturnus	Philippine night octopus	0.0019	0	0.0004	0	0.0006	0.0005	0.0011	0.001	0.001	0.0068
32	Azorinus abbreviatus	small short razor	0.0015	0	0.0012	0	0.0007	0.0007	0.0005	0.001	0.001	0.0065
33	Nerita planospira	flatspired nerite	0.0015	0	0.0008	0	0.0006	0.0007	0.0008	0.001	0.001	0.0064
34	Malleus malleus	black hammery oyster	0.0019	0	0.0001	0	0.0006	0.0007	0.0010	0.001	0.001	0.0063
35	Marcia hiantina	hiant venus	0.0011	0	0.0012	0	0.0007	0.0007	0.0008	0.001	0.001	0.0063
36	Modiolus modulaides	yellowbanded horse mussel	0.0008	0	0.0017	0	0.0006	0.0007	0.0009	0.001	0.001	0.0063
37	Meretrix lyrata	lyrate hard clam	0.0002	0	0.0014	0	0.0006	0.0007	0.0011	0.001	0.001	0.0062
38	Austriella corrugata	corrugate lucine	0.0015	0	0.0007	0	0.0006	0.0007	0.0008	0.001	0.001	0.0062
39	Gafrarium pectinatum	tumid venus	0.0006	0	0.0018	0	0.0007	0.0007	0.0006	0.001	0.001	0.0062
40	Crassostrea echinata	spiny rock oyster	0.0017	0	0.0010	0	0.0012	0.0007	0.0002	0.0001	0.001	0.0061
41	Glauconome virens	greenish glauconomya	0.0015	0	0.0015	0	0.0008	0.0007	0.0002	0.0002	0.001	0.0061
42	Conus figulinus	fig cone	0.0008	0	0.0012	0	0.0006	0.0007	0.0006	0.001	0.001	0.0060
43	Trisidos semitorta	half-propellor ark	0.0008	0	0.0011	0	0.0006	0.0007	0.0005	0.001	0.001	0.0059
44	Lambis lambis	common spider conch	0.0017	0	0.0007	0	0.0006	0.0007	0.0005	0.000	0.001	0.0058
45	Meretrix meretrix	Asiatic hard clam	0.0013	0	0.0007	0	0.0006	0.0007	0.0006	0.001	0.001	0.0057
46	Oliva oliva	common olive	0.0007	0	0.0012	0	0.0006	0.0007	0.0005	0.001	0.001	0.0056
47	Haliotis glabra	glistening abalone	0.0017	0	0.0011	0	0.0006	0.0007	0.0006	0.001	0.0004	0.0056
48	Isognomon ephippium	saddle tree oyster	0.0010	0	0.0014	0	0.0006	0.0007	0.0002	0.0003	0.001	0.0054
49	Barbatia virescens	blood clam	0.0010	0	0.0010	0	0.0006	0.0007	0.0004	0.0003	0.001	0.0052

RANK	SPECIES	Common Names (FAO, 1998)	LCV	ECV	CR	PP	G/F	G	FPM	FSS	IA	sum
50	Canarium urceus	little pitcher conch	0.0005	0	0.0009	0	0.0006	0.0007	0.0005	0.001	0.001	0.0052
51	Nerita albicilla	oxpalate nerite	0.0007	0	0.0008	0	0.0006	0.0007	0.0004	0.001	0.001	0.0052
52	Anadara globosa	globose ark	0.0008	0	0.0008	0	0.0006	0.0007	0.0005	0.001	0.001	0.0052
53	Potamocorbula fasciata	basket clam	0.00004	0	0.0020	0	0.0006	0.0007	0	0.001	0.001	0.0051
54	Gari togata	courtesan sunset clam	0.0007	0	0.0011	0	0.0006	0.0007	0.0004	0.0003	0.001	0.0051
55	Anodontia philippiana	chalky buttercup lucine	0.0004	0	0.0014	0	0.0006	0.0007	0.0006	0.001	0.001	0.0051
56	Crassostrea glomerata	New Zealand rock oyster	0.0017	0	0.0004	0	0.0006	0.0007	0.0002	0.0001	0.001	0.0048
57	Pinna bicolor	bicolor pen shell	0.0006	0	0.0004	0	0.0006	0.0007	0.0008	0.001	0.001	0.0048
58	Solen grandis	grand razor shell	0.0006	0	0.0004	0	0.0006	0.0007	0.0008	0.001	0.001	0.0048
59	Barbatia amygdalumtostum	almond ark	0.0014	0	0.0003	0	0.0006	0.0007	0.0002	0.0003	0.001	0.0048
60	Placuna ephippium	saddle-shaped oyster	0.0011	0	0.0006	0	0.0006	0.0007	0.0005	0.0004	0.001	0.0047
61	Euprotomus aurisdianae	diana conch	0.0006	0	0.0002	0	0.0006	0.0007	0.0006	0.001	0.001	0.0047
62	Gari virescens	sunset or sanguin clam	0.0004	0	0.0005	0	0.0006	0.0007	0.0006	0.001	0.001	0.0047
63	Nerita polita	polished nerite	0.0006	0	0.0001	0	0.0006	0.0007	0.0008	0.001	0.001	0.0047
64	Angaria delphinus	common delphinula	0.0011	0	0.0004	0	0.0006	0.0007	0.0002	0.0005	0.001	0.0047
65	Turbo intercostalis	ribbed turban	0.0011	0	0.0007	0	0.0006	0.0007	0.0002	0.0001	0.001	0.0046
66	Scapharca pilula	pill ark	0.0002	0	0.0008	0	0.0006	0.0007	0.0004	0.001	0.001	0.0046
67	Turbo chrysostomus	goldmouth turban	0.0011	0	0.0002	0	0.0006	0.0007	0	0.001	0.001	0.0045
68	Conus ebraeus	Hebrew cone	0.0007	0	0.00001	0	0.0006	0.0007	0.0006	0.001	0.001	0.0044
69	Gari elongata	elongate sunset clam	0.0007	0	0.0003	0	0.0006	0.0007	0.0006	0.0003	0.001	0.0044
70	Nerita undata	waved nerite	0.0008	0	0.0010	0	0.0006	0.0007	0	0	0.001	0.0043
71	Monodonta canalifera	canal monodont	0.0006	0	0.0003	0	0.0006	0.0007	0.0007	0.001	0.001	0.0043
72	Conus caracteristicus	characteristic cone	0.0008	0	0.00002	0	0.0006	0.0007	0.0005	0.0004	0.001	0.0043
73	Paphia undulata	short-necked clam	0.0011	0	0.0002	0	0.0006	0.0007	0.0002	0.0003	0.001	0.0043
74	Nerita exuvia	snakeskin nerite	0.0006	0	0.0008	0	0.0006	0.0007	0.0006	0.001	0.000	0.0043
75	Donax cuneatus	cuneate donax	0.0006	0	0	0	0.0006	0.0007	0.0005	0.001	0.001	0.0042
76	Cypraea tigris	tiger cowrie	0.0008	0	0.0002	0	0.0006	0.0007	0.0004	0.0003	0.001	0.0042
77	Pharella acutidens	rharp razor clam	0.0007	0	0.00002	0	0.0006	0.0007	0.0005	0.0004	0.001	0.0041

RANK	SPECIES	Common Names (FAO, 1998)	LCV	ECV	CR	PP	G/F	G	FPM	FSS	IA	sum
78	Conus pulicarius	Pacific deer cowrie	0.0008	0	0.0004	0	0.0006	0.0007	0.0002	0.0001	0.001	0.0040
79	Lyncina vitellus	flea-bitten cone	0.0008	0	0.0004	0	0.0006	0.0007	0.0002	0.0001	0.001	0.0040
80	Tellina scobinata	rasp telline	0.0007	0	0.00002	0	0.0006	0.0007	0.0003	0.0003	0.001	0.0038
81	Clypeomorus bifasciata	morus cerith	0.0007	0	0.00001	0	0.0006	0.0007	0.0003	0.0003	0.001	0.0038
82	Umbonium vestiarium	common button top	0.0007	0	0.00001	0	0.0006	0.0007	0.0003	0.0003	0.001	0.0038
83	Lambis millepeda	milleped spider conch	0.0006	0	0.00002	0	0.0006	0.0007	0	0.001	0.001	0.0038
84	Tectus pyramis	pyramid top	0.0008	0	0.0004	0	0.0006	0.0007	0	0	0.001	0.0037
85	Terebralia sulcata	sulcate swamp cerith	0.0006	0	0.0005	0	0.0006	0.0007	0	0.0001	0.001	0.0037
86	Mancinella alouina	Mancinella rock-shell	0.0006	0	0.0006	0	0.0006	0.0007	0.0003	0.0004	0.0004	0.0036
87	Lunella cinerea	smooth moon turban	0.0006	0	0.0004	0	0.0006	0.0007	0.0005	0.0004	0.0004	0.0036
88	Distorsio anus	common distorsia	0.0007	0	0.00001	0	0.0006	0.0007	0.0002	0.0001	0.001	0.0035
89	Meropesta nicobarica	Nicobar mactra	0.0008	0	0.0003	0	0.0006	0.0007	0.0002	0.0003	0.0004	0.0032
90	Pinctada imbricata	Atlantic pearl-oyster	0.0007	0	0.00002	0	0.0006	0.0007	0.0002	0.0001	0.0004	0.0027

The cephalopods, comprised of nine species, figure prominently in the list and confirm their reported commercial importance in Philippine fisheries. The list now includes oceanic species, such as the purpleback flying squid *Sthenoteuthis oualanensis* which is caught in deeper waters (9.1-18.3 m) in Antique by lighted jiggers, spear, and hook and line. While the flying squid has been previously reported to occur in the northwestern Philippines (Siriraksophon et al. 2000; Basir 2000), as well as in Ayungon and Bindoy, Negros Oriental (Campos et al. 2016), it has never been recorded in Panay waters. The once-named *Uroteuthis bartschi* by del Norte-Campos et al. (2000), is now verified actually to be the swordtip squid *Uroteuthis edulis*. The confusion was likely caused by the similar elongate body shape of both species. The list also includes the day octopus *Octopus cyanea*, as well as *O. nocturnus*, which is only encountered in Antique (Table 6).

Table 6. Occurrence of mollusk species by province in Panay and corresponding fishing gears/methods used in the collection of species.

No.	*Species*	Iloilo	Capiz	Aklan	Antique	Fishing Gears/Methods
1	*Amusium pleuronectes*	x	x			Trawl
2	*Anadara antiquata*		x			gleaning
3	*Anadara globosa*		x			diving
4	*Angaria delphinus*	x	x	x	x	gleaning
5	*Annachlamys striatula*	x				diving
6	*Anodontia philippiana*		x			gleaning
7	*Antigona magnifica**	x				gleaning
8	*Atrina pectinata*	x				diving
9	*Austriella corrugata*			x		gleaning
10	*Azorinus abbreviatus*	x	x	x		gleaning
11	*Barbatia amygdalumtostum*		x			gleaning
12	*Barbatia fusca**		x			gleaning
13	*Barbatia virescens*	x	x			gleaning
14	*Bractechlamys*	x	x			diving
15	*Canarium urceus*	x			x	gleaning
16	*Clypeomorus bifasciata*				x	gleaning
17	*Conomurex luhuanus*			x	x	gleaning
18	*Conus characteristicus*				x	Diving, gleaning
19	*Conus ebraeus*				x	diving
20	*Conus figulinus*				x	gleaning
21	*Conus pulicarius*			x		gleaning
22	*Crassostrea echinata*	x	x	x		gleaning
23	*Crassostrea glomerata*			x		gleaning
24	*Cypraea tigris*		x	x		gleaning
25	*Decatopecten amiculum*	x				diving
26	*Distorsio anus*				x	Diving, gleaning
27	*Donax cuneatus*				x	gleaning
28	*Euprotomus aurisdianae*				x	gleaning
29	*Gafrarium pectinatum*	x	x	x		gleaning
30	*Gari elongata*	x				gleaning

No.	*Species*	Iloilo	Capiz	Aklan	Antique	Fishing Gears/Methods
31	*Gari togata*			x		gleaning
32	*Gari virescens*		x			gleaning
33	*Geloina expansa*	x	x	x		gleaning
34	*Glauconome virens*			x		gleaning
35	*Haliotis asinina*			x	x	gleaning
36	*Isognomon ephippium*	x	x			gleaning
37	*Marcia hiantina*	x	x	x		gleaning
38	*Laevistrombus turturella*		x	x		gleaning
39	*Lambis lambis*			x		gleaning
40	*Lambis millepeda*				x	gleaning
41	*Lunella cinerea*			x		gleaning
42	*Lyncina vitellus*			x		gleaning
43	*Malleus malleus*	x	x			Diving, gleaning
44	*Mancinella alouina*			x		gleaning
45	*Melo broderipii*	x		x		Diving, gleaning
46	*Meretrix lyrata*		x			gleaning
47	*Meretrix meretrix*		x	x		gleaning
48	*Meropesta nicobarica*	x				gleaning
49	*Mimachlamys sanguinea*	x				diving
50	*Modiolus modulaides*	x	x			gleaning
51	*Monodonta canalifera*			x	x	gleaning
52	*Nautilus pompilius*			x	x	Baited traps
53	*Nerita albicilla*		x		x	gleaning
54	*Nerita exuvia*			x		gleaning
55	*Nerita planospira*			x		gleaning
56	*Nerita polita*		x		x	Diving, gleaning
57	*Nerita undata*			x		gleaning
58	*Neverita didyma**		x			gleaning
59	*Octopus cyanea*	x	x	x	x	Spear, trawl
60	*Octopus nocturnus*				x	Spear
61	*Oliva oliva*				x	gleaning
62	*Paphia undulata*	x				Diving
63	*Pharella acutidens*				x	gleaning
64	*Pholas orientalis*		x			Diving
65	*Pinctada imbricata*	x				gleaning
66	*Pinna bicolor*	x				gleaning
67	*Placuna ephippium*	x	x			gleaning
68	*Placuna placenta*	x	x	x		gleaning
69	*Potamocorbula fasciata*		x			gleaning
70	*Rochia nilotica**		x		x	gleaning
71	*Saccostrea cucullata*	x	x			gleaning

No.	*Species*	Iloilo	Capiz	Aklan	Antique	Fishing Gears/Methods
72	*Scapharca inequivalvis*	x	x	x	x	gleaning , diving
73	*Scapharca pilula*		x			gleaning
74	*Scutarcopagia scobinata*				x	gleaning
75	*Sepia latimanus*				x	Spear, hook & line,trawl
76	*Sepia recurvirostra*	x	x	x	x	Spear, trawl
77	*Sepioteuthis lessoniana*	x	x		x	Spear, traps, trawl
78	*Solen grandis*	x				gleaning
79	*Spondylus barbatus*	x				diving
80	*Spondylus butleri*	x				diving
81	*Spondylus squamosus*	x				diving
82	*Spondylus versicolor*	x				diving
83	*Sthenoteuthis oualaniensis*				x	Jigger
84	*Tectus pyramis*		x	x		gleaning
85	*Tegillarca granosa*	x	x	x		gleaning
86	*Telescopium telescopium*	x	x	x		gleaning
87	*Terebralia sulcata*	x				gleaning
88	*Trisidos semitorta*	x				gleaning
89	*Trochus radiatus*			x		gleaning
90	*Turbo chrysostomus*				x	gleaning
91	*Turbo intercostalis**		x			gleaning
92	*Umbonium vestiarium*		x		x	gleaning
93	*Uroteuthis duvaucelii*	x	x	x		Trawl, motorized bag-net, traps
94	*Uroteuthis edulis*	x	x			Trawl, motorized bag-net, traps
95	*Vasticardium pectiniforme**		x			gleaning

Some species formerly reported to be abundant have now suffered a decline. These include, for instance, the angelwing *Pholas orientalis*, which is now caught in much smaller quantities and on a very erratic basis. While biological data are available and intense restocking efforts (Marasigan and Laureta 2001; Laureta et al. 2014), it is apparent that the lack of parallel management efforts has caused its decline. The hammerhead oyster *Malleus malleus*, reported to be the number one species (mean monthly catch = 483 kg) in the diving fishery of Bancal bay, northern Panay (Declarador and del Norte-Campos 2004) only ranks 14th in the present survey. The same goes for the Asian moon scallop *Amusium pleuronectes*, which was once caught in huge quantities in the Visayan Sea (Gabral-Llana 1983) and landed in Estancia, northeastern Panay. Currently, this scallop is now only landed in much lesser quantities in Concepcion, Iloilo and Roxas Capiz (del Norte-Campos et al. in prep.).

Aside from the occurrence of species by province, Table 6 also shows the gears/methods of fishing for each. Included herein is the glistening abalone *Haliotis glabra*, a species of abalone not previously reported in Panay. This species is regularly gleaned in Nabas, Aklan. Restocking efforts in various areas in the western Visayas by SEAFDEC (Buen-Ursua and Ludevese 2011; Lebata-Ramos et al. 2013) pertain to another abalone species, the Donkey's ear abalone *Haliotis asinina*, reportedly introduced in Panay.

3.2. Species Importance: Commercial Value and Catch Rates

Table 5 shows the list of species ranked ac-

cording to the given set of criteria. The number 1 species in the list, the comb pen shell *Atrina pectinata*, ranked higher than the Indian squid, which has greater local and export commercial value (see below). This is primarily because the comb pen shell is the only mollusk species with processing plants in the area (scored in the criteria PP = processing plant) dedicated to extracting the species' adductor muscles for export to Taiwan. It is thus logically conceivable that a more targeted, severely wasteful, level of harvesting (Burgos et al. in prep.), is being conducted for this species given that only its adductor muscle has a high commercial value.

The number two species in the list, the Indian squid *Uroteuthis duvaucelii* ranked high due to its local and export commercial value (LCV = PHP 275 kg^{-1} and ECV = 400.00 kg^{-1}) and high catch rates. Catch rates for trawl during the summer months (March-April) were comparable for the two areas in Pilar Bay (1.97 kg hr^{-1}) and Concepcion Bay (3.7 kg hr^{-1}). Higher catch rate values in the latter are due to fishing in the fringes of the highly productive Visayan Sea. Lift nets, on the other hand, despite using attractants (lights), have lower catch rates (1.86 kg hr^{-1}) for *U. duvaucelii*, as they operate more towards nearshore areas.

It is also noteworthy that 4 (*Mimachlamys senatoria, Bractechlamys vexillum, Decatopecten amiculum,* and *Annachlamys striatula*) out of the top 10 species are scallops (Pectinidae). Aside from the works of Soliman and Dioneda (2004) and Morillo-Manalo (2017) on *C. senatoria*, the other three scallop species have been unstudied in the country. They are those occurring in more coralline substrates of the Gigantes Islands where diving fisheries are conducted. The more studied species the Asian moon scallop *Amusium pleuronectes* (Gabral-Llana and Aprieto 1980; Gabral-Llana 1983; del Norte 1988; del Norte et al. 1988; Belda and del Norte 1988), on the other hand, occurs in soft bottoms and is a trawl by-catch.

While ranking relatively low in the past study, the Chambered nautilus *Nautilus pompilius* has risen to become one of the top 10 species in the present study, and this is attributed first to the change in its use in the market. Whereas it was formerly harvested only for its shell (del Norte-Campos 2005), its meat is now likewise sold. In addition, change in the species' fishing seasonality was observed, which factored in the rankings, i.e., traps to catch the chambered nautilus are now deployed even outside the rainy season, unlike before.

Five species that were excluded in Table 5 (ranked) are included in Table 6 (not ranked). These are the species which likewise occur in Panay Island but have no direct commercial value as they are only for fisher household consumption. From here, it appears species are divided into two categories, i.e., those caught by single fishing gears/methods (86%), and those caught by a combination of gears (13%). For the species caught by single gears/methods, gleaning is the most important (79.8%) fishing method, followed by diving (14.3%). Exploiting species using a combination of methods, attest to fisher ingenuity and resourcefulness.

3.3. Sources of Threats

Of the gears/methods used to catch mollusks in Panay, the trawl remains to be the most destructive gear causing a considerable extent of damage to the bottom (Stiles et al. 2010). *Uroteuthis duvaucelii*, the number two ranked species (Table 5), also scores high in this criterion as it is caught by trawl and landed primarily in Iloilo and Capiz. At the same time, however, the extent of damage caused by diving and gleaning in terms of the upturning of the bottom substrate cannot be underrated. The existence of processing plants where shucked pen shell adductor muscles (*Atrina pectinata*) are sold, causes grave threats, together with the means of harvesting this species (digging up the substrate to unearth pen shells). These processing plants which purchase shucked adductor muscles of pen shells for export to Taiwan represent an easily accessible source of income for the fishers, which then will further encourage unabated harvesting at the expense of the stock.

3.4. Information Available

Ranking higher less-studied species highlighted those that need more attention, foremost of which is the pen shell *Atrina pectinata*. While the species has been studied in other areas, e.g., China (Qiu et al. 2014), no known studies on the species exist in the country. While squids have traditionally been included in trawl survey lists (Hernando and Flores 1981), there has been little effort to identify the species correctly and even worse, just referring to all of them as *Loligo* spp. (e.g., Armada et al. 1983). More specific studies on squids have also been recently conducted, such as that of the age and growth of the bigfin reef squid *Sepioteuthis lessoniana* (Balgos 1990) and reproductive biology of *Uroteuthis duvaucelii* (Tajolosa 2011), all species whose names have been updated in FAO (1998b) from the original (Voss 1963). There is

also an obvious need for studies on *Octopus cyanea*, which is caught in all provinces of Panay (Table 6).

The newly-reported invasive species, the Charru mussel *Mytella charruana* (Vallejo et al. 2017) in Manila Bay, has fortunately not yet been observed in Panay waters.

4. CONCLUSIONS AND RECOMMENDATIONS

This inventory provides the only known list and importance ranking of the commercially-important mollusk species in Panay Island, albeit short-term and limited. Although the data do not fully integrate the effects of seasonality, the list is considered nonetheless realistic as ranking was based on recorded catch rates (fisher's records) rather than solely based on recall interviews. This ranked inventory does not only highlight the multi-species and multi-gear character typical of many tropical species but also emphasizes the importance of Panay as a center of mollusk biodiversity. There is no area in the Philippines now known for such a high malacofauna record. Although the list is acknowledged to be incomplete and remains to be updated, it provides a picture of species importance and serves as a guide on where future more in-depth malacological studies should be focused. Assessment studies on the heavily exploited species can be initiated based on this inventory. Further studies on the species' biology can be investigated, so guidelines may be formulated for their proper resource utilization and to avoid possible stock collapse.

5. ACKNOWLEDGMENTS

This study was conducted under the DOST-funded project "Studies on the Biology and Utilization of Commercially-Important Mollusk Species in Panay Island, Western Visayas, Philippines" under the Niche Centers in the region for Research and Development (NICER) Program. Switzel Lapara, Kris Angeli Sanchez, and Jane Frances Senosa ably assisted in the field collection and data encoding. We are grateful to Dr. Takuma Haga of the National Museum of Nature and Science in Tokyo, Japan, for identifying unknown species, as well as pointing our attention to recent revisions in the scientific names of some species. We likewise thank numerous Municipal Agriculture Officers (MAO's), barangay captains, and Prof. Zaida Ochavo of Aklan State University (ASU), New Washington, Aklan, who helped facilitate data collection in the area. This paper is a contribution to the JSPS Core to Core Program B. Asia-Africa Platforms.

6. REFERENCES

Armada NB, Hammer C, Saeger J, Silvestre GT. 1983. Results of the Samar sea trawl survey. Pp. 1-146. In: J. Saeger (ed.). results of the Samar Sea trawl survey. Technical Report of the Department of Marine Fisheries, UPV. 3(1): 191 p.

Balgos MC. 1990. Age and growth of the squid *Sepioteuthis lessoniana* Lesson, 1830 in Bolinao, Pangasinan by statolith observation and length-frequency analysis. [MS Thesis]. Marine Science Inst., University of the Philippines, Dilan, Quezon City, Philippines. 78 p.

Basir S. 2000. Biological feature of an oceanic squid, *Sthenoteuthis oualaniensis* in the South China Sea, Area III: Western Philippines. In Proceedings of the SEAFDEC Seminar on Fishery Resources in the South China Sea, Area III: Western Philippines. Malaysia. p. 135-147.

Belda CA, Del Norte AGC. 1988. Notes on the induced spawning and larval culture of the Asian Moon Scallop, *Amusium pleuronectes* (Linné). Aquaculture. 72: 173-17.

Buen-Ursua, SMA, Ludevese G. 2011. Temperature and size range for the transport of juvenile Donkey's Ear Abalone *Haliotis asinina* Linné. Aquacultural Research. 42(8): 1206-1213.

Burgos LA, del Norte- Campos AGC, Lapara SL. In prep. The diving fishery of San Dionisio Iloilo, Northeastern Panay.

Campos WL, Nuñez KP, Guarte DM, Cadenas MC, Malingin MCL, Piloton RD, Felix LR. 2016. Determining harvest control reference points for near shore resources targeted for livelihood-linked approaches to sustainable fisheries in RARE project sites Ayungon and Negros Oriental submitted to Rare Philippines Inc. UP Visayas Foundation, Inc., Miag-ao, Iloilo, Philippines. p. 8-22.

Declarador MB, Del Norte-Campos AGC. 2004. Diving fishery in Bancal Bay, northeastern Panay. UPV Journal of Natural Sciences. 9(2): 262-270.

del Norte AGC. 1988. Some aspects of the growth, recruitment, mortality and reproduction of the Asian Moon Scallop, *Amusium pleuronectes* (Linné) in the Lingayen Gulf, Philippines. Ophelia. 29(2): 153-168.

del Norte AGC, Capuli EC, Mendoza RC. 1988. The scallop fishery of Lingayen Gulf, Philippines. Asian Fisheries Science. 1: 207-213.

del Norte-Campos AGC. 2005. The chambered nautilus fishery of Panay Island, west central Philippines: Fishing practices and yield. Phuket Marine Biological Center Research Bulletin. 66: 299-305.

del Norte-Campos AGC, Beldia RA, Villarta KA, Tad-y MA. 2000. A market survey of commercially-important invertebrates around Panay Island and use of the data to prioritize research. UPV Journal of Natural Sciences 5(1): 9-11.

del Norte-Campos AGC, Campos WL, Burgos, LA., Sanchez, KAS. In prep. Cephalopods of the trawl fishery of Panay Island, Western Visayas, Philippines.

del Norte-Campos AGC, Declarador MB, Beldia RA. 2003. Catch composition, harvest and effort estimates of gleaned macroinvertebrates in Malalison Island, northwestern Panay. UPV Journal of Natural Sciences. 8 (1 & 2):: 129-141.

del Norte-Campos AGC, Campos WL, Villarta KA. 2005. A survey of macro-invertebrate gleaning in the Banate Bay intertidal area, eastern Panay. Science Diliman. 17(2): 11-20

del Norte-Campos AGC, Villarta KA, Panes JB. 2003. Invertebrate trawl fishery of Pilar and Capiz Bays, northern Panay, west central Philippines. UPV Journal of Natural Sciences. 8 (1 & 2): 115-128.

FAO species identification guide for fishery purposes. 1998a. Carpenter, K.E. and V.H. Niem (eds.) The living marine resources of the western central Pacific. Vol. 1. Seaweeds, corals, bivalves and gastropods. Rome: p. 1-686.

FAO species identification guide for fishery purposes. 1998b. Carpenter, K.E. and V.H. Niem (eds.) The living marine resources of the western central Pacific. Vol. 2. Cephalopods, crustaceans, holohurians and sharks. Rome: p.687-1396.

Gabral-Llana ME.1983. Size composition, occurrence, distribution and abundance of scallops in the Visayan Sea. Philippine Journal of Fisheries. 16: 75-94.

Gabral-Llana ME, Aprieto VL. 1980. Reproductive biology of the Asian Moon Scallop *Amusium pleuronectes*. Fisheries Research Journal of the Philippines. 5: 1-10.

Hernando A, Flores EC. 1981. The Philippine squid fishery: A review. Marine Fisheries Review. 13-20.

Laureta LV. 2008. Compendium of the economically important seashells in Panay, Philippines. University of the Philippines Press, QC: 147 p.

Laureta LV, Piñosa LAG, Golez SM. 2014. Restoration of the oriental angelwing (*Pholas orientalis*) resources through broodstock transplantation in Western Visayas, Philippines. ELBA Bioflux 6(2):108-120.

Lebata-Ramos MJH, Doyola-Solis EFH, Abogueña J, Ogata H, Sumbing JG, Sibonga RC. 2013. Evaluation of post-release behavior, recapture and growth rates of hatchery-reared abalone *Haliotis asinina* released in Sagay Marine Reserve, Philippines. Review of Fisheries Science. 21(3-4): 433-440.

Marasigan ET, Laureta LV. 2001. Broodstock maintenance and early gonadal maturation of *Pholas orientalis* (Bivalvia: Pholadidae). Journal of Shellfish Research. 20, 1095–1099.

Morillo-Manalo L. 2017. Fishery, stock assessment and biology of the Senatorial Scallop *Chlamys senatoria* (Gmelin, 1791) in Gigantes Islands, Carles, central Phils. [PhD dissertation]. Institute of Marine Fisheries and Oceanology, College of Fisheries and Ocean Sciences, UP Visayas, Miagao, Iloilo, Philippines: 92 p.

[PSA] Philippine Statistics Authority. 2018. Fisheries Database; [cited 27 June 2018]. Available from:

http://openstat.psa.gov.ph/Database/Agriculture-Forestry-Fisheries

Qiu T, Zhang T, Bai Y, Xue D, Pan Y. 2014. Gonad development of pen shell *Atrina pectinata* from Shandong Province. Journal of Shellfish Research. 33 (2): 465-471.

Siriraksophon S, Nakamura Y, Pradit S, Sukramongkol N. 2000. Ecological Aspects of Oceanic Squid, *Sthenoteuthis oualaniensis* (Lesson) in the South China Sea, In the Proceedings of the Third Technical Seminar on marine Fishery Resources Survey in the South China Sea, Area III: Western Philippines. Bangkok: Special Paper No. SEC/SP/41, SEAFDEC; pp. 101–117.

Soliman VS, Dioneda SS Sr. 2004. Quick stock assessment of the commercial scallops (Bivalvia: Pectinidae) in Asid Gulf, masbate. UPV Journal of Natural Sciences. 9(1): 165-176.

Stiles ML, Stockbridge J, Lande M, Hirschfield MF. 2010. Impacts of bottom trawling on fisheries, tourism and marine environment. Oceana (oceana.org/sites/default/sites/reports/Trawling_BZ.10May10_to audrey.pdf)

Tajolosa MAT. 2011. Population and reproductive biology of the Indian Squid *Photololigo duvaucelii* D'Orbigny 1835 (Cephalopoda: Loliginidae) in the Visayan Sea, Philippines. [MS Thesis]. Division of Biological Sciences, UP Visayas, Miagao, Iloilo, Philippines: 91 p.

Vallejo B, Conejar-Espedido J & L Manubag. 2017. The ecology of an incipient marine biological invasion: The Charru mussel *Mytella charruana* d'Orbignyi, 1846 (Mollusca: Mytilidae) from Manila Bay, Luzon. Philippine Journal of Science. 146(4): 483-492.

Voss GL. 1963. Cephalopods of the Philippine Islands. Smithsonian Inst., Wash.: 179 p. http://countrystat.psa.gov.ph/ retrieved June 27, 2018 from the World Wide Web