Tropical Technology Journal ISSN: 1656-0264
Volume 11, No. 1-2, January-June 2008

CATCH DISTRIBUTION AND BIOLOGICAL CHARACTERISTICS OF DIAMONDBACK SQUID (*Thysanoteuthis rhombus*) OFF NORTHEAST CEBU ISLAND, PHILIPPINES

Roberto C. Lamayo[1], Venerando D. Cunado[1], Gloria G. Delan[1], Rachel Luz V. Rica[2], Anthony S. Ilano[3], and Ma. Helian A. Lamayo[1]

[1]Cebu State College of Science and Technology – Carmen Campus
[2]Cebu State College of Science and Technology- Cebu City Campus
[3]Marine Biology Section, University of San Carlos – Cebu City

ABSTRACT

This study examines the catch distribution of Diamondback Squid (*Thysanoteuthis rhombus*) in northeast Cebu, the physical characteristics of its habitat and its biological characteristics. Catch rates were monitored to determine its seasonal occurrence. Data were collected using squid jigs, a nautical chart, Nansen bottles, a refract meter, and a thermometer. Data collection involved pre-survey activities, establishing a study site, plotting the grid levels, measuring water temperature and salinity, and determining the moon phases and biological characteristics of captured squid. Data were collated and analyzed statistically using analysis of variance and regression. Catches were highest near Carmen at 10^0 30-36'N and 120^0 05-11'E. Catches occurred at 1-50 m depth, and were highest in July.

INTRODUCTION

Fishery resource assessment is necessary because it provides both a qualitative and a quantitative status of the resource. Assessment can monitor short- and long-term changes in resource status due to both natural and man-induced factors, thus enabling a comparison of changes in resources status over local, regional, and global scales.

Thysanoteuthis rhombus is a large nektonic squid distributed worldwide in tropical and subtropical waters, including the Philippines (Bower and Miyahara, 2005). Its common name is the "diamondback squid" (Turgeon *et al.*, 1998). In the Philippines, particularly in the Visayas region, it is known as "*dalupapa*". In Okinawa, Japan, Omoto, Kajita, and Shiraishi 1996 reported that from 1990 to 1994, over tons of Diamondback Squid were landed each year. They further stressed that in Okinawa in 1992, the value of the annual catch exceeded one billion yen, making Okinawa a major coastal fishery.

The Philippines is rich in fish and other marine resources, and the sea plays an important role in the lives of the Filipino people. Diamondback Squid jig fishing in the Philippines is believed to have started in Masbate but with only a few fishers. It was only in 1988 that the Diamondback Squid fishery started to grow when fishers from Negros Oriental introduced the fishing technology to northern Cebu (BFAR – 7, 2001). Diamondback Squid has a high demand in both local and foreign markets. According to the fishers of Luyang, Cebu, Diamondback Squid catches are low in October, November, December and January during the northeast monsoon. Diamondback Squid exports by Mr. Vicente Jayson, a local leader of Luyang, Carmen, Cebu, during 1997 – 1999 amounted to 248.071 MT or an average of 82.69 MT per year. These catches were made by at least 300 fishers from Northern Cebu, Camotes Island, Isabel and Ormoc City, Leyte (personal communication).

The fishing of Diamondback Squid in the Camotes Sea started in March 1998 by Mr. Jayson with the assistance of the Regional Fishermen's Training Center, Carmen, Cebu, which conducted training in Diamondback Squid jig fishing. Monthly catches exported to Japan range from 12 to 26 MT during peak months. Hence, the environmental threat of this practice should be considered.

The main purpose of this study was to determine the distribution and biological characteristics of Diamondback squid as basis in proposing sustainability and conservation measures of this resource in northeast Cebu, Philippines.

MATERIALS AND METHODS

The study was conducted in northeast Cebu in the Camotes Sea off Carmen, Catmon and Sogod, Cebu. The study site was located between 10° 35'N and 10° 48'N, and between 120° 02' 30"E and 120° 10"E and this was plotted on a nautical chart (NAMRIA #4427).From these sites, sampling was conducted during February to July 2005.

Water physical parameters of the study site were recorded to determine their effect on the said species. Number of diamond squid caught within the study area during the study period was monitored and recorded to determine its biological characteristics and its occurrence. The external and internal features, physical manifestations and food preferences of diamond squid were noted. The outline of the study is shown in Figure 1.

Data Gathering

Pre-survey activities. This included gathering of information through informal interviews of fishers engaged in Diamondback Squid fishing particularly in the coastal barangays of Carmen, Catmon, and Sogod, Cebu. The position of aids to navigation (such as land marks, towers, churches, river banks, market buildings and etc.) were established using the Global Positioning System (GPS) to give researchers an easy way in conducting the plotting of the study site. Fishing operations were monitored and recorded on a daily basis. Physical parameters were also monitored and recorded weekly. Catches of Diamondback squid were made using squid jigs.

Monitoring instruments. Salinity at 1-meter depth and the bottom (50-meters depth) were monitored and recorded using a refractometer. Water temperature at the surface was measured using a laboratory thermometer, while water temperature at the bottom was measured using a reversible thermometer attached to a Nansen bottle. Tide and moon phase data were obtained from NAMRIA (2006).

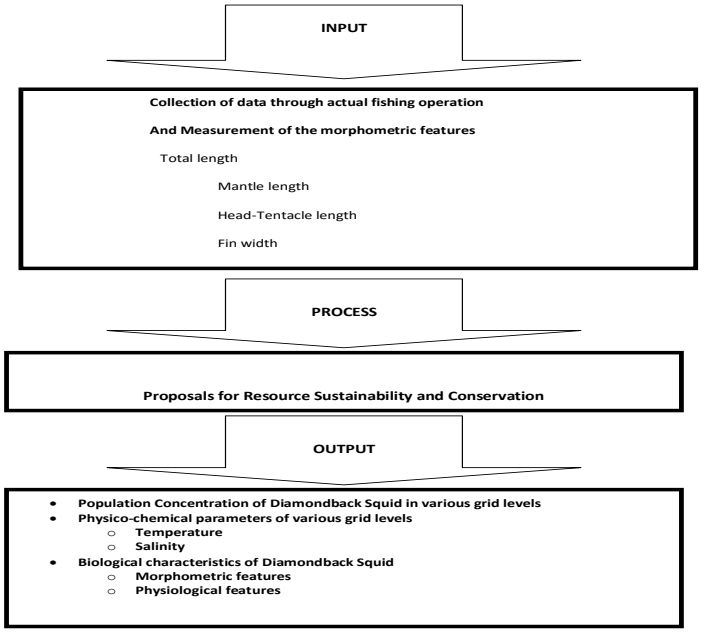


Figure 1. Outline of the study.

Biological Parameters

Squid morphometry. Length and weight measurements were made manually using a steel tape measure and a weighing scale. Measurements were made on the head-tentacle length, mantle length, and total length. Sex was determined based on the Japanese system developed by fishers and fish dealers of Tajima Region (Japan Sea Coast of Hyogo). Samples were placed on a flat surface and individuals having a flat body were categorized as female and

those with a rounded body were categorized as male.

Treatment of Data. The research design consisted of three identified areas, each having three replicates in a Completely Randomized Design (CRD). Results obtained were analyzed using the one-way analysis of variance (ANOVA) to determine if there is significant difference between the three areas. Correlation coefficient was also used to determine if there is a relationship between the determinants and the concentration of diamond squid.

Data obtained from the different morphometric features of the Diamondback Squid was correlated using the Multiple Correlation Analysis, and the gut analysis data was analyzed using the mean.

RESULTS AND DISCUSSION

The quantity of species of Diamondback squid caught was highest in the fishing ground of Carmen, Cebu (Table 1) within the grid level at Latitude 10° 30'N to Latitude 10° 36'N and at Longitude 120° 08' 30"E to Longitude 120° 11'E. This species were usually caught at the deeper part of the water. The month which has the highest number of species caught was during the month of July in the study site of Carmen (Figure 2).
The number of Diamondback Squid caught have significant difference at 1% level (F = 36. 73; Ft = 18) from the fishing areas considered. From the different research sites (Figure 3) higher catch were experienced in Carmen than in Sogod and in Catmon. The gut content of the catch usually include small squid, milkfish (as bait) and others.

Table 1. Total catches of Diamondback squid at different fishing locations during February to July 2005.

LOCATION	LATITUDE	LONGITUDE	SQUIDS CAUGHT			TOTAL
			1	2	3	
		120° 02'30" – 05'E	4	15	6	25
Sogod	10° 42'-48'N	120° 05' – 08'30"E	0	0	0	0
		120° 08'30" – 11'E	0	0	0	0
		120° 02'30" –05'E	0	0	1	1
Catmon	10° 36'-42'N	120° 05' – 08'30"E	1	32	50	83
		120° 08'30" – 11'E	0	0	0	0
		120° 02'30" – 05'E	0	14	0	14
Carmen	10° 30'-36'N	120° 05' – 08'30"E	0	215	267	482
		120° 08'30" – 11'E	0	196	308	504
Total			5	472	632	1,109

Figure 2. Total monthly catches of diamond squid during February to July 2005

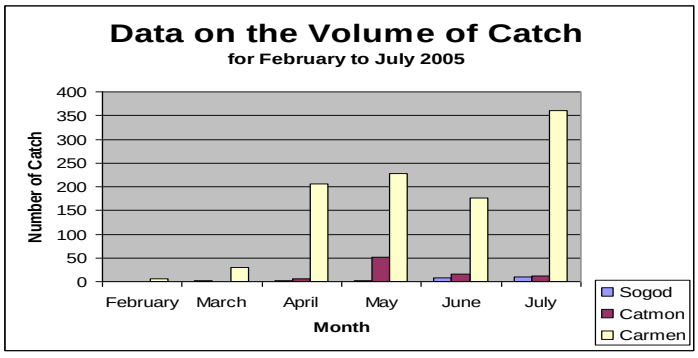
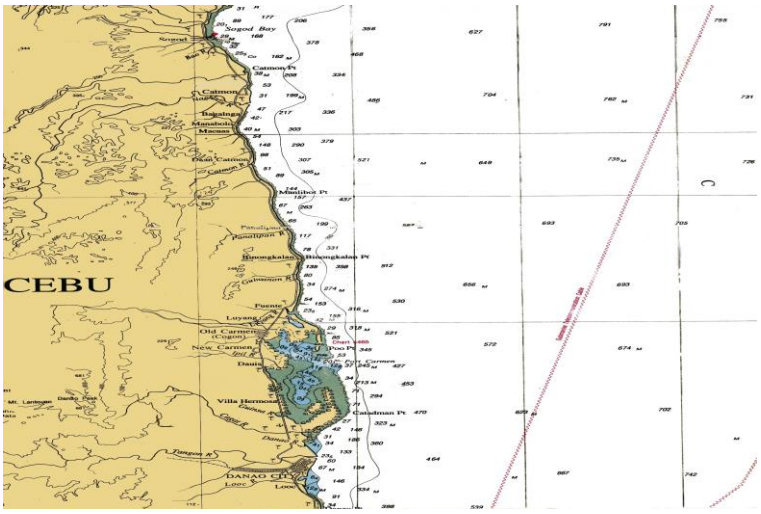


Figure 3. The Site Study

 ISSN: 1656-0264



The total length of the Diamondback Squid caught was directly proportional with the total weight, mantle length, fin width and tentacle head (Figures 4 – 6). Using regression correlation, it was observed that the total length have direct relationship with mantle length, i.e. the longer the total length, the longer is the mantle length.

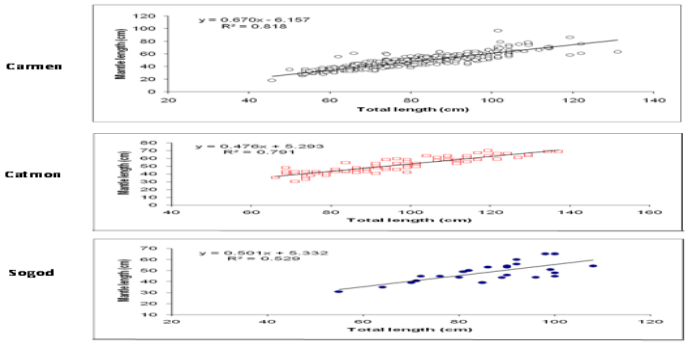


Figure 4. Relationship between total length and mantle length

Total length was also positively correlated with fin width (Fig 7), head-tentacle weight (Fig. 8), mantle weight (Fig 9), and total weight (Fig. 10).

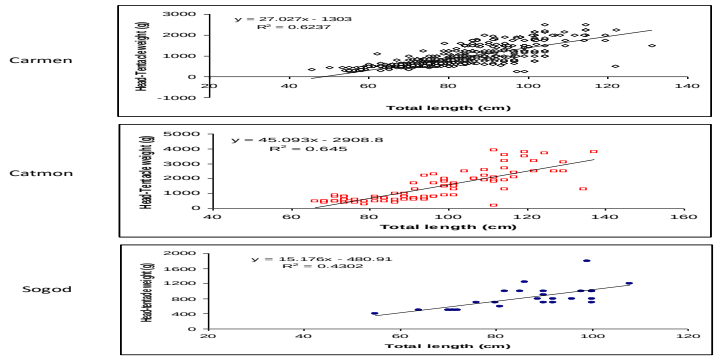


Figure 5. Relationship between total length and head-tentacle length

Total length was also positively correlated with fin width (Fig 6), head-tentacle weight (Fig. 7), mantle weight (Fig 8), and total weight (Fig. 9).

 ISSN: 1656-0264

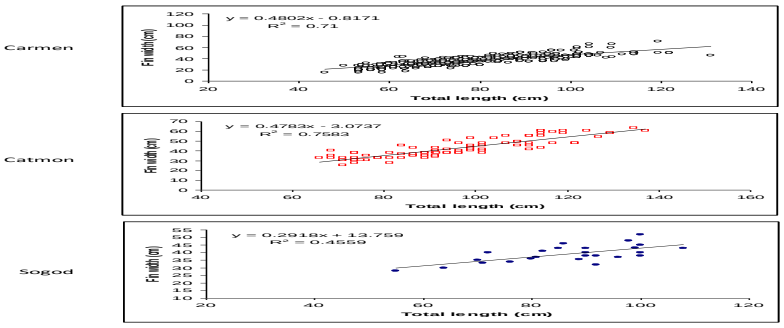


Figure 6. Relationship between total length and fin width.

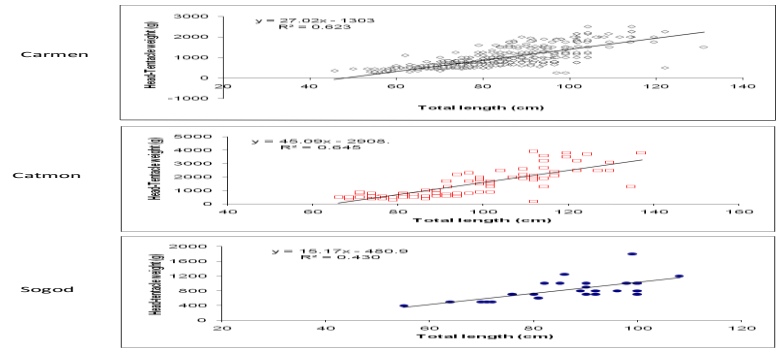


Figure 7. Relationship between total length and mantle weight.

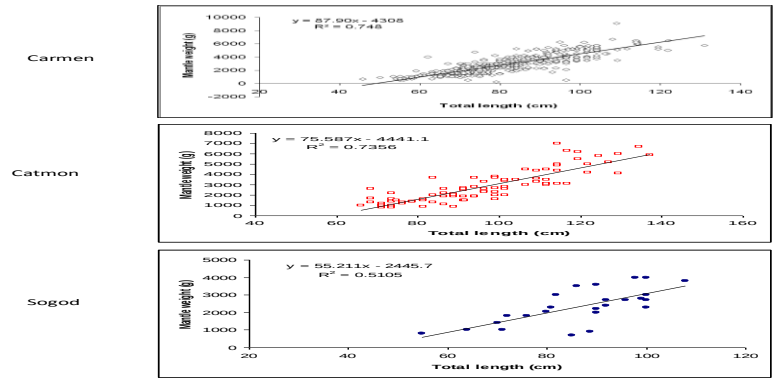


Figure 8. Relationship between total length and mantle weight.

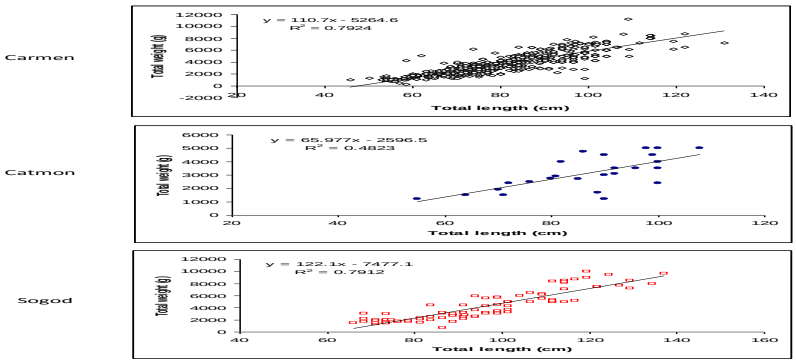


Figure 9. Relationship between total length and total weight

 ISSN: 1656-0264

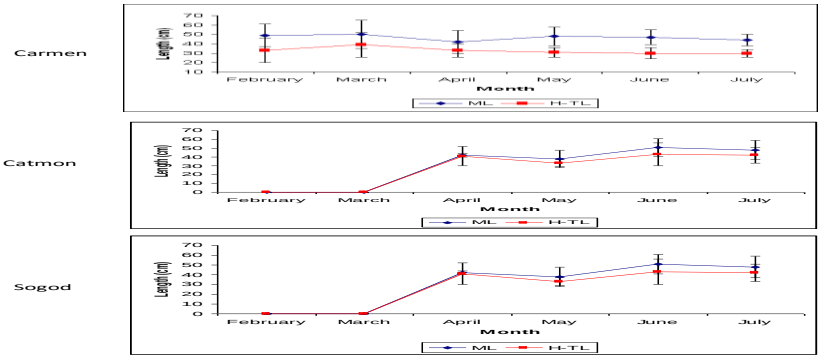


Figure 10. Monthly mean mantle and head-tentacle lengths of Diamondback Squid.

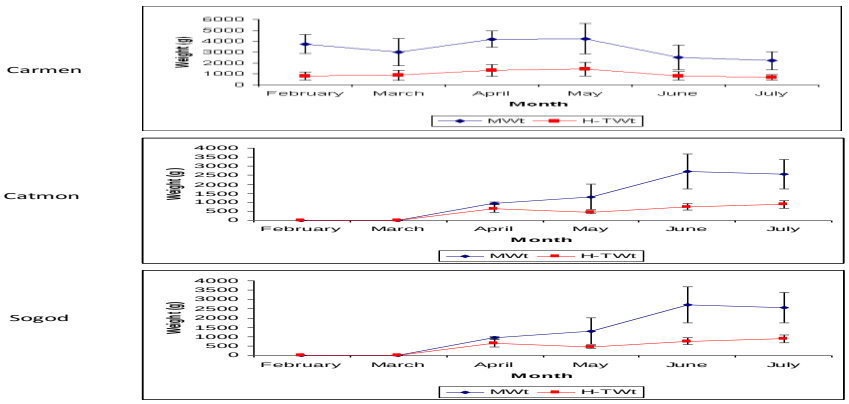


Figure 11. Monthly mean mantle and head-tentacle weights of Diamondback Squid.

The total weights were largest in July and smallest in February and March (Fig 12). The increase in weight was most probably due to the length of time that they were feeding in the fishing grounds.

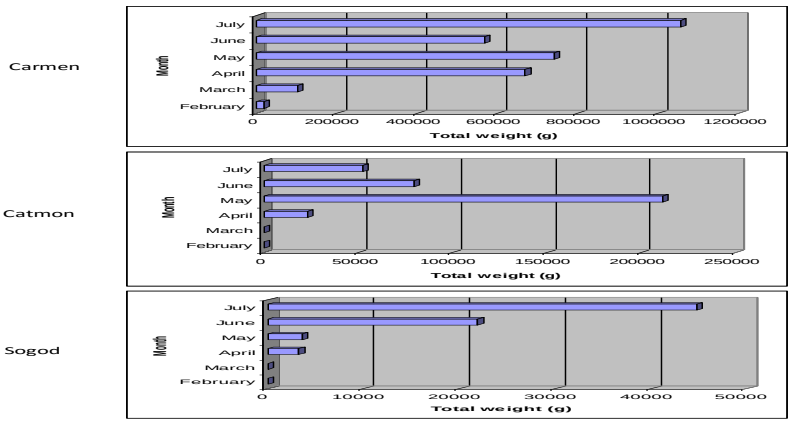


Figure 12. Monthly total weight of Diamondback squid.

Sex Ratio

One of the distinguishing features of male and female giant diamond squid was their body form. The females had a flattened body form, while the males were round. The monthly sex ratio is presented in Figure 13.

 ISSN: 1656-0264

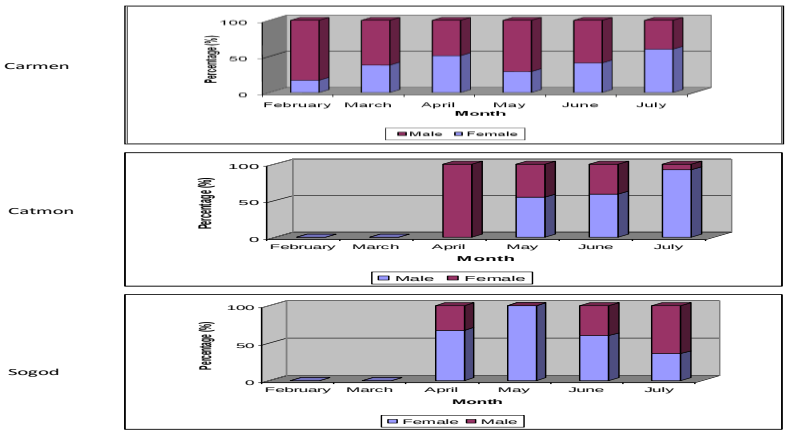


Figure 13. Monthly sex ratio of Diamondback Squid.

From February to June, more females were captured. Females were presumably more voracious feeders because they were spawning and had to sustain their reproductive activities. More females were captured, hence, on the month of July more male were mostly captured because they were the most numbered population in the group as most of the female were already captured during the previous months.

The frequency of developed gonads was highest in February and steadily declined through July (Fig. 14). This observation only shows that the reproductive stage of this species started during the month of February as the physical environment became favorable for them to spawn.

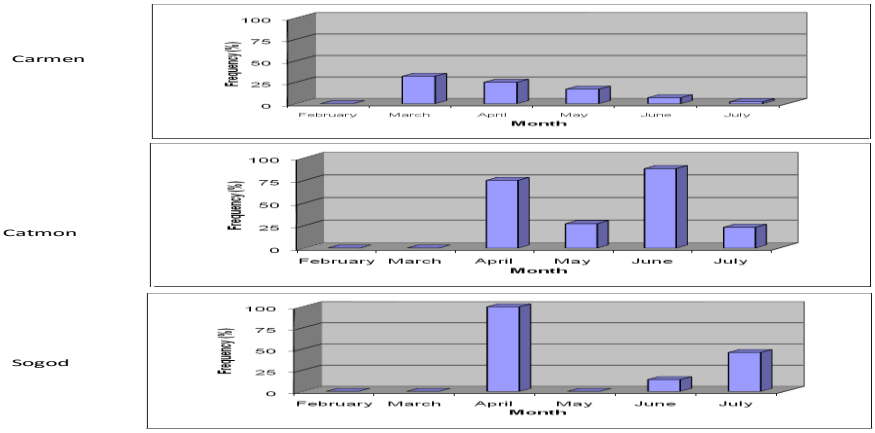


Figure 14. Monthly frequency (%) of Diamondback Squid with developed gonads.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

Catches were highest near Carmen, Cebu, at 10°30-36'N and 120°05-11'E, and were significantly higher at Carmen than in neighboring municipalities. Catches were highest in July and usually occurred at 100-200 m depth. Regardless of moon phase, diamondback squid were available all times of the day on the month of July. These were captured mainly when the high tide was moderate and the current speed was less than 0.30 m/sec, especially during the new moon and first quarter.

Male gonads were white, and female gonads were pink, light pink, dark pink, purple, and orange.

RECOMMENDATION

It is recommended that conservation program shall be formulated and implemented for the sustainability of Diamondback squid. Further studies should also be conducted in order to verify the veracity of the findings. Finally, more studies of its biological characteristics should be done for stock enhancement purposes of this species.

REFERENCES

Bower J.R., and K. Miyahara. 2005. The diamond squid (*Thysanoteuthis rhombus*): a review of thefishery and recent research in Japan. *Fisheries Research*. 73(1-2):1-11.

BFAR – 7. 2001. Central Visayas Technology Guide On Marine Fisheries. Planning, Monitoring and Evaluation Division – BFAR – 7. 33-40 pp.

FAO. 2006. Stock assessment for fishery management. FAO Fisheries Technical Paper. No. 487. FAO. 2006. 262 pp.

Hamabe, M., C., Hamuro and M., Ogura. 1982. Squid jigging From Small Boats. FAO Fishing Manual; Fishing News Book Ltd.; Surrey, England; 1- 74 pp.

NAMRIA. 2005. Tide and Current Tables: Philippines. Fort Bonifacio, Makati City.

Townsend, R.E. 2003. Community Management, Sustainable Fisheries and Economic Development. UPV Journal of Natural Sciences, 8:271 – 282.

Omoto, S. A. Kajita and H. Shiraishi. 1998. The marketing and price formation of diamond squid *Thysanoteuthis rhombus* in Japan. In: T. Okutani, Editor, *Contributed Papers to International Symposium on Large Pelagic Squids*, Japan Marine Fishery Resources Research Center, Tokyo (1998), pp. 199–205.

Pechenik, Jan A., 2000. Class Cephalopoda: The Molluscs: Biology of the Invertebrates; 4th Edition. McGraw-Hill International Editions, USA. pp 244-259.

Turgeon, D.D., J.F. Quinn Jr., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Mikkelsen, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F.G. Thompson, M.Vecchione and J.D. Williams. 1998. *Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks* **vol. 26**, American Fisheries Society, Special Publication, Bethesda, MD (1998) p. 526.