THE USE OF CPUE, MEAN SIZE AND SIZE OF SPAWNERS AS INDICATORS FOR THE MANAGEMENT OF RINGNET FISHERIES IN CAMOTES SEA

Noel C. Barut
Grace V. Lopez and Eunice C. Bognot
National Fisheries Research & Development Institute
940 Quezon Avenue,
Quezon City, Philippines

Introduction

The Philippine fisheries, in general, are already showing signs of resource depletion due to the excessive and uncontrolled fishing exploitation and environmental degradation. Camotes Sea, the study area, is one of the traditional fishing grounds known to be abundant in pelagic species. However, in the past study of Jabat & Dalzell (1988) they indicated that some of the small pelagics caught by the ringnet fishery were showing high exploitation rates.

The first resource assessment activity in the Camotes Sea was conducted in 1983-1990 under the Regional Stock Assessment Program (RSAP), a joint project of the Philippine Council for Agriculture and Resource Research and Development (PCARRD) and the Bureau of Fisheries and Aquatic Resources (BFAR). In 1996, BFAR implemented the National Stock Assessment Program (NSAP), a continuing activity as mandated in Republic Act 8550 (Fisheries Code of 1998).

The availability of catch and effort data as well as length measurements collected for the past several years were considered in choosing the ringnet fishery in Camotes Sea as the pilot project site. The data gathered for twenty years will be used to estimate the catch per unit effort (CPUE) and mean size of fish to assess whether these parameters are useful indicators in order to come up with a good management scheme for the ringnet fisheries in Camotes Sea. Moreover, the cooperation and support of the Regional Office, Local Government Units and stakeholders are also considered as they have shown their cooperation and support in previous studies conducted in the area.

For this study, CPUE, mean size of fish and size of spawners are the indicators chosen in the management of the ringnet fisheries in Camotes Sea. These indicators will serve as ready tools for describing the state of a fishery, for assessing the trends regarding sustainable development objectives and also as basis for decision-making. These can be used as an alternative to the classic empirical stock assessment models, which was designed for temperate zone rather than in tropical zones where the fisheries are more complex due to multi-species and multi-fleet fisheries.

This study was implemented with funding and technical support from SEAFDEC MFRDMD. SEAFDEC Secretariat also supported this project during the stakeholder consultation held in Cebu City by sending an expert to present and discuss indicators for fisheries management together with the expert from the MFRDMD who also presented a paper on indicators.

Description of Fishing Ground (Study Area/Monitoring Site)

Camotes Sea (Figure 1) is located approximately at longitudes 124° to 125°E and latitudes 10° to 11°N. The area is bounded on the north by Visayan Sea, on the east by Leyte, on the south by Danajon Bank and Bohol, and on the west by Cebu. At its center is Camotes Islands. It covers a total area of 10,900 km^2 with the deep offshelf water of 9,500 km^2 and depths of 10-800 meters. The southern portion along the northern coast of Bohol has a shelf covering of about 1,400 km^2 including Danajon Bank with depth ranging from 14m to 700m.

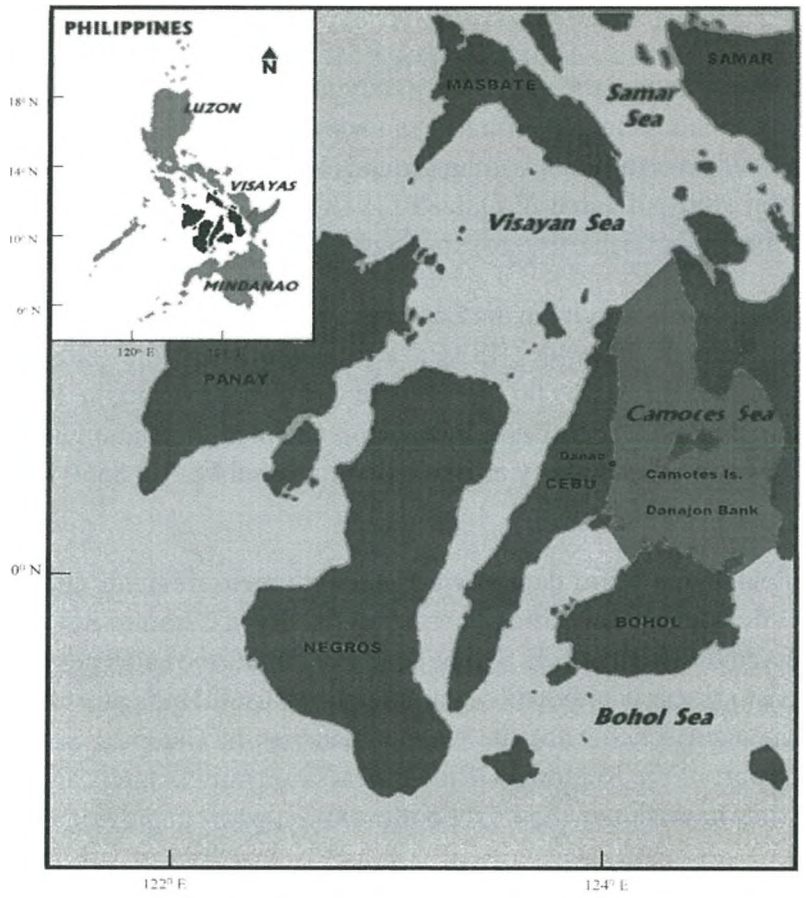

Figure 1: Map of Cebu showing the location of Camotes Sea

The Danao Ringnet Fishery

The ringnet is a kind of surrounding net with a bunt at the center and where hauling is done manually by pulling simultaneously both sides of the net (Figure 2). The operation of ringnet is usually done in conjunction with a Fish Aggregating Device (FAD) locally known as "payao" that are lighted at night, or by scouting for schools of fish. The "mother" boats remain in the fishing grounds for several days and their catches are transported to the landing centers by carrier vessels.

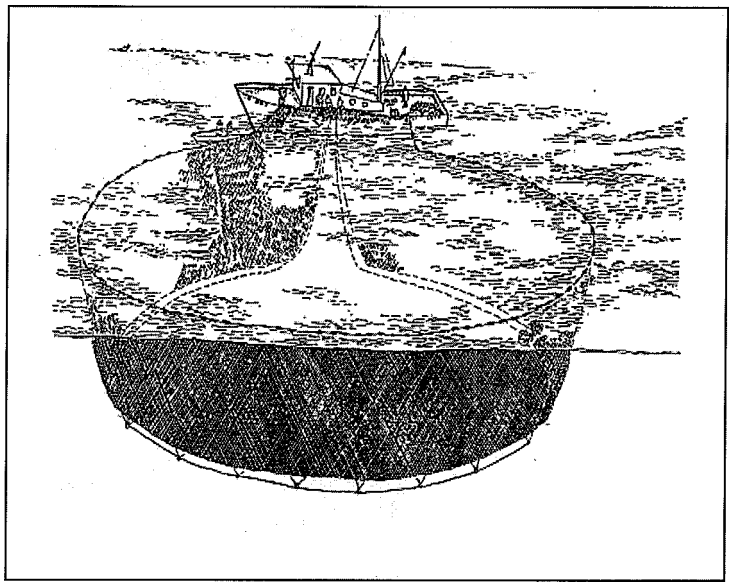

Figure 2: Operation of the ringnet in the Philippines

The ringnet fishery in the Philippines is classified into municipal and commercial types (Figure 3) depending on the attraction techniques, size of boat, and target species as shown in the diagram. The municipal type is operated by boats less than 3 GT that are either motorized or non-motorized. The commercial type use boats of more than 3 GT. The commercial fishing boats by law are generally restricted to fish inside the 15 km municipal waters except if allowed by the municipality to enter the area of 10 to 15 km.

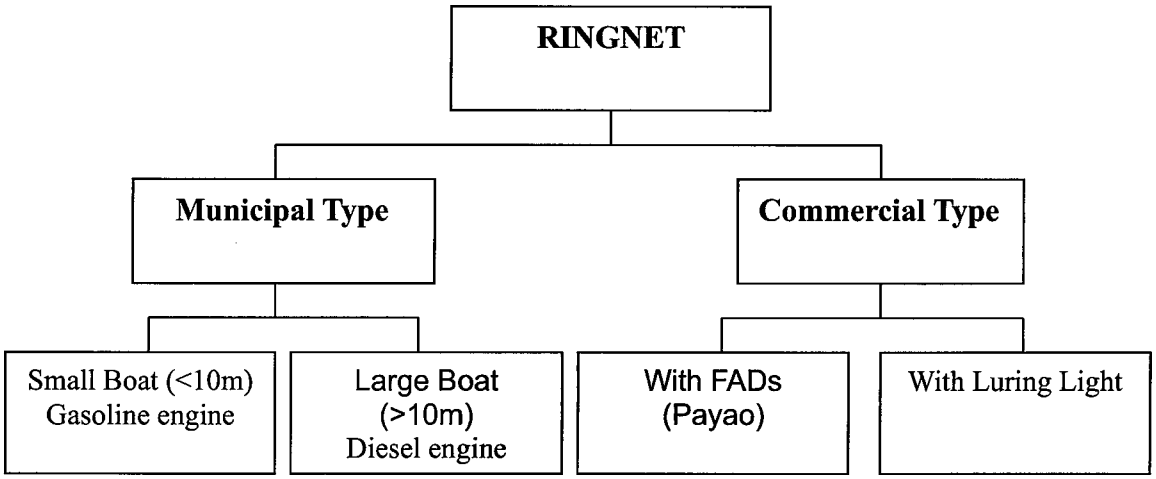

Figure 3: Classification of ringnet in the Philippines
Source: Dickson et al., 2003

The number of ringnets in the country has increased significantly from 1975-1986 (Table 1). The Danao ringnet boats are considered the commercial type and Table 2 shows the number of Danao ringnet boats operating in the Camotes Sea from 1983-2003.

Table 1: Number of ringnetters exploiting small pelagics in the Philippines, 1975-1986

Year	Ringnets
1975 *	58
1976	58
1977	61
1978	150
1979	143
1980	158
1981	222
1982	269
1983	310
1984	394
1985	418
1986	404

Source: Dalzell et. al., 1991
* No available ringnet data before 1975

Table 2: Number of Danao ringnet boats operating in Camotes Sea, 1983-2003

Year	Ringnets
1983-1987	10
1998	52
1999	31
2000	21
2001	18
2002	26
2003	35

Source: (1983-1987) Jabat & Dalzell, 1988
(1998-2003) NSAP-Region VII

There are four types of fishing gears operating in Camotes Sea that land their catch in Danao fish landing centers namely, ringnet, purse seine, gillnet and hook & line. Of these four, the ringnet contributed the highest catch of about 93% (Figure 4).

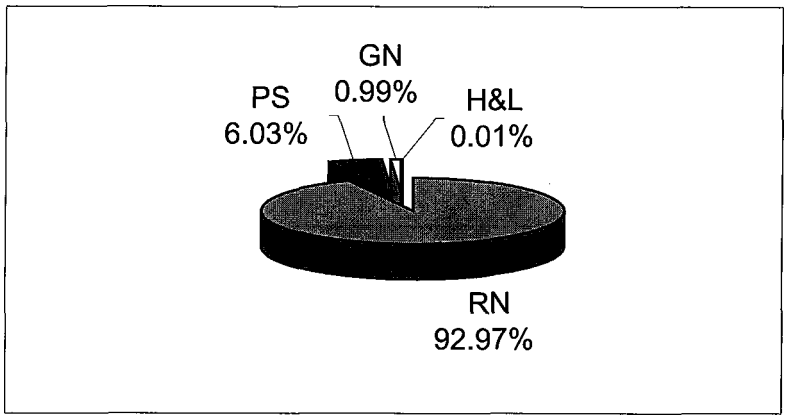

Figure 4. Catch percentage by gear in Camotes Sea, 1998-2002

Based from the latest NSAP survey (Year 2003), a total of 35 ringnet boats that are operating in Camotes Sea landed their catch in Danao City. The length of the ringnet boats ranges from 14.03 m to 64.0 m (=21.56 m). The gross tonnage (GT) ranges from 6.34 33.67 GT, (=19.31 GT). All the boats are powered by diesel engine with horsepower ranging from 45 to 310 hp (=141.86 hp) and the average number of crew per boat is 25. The ringnet gear varies in size with length and depth ranging from 180 m to 600 m (=316.86m) and 60 m to 195 m (=110.29 m), respectively. The mesh size of the ringnet bunt or bag varies from 1.79 cm 2.77 cm (=2.12 cm).

Objectives

It is the intention of this project to know the state of the ringnet fishery in Camotes Sea and its adjacent waters for fisheries management using the proposed indicators namely, CPUE, mean size and size of spawners.

A. Long Range:
   1. To determine the status and trend of fisheries as basis for sustainable management of the ringnet fishery.
   2. To develop a biological and economic database.
   3. To provide scientific information for formulating Fisheries Management Plan.

B. Short Range:
   1. To determine the top ten species composition, CPUE and changes in number of species of the ringnet fishery in Camotes Sea.
   2. To identify the size of spawners and the percentage of spawners in the ringnet catch of commercially dominant pelagic species.
   3. To determine the changes in mean length of species from ringnet catch.

Methodology

Both primary and secondary data were collected for this study. The primary data are catch and effort, length and weight measurements by species, sex and gonadal maturity by species while the secondary data are the historical catch and effort data, and length measurements by species. Data from 1983-1990 were taken from the result of the RSAP; data from 1996-1997 were taken from the BFAR Project on the Assessment of Major Pelagic Resouces in Camotes Sea; and from 1998-2003 were taken from the NSAP data.

The same fish landing sites of the NSAP were selected for this project. The two landings sites are Barangay Looc and Sitio Tabok-Looc both in Danao City. Ringnet landings were monitored every after two days regardless of Saturdays, Sundays and Holidays for a total of 10-11 sampling days a month in each landing site. A one-year data (January-December 2003) of the ring nets were collected. The fishermen or crew depositing the catch were interviewed on the location of the fishing operation, the number of hours actually spent fishing and other important information. The total weight of boat catch was recorded by first counting the total number of boxes/containers with fish then multiplied by 50 kgs (weight capacity of the container) to give the catch weight in kilograms. The species composition and weight composition was determined by sampling from several different boxes in the catch. Usually the catches were already pre-sorted into genera or species groups such as bullet tunas, roundscads, big-eyed scads, moonfish, *etc.* This facilitated sorting and identification of individual species. The sample was sorted further to species and then weighed, and the length measurements of the selected commercially important species were taken to the nearest 0.1 cm.

Emphasis on this study will focus on the nine commercially and dominant species namely, roundscads (*Decapterus macrosoma, D. tabl* and *D. kurroides),* mackerels (*Rastrelliger kanagurta* and *R. faughni),* big-eye scads (*Selar crumenophthalmus),* frigate tuna (*Auxis thazard),* bullet tuna (*Auxis rochei)* and moonfish (*Mene maculata).*

From the sample data, the monthly total landed catches were raised to total monthly catch weights by species.

Sex and gonad maturity determination of the nine selected species were collected for one year. Specimens of the nine selected species were dissected and their sex and gonad maturity were determined, following the recently grouped 5 stages of sex and maturity classification, which was modified based from the standard 8-stage maturity scale (Heicke-Naier's Sexual Maturity Determination).

Estimation of Indicators

Three indicators namely, CPUE, mean length by species, and size of spawners were selected for this study that can be used in the management of the ringnet fisheries.

CPUE will be estimated using the formula:

CPUE = Catch/ Effort (monthly = **kg/hr,** annual = **m.t./hr)**

Fishing effort was measured in terms of hours actually spent fishing that is, the time spent from setting up to hauling the net. Ringnet boats make an average two hauls per day, usually between 0300 0500 hours.

The Mean Length of the sample was computed using the defined formula:

Length Frequency x Midlength / Total Number of Frequencies

The determination of fish maturity was based from the five maturity stages of gonads. The size of the different stages particularly the spawners (Stage IV) and percentage of spawners in the catch by species were taken.

Species Composition and Dominance

The ringnet is a gear usually designed for catching pelagic species but just as the pelagic fishes are caught substantially by the trawl, the demersal fishes are also caught by ringnet but in very minimal quantities. It was unusual, however, for the two demersal species (*Cubiceps whiteleggii* and *Apogon septemstriatus)* to be included in the top ten dominant species in 1985-1990 and 1998-1999 (Table 3).

The annual top ten species caught by ringnet from 1983-2003 is given in Table 3. A slight change in species composition and dominance was observed. Some species were dominant in a certain year only but went down in rank or were no longer included in the top ten. *Auxis rochei* (bullet tuna) was constantly included in the top ten species and it remained on top from 1988 to 1990 except in 1989 where it was not even included among the top ten species. *Decapterus tabl* was the top contributor in 2003 but was not even observed in the previous years from 1983 to 2001. Probably, the enumerators might have misidentified this species. The other species that constantly remained in the top ten are S*elar crumenophthalmus* (big eye scad) and *Rastrelliger faughni* (mackerel).

Jabat & Dalzell (1988) reported that the Danao ringnet fishery was directed towards the catch of a single species since *A. rochei* (bullet tuna) remained the top dominant species from 1983 1987. *A. rochei* was caught in large quantities (almost 60% of the catch) as compared to the other species. However, a shift in the ranking of species dominance was observed starting 1998. Belga *et. al.*, on the other hand, showed a different ranking of the top ten species. From 1998-2002, *Decapterus kuroides* (roundscad) was the largest contributor (22.4%) followed by *D. macrosoma* (roundscad) and *R. faughni* (mackerel), each sharing about 17% of the total catch. The once top two species, *A. rochei* and S. *crumenophthalmus* went down to ranks 5 and 4, respectively. In spite of this, when combining the catches from 1983-2003 (Table 4), *A. rochei* (bullet tuna) still remained the highest contributor at 28% followed by S. *crumenophthalmus* (big eye scad), which contributed 13%. The rest of the catch was a variety of pelagic fish species, a few demersal species and invertebrates.

Table 3: Annual changes of species dominance (percentage) caught by ringnets in Camotes Sea, 1983-2003

	Species composition	1983 %		Species composition	1984 %
1	*Auxis rochei*	74.6	1	*Auxis rochei*	46.5
2	*Selar crumenophthalmus*	7.3	2	*Selar crumenophthalmus*	16.5
3	*Decapterus macrosoma*	6.3	3	*Decapterus russelli*	16.1
4	*Decapterus russelli*	3.6	4	*Mene maculara*	4.1
5	*Auxis thazard*	1.5	5	*Decapterus maruadsi*	1.8
6	*Rastrelliger brachysoma*	1.5	6	*Rastrelliger kanagurta*	1.4
7	*Caranx ferdau*	1.2	7	*Rastrelliger brachysoma*	1.0
8	*Rastrelliger faughni*	0.8	8	*Rastrelliger faughni*	0.9
9	*Decapterus maruadsi*	0.7	9	*Decapterus macrosoma*	0.8
10	*Rastrelliger kanagurta*	0.6	10	*Sardinella longiceps*	0.7
	Species composition	**1985 %**		**Species composition**	**1986 %**
1	*Auxis rochei*	64.6	1	*Auxis rochei*	43.8
2	*Decapterus russelli*	7.8	2	*Selar crumenophthalmus*	13.3
3	*Selar crumenophthalmus*	5.8	3	*Decapterus macrosoma*	9.6
4	*Decapterus maruadsi*	3.2	4	*Decapterus russelli*	7.0
5	*Rastrelliger kanagurta*	2.4	5	*Rastrelliger kanagurta*	4.4
6	*Katsuwonus pelamis*	1.6	6	*Mene maculara*	3.3
7	*Decapterus macrosoma*	1.3	7	*Rastrelliger faughni*	3.0
8	*Apogon septemstriatus*	0.6	8	*Auxis thazard*	2.7
9	*Mene maculara*	0.5	9	*Apogon septemstriatus*	2.2
10	*Rastrelliger faughni*	0.5	10	*Euthynnus affinis*	1.9
	Species composition	**1987 %**		**Species composition**	**1988 %**
1	*Auxis rochei*	63.8	1	*Auxis rochei*	51.5
2	*Decapterus russelli*	12.2	2	*Selar crumenophthalmus*	14.1
3	*Decapterus macrosoma*	5.3	3	*Rastrelliger faughni*	7.7
4	*Selar crumenophthalmus*	5.3	4	*Decapterus russelli*	4.9
5	*Decapterus kurroides*	2.1	5	*Decapterus kurroides*	3.9
6	*Rastrelliger faughni*	2.1	6	*Mene maculata*	3.5
7	*Apogon septemstriatus*	1.6	7	*Selaroides leptolepis*	2.9
8	*Sardinella sirm*	1.5	8	*Decapterus macrosoma*	2.5
9	*Decapterus maruadsi*	0.9	9	*Caranx sexfasciatus*	2.3
10	*Rastrelliger kanagurta*	0.7	10	*Apogon septemstriatus*	1.3
	Species composition	**1989 %**		**Species composition**	**1990 %**
1	*Mene maculata*	13.1	1	*Auxis rochei*	33.7
2	*Selar crumenophthalmus*	12.7	2	*Decapterus russelli*	23.7
3	*Rastrelliger faughni*	7.5	3	*Selar crumenophthalmus*	22.3
4	*Selaroides leptolepis*	2.9	4	*Rastrelliger faughni*	5.6
5	*Katsuwonus pelamis*	1.1	5	*Auxis thazard*	5.0
6	*Thunnus albacares*	0.9	6	*Mene maculata*	3.1
7	*Megalaspis cordyla*	0.2	7	*Apogon septemstriatus*	2.3
8	*Loligo sp.*	0.2	8	*Decapterus macrosoma*	1.3
9	*Sardinella fimbriata*	0.1	9	*Sardinella fimbriata*	1.2
10	*Sardinella sirm*	0.1	10	*Decapterus kurroides*	0.5

	Species composition	1996 %		Species composition	1997 %
1	*Selar crumenophthalmus*	15.7	1	*Decapterus kurroides*	21.6
2	*Auxis rochei*	12.6	2	*Selar crumenophthalmus*	21.1
3	*Sardinella longiceps*	11.5	3	*Auxis rochei*	12.6
4	*Mene maculata*	10.5	4	*Auxis thazard*	10.1
5	*Auxis thazard*	9.3	5	*Decapterus macrosoma*	8.1
6	*Rastrelliger faughni*	9.1	6	*Rastrelliger faughni*	6.4
7	*Decapterus kurroides*	7.0	7	*Sardinella longiceps*	6.3
8	*Decapterus macrosoma*	5.4	8	*Mene maculata*	3.6
9	*Rastrelliger kanagurta*	4.1	9	*Rastrelliger. kanagurta*	1.5
10	*Decapterus russelli*	3.0	10	*Katsuwonus pelamis*	1.2
	Species composition	**1998** **%**		**Species composition**	**1999** **%**
1	*Selar crumenophthalmus*	25.5	1	*Rastrelliger faughni*	26.7
2	*Auxis rochei*	19.8	2	*Selar crumenophthalmus*	21.1
3	*Decapterus kurroides*	16.6	3	*Decapterus kurroides*	16.4
4	*Rastrelliger faughni*	8.7	4	*Decapterus macrosoma*	7.0
5	*Decapterus macrosoma*	7.2	5	*Mene maculata*	7.0
6	*Auxis thazard*	5.7	6	*Auxis rochei*	6.2
7	*Cubiceps whiteleggii*	3.5	7	*Auxis thazard*	6.2
8	*Sardinella longiceps*	3.3	8	*Sardinella longiceps*	2.3
9	*Mene maculata*	2.0	9	*Cubiceps whitelegii*	0.9
10	*Euthynnus affinis*	1.2	10	*Katsuwonus pelamis*	0.9
	Species composition	**2000** **%**		**Species composition**	**2001** **%**
1	*Rastrelliger faughni*	24.1	1	*Decapterus macrosoma*	30.2
2	*Decapterus kurroides*	17.8	2	*Decapterus kurroides*	23.0
3	*Selar crumenophthalmus*	15.2	3	*Rastrelliger faughni*	18.7
4	*Decapterus macrosoma*	13.9	4	*Mene maculata*	9.4
5	*Mene maculata*	10.1	5	*Auxis thazard*	8.8
6	*Auxis thazard*	7.3	6	*Selar crumenophthalmus*	4.7
7	*Auxis rochei*	5.1	7	*Rastrelliger kanagurta*	1.4
8	*Katsuwonus pelamis*	1.8	8	*Sardinella sirm*	0.7
9	*Rastrelliger kanagurta*	1.2	9	*Auxis rochei*	0.6
10	*Euthynus affinis*	0.7	10	*Katsuwonus pelamis*	0.4
	Species composition	**2002** **%**		**Species composition**	**2003** **%**
1	*Decapterus kurroides*	38.3	1	*Decapterus tabl*	33.0
2	*Decapterus macrosoma*	25.1	2	*Decapterus macrosoma*	20.1
3	*Auxis rochei*	9.9	3	*Rastrelliger faughni*	11.0
4	*Mene maculata*	9.0	4	*Auxis rochei*	8.5
5	*Auxis thazard*	8.2	5	*Selar crumenopthalmus*	6.3
6	*Rastrelliger faughni*	3.1	6	*Decapterus kurroides*	5.9
7	*Selar crumenophthalmus*	2.4	7	*Mene maculata*	4.7
8	*Decapterus tabl*	1.2	8	*Auxis thazard*	3.8
9	*Rastrelliger kanagurta*	0.7	9	*Decapterus maruadsi*	2.0
10	*Selaroides leptolepis*	0.5	10	*Sardinella longiceps*	0.9

Table 4: Top ten species composition (percentage) by weight caught by ringnet in Camotes Sea, 1983-2003

	Species composition*	Mean %
1	*Auxis rochei*	28.4
2	*Selar crumenophthalmus*	13.1
3	*Decapterus kurroides*	9.5
4	*Decapterus macrosoma*	9.0
5	*Rastrelliger faughni*	8.5
6	*Decapterus russelli*	4.9
7	*Mene maculata*	4.7
8	*Auxis thazard*	4.3
9	*Decapterus tabl*	2.6
10	*Rastrelliger kanagurta*	1.1

* (no data from 1991-1995)

Figure 5 shows the annual catch production and number of boats that landed their catch. The mean catch of ringnets was very high in 1988 and 1998 because of the high catch of *Auxis rochei* (bullet tuna) with a noticeable increase also of the number of ringnet boats that landed in the same year. The mean catch went down after 1998 but was still high when compared with the past years (1983-1990). This can be explained by the increased number of Danao ringnetters that operated in the Camotes Sea.

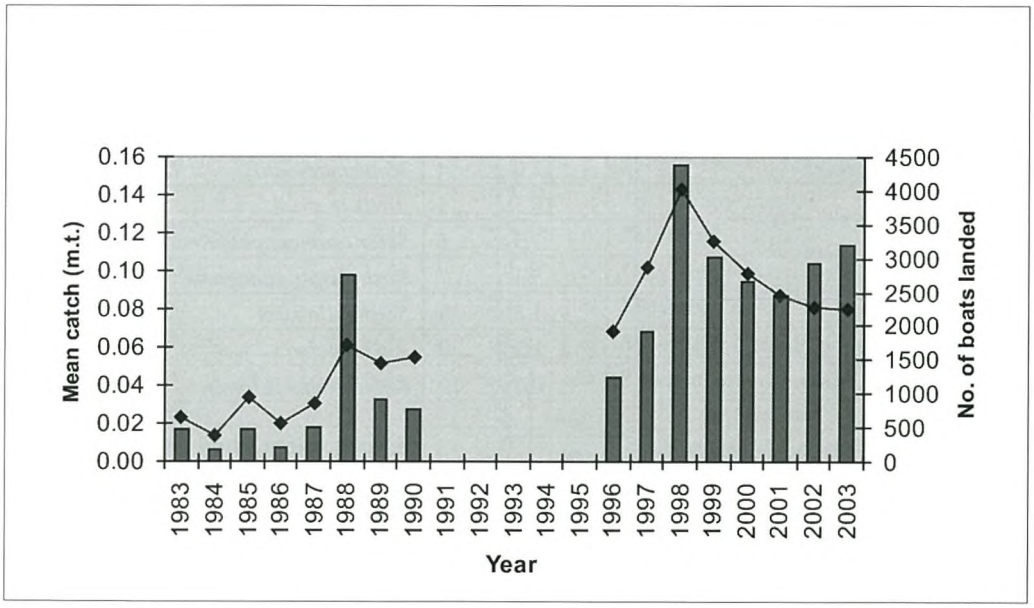

Figure 5. Annual mean catch of ringnet and boats that operated in Camotes Sea, 1983-2003

CPUE and Seasonality

The mean CPUE in this instance is expressed in km/hr (monthly) and mt/hr (annual). It is apparent in Fig. 6 that the ringnet fishery in Camtoes Sea in 2003 was highly seasonal. The catch rate was high in January at 2384 kg/hr but went down to 722 kg/hr in February and went up again in March to 1614 kg/hr. After March, the catch rate was very low; it increased very slightly only in December to 888 kg/hr.

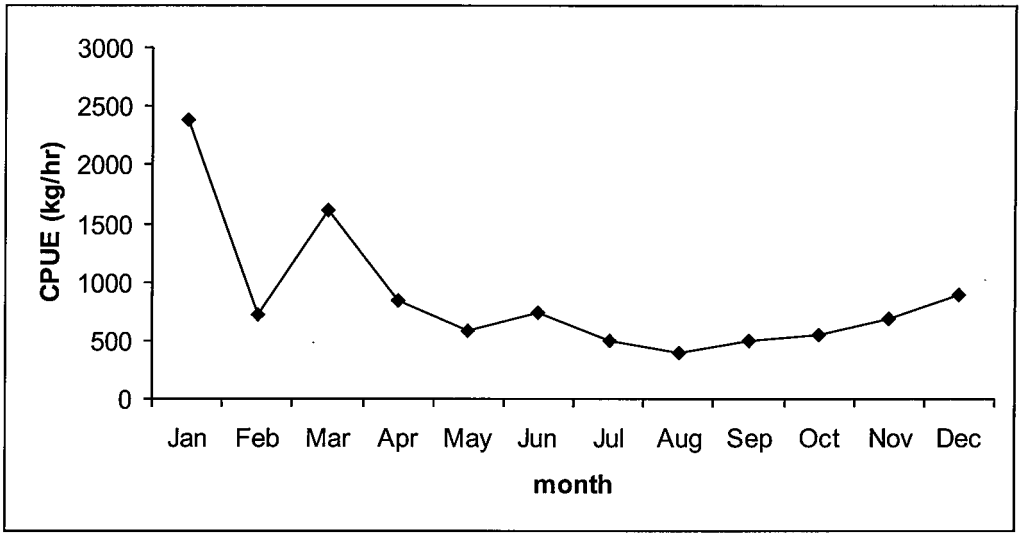

Figure 6: Monthly CPUE of Danao ringnet fishery in Camotes Sea, 2003

A varied seasonality was observed for the Danao ringnet fishery in Camotes Sea based from previous studies. The mean CPUE (kg/hr) from 1983-1987 was highest in June and then the fishery declined steadily until after January (Jabat & Dalzell, 1988). Based on the record of NSAP, CPUE (kg/hr) was high in April in 1998 and 1999, in October in 2000, March in 2001, and April, August & November in 2002 (Belga *et al.*).

Pilot Project Implementation

The project started in January 2003. Under the planning stage, the activities included preparation of the project proposal, gathering of information on the proposed study area and review of existing data. Two consultation meetings were conducted at separate times and venues to introduce the proposed indicator project. The first consultation meeting was held on 11 December 2002 and was attended by the Local Government Units, BFAR staff and other stakeholders. Since many of the ringnet fishing operators and stakeholders were not able to attend the first consultation meeting, a second local consultation meeting was scheduled in January 2003 and fishing boat operators, fisherfolk and stakeholders attended it this time. Indicators like, CPUE, mean size and size of spawners were presented and were accepted by the stakeholders. Training of enumerators on data collection, especially in the collection of biological data was also conducted in December 2002.

Draft Management Plan for Pilot Project

So far, a draft management plan for this project could not be developed yet until such time when the data are all collated, process and analysed. Data verification should also be done to determine the accuracy and reliability of the data collected.

Constraints in the Implementation of Pilot Project an Proposed Solutions

There were no significant problems encountered during the implementation of this project. Problems encountered were minor in nature and could easily be solved.

Conclusion

Processing of the data is not complete, so no definite conclusions could be drawn at present. However, we are recommending the continuation of the data collection at least for another year to validate the present data collected.

References

Arce, F. 1986. Distribution and Relative Abundance of Nemipterids and Carangids (Pisces: Nemipteridae and Carangidae) caught by Trawl in the Visayan Sea with Notes on the Biology of *Nemipterus oveni* AND *Selaroides leptolepis* (A Thesis). *The Phil. J. of Fish. Vol. 19*, Nos. 1 & 2. Jan.-Dec. 1986.

Barut, N. & E. Bognot. Assessment of the Major Pelagic Resources in Camotes Sea, 1996- 1997 (Unpublished)

Belga, P., L. Romena, & D.F. Nuñal. 2003. Fishery Stock Assessment of Camotes Sea, Northeastern Part of Cebu (Region VII. (Unpublished).

Chee, P.E. 2003. A Proposal for the Introduction of the use of Indicators for the Sustainable Development and Management of Fisheries in the ASEAN Region. *In*: Chee (Ed.) 2003. Proceedings of the Regional Technical Consultation on the Use of Indicators for the Sustainable Development and Management of Capture Fisheries in the ASEAN Region, Kuala Terengganu, Malaysia, 16-18 September 2002.

Dalzell, P., P. Corpuz & R. Ganaden. 1991. The Characteristics of the Philippine Small Pelagic Fisheries and Options for Management. *Phil. J. Fish. 22*:1-28.

Dickson, J., E Alba, A. Munprasit, B. Chokesanguan, & S. Siriraksophon. Jan 2003. Fishing Gear & Methods in Southeast Asia: III. Philippines, Part 1. TD/RES/38-1.

Gayanilo, F.C., Jr. & D. Pauly (eds.). 1997. FAO-ICLARM Stock Assessment Tools (FiSAT). Reference Manual. FAO Computerized Information Series (Fisheries) No. 8. Rome, FAO. 262p.

Jabat, M. & Dalzell, P. 1988. Preliminary Stock Assessment of the Danao Ring Net Fishery for Bullet Tunas & Small Pelagic Fishes in the Camotes Sea, Central Visayas, Philippines. BFAR Tech. Paper Series, vol. XI, No. 1, Jan. 1988.

Kato, Y. 2003. Consideration on the Use of Indicators. *In*: Chee (Ed.) 2003. Proceedings of the Regional Technical Consultation on the Use of Indicators for the Sustainable Development and Management of Capture Fisheries in the ASEAN Region, Kuala Terengganu, Malaysia, 16-18 September 2002.

Metzner, R. 2001. The Usefulness of Indicators for Fisheries Management. *In*: Proceedings of the Regional Technical Consultation on Indicators for Sustainable Fisheries Management in ASEAN Region, 2-5 May 2001, Haiphong, Vietnam.

R.A. 8550 (Republic Act 8550). 1998. Philippine Fisheries Code of 1998. Promulgated on February 19, 1998. Congress of the Philippines, Metro Manila.

Sparre, P. and S. Venema. 1992. Introduction to Tropical Fish Stock Assessment. Part I Manual. FAO Fish. Tech. Paper 306/1, Rev. 1.

Supongpan, M.. 2001. Possible Indicators for Improved Management of Marine Capture Fisheries in ASEAN Countries. In: Proceedings of the Regional Technical Consultation on Indicators for Sustainable Fisheries Management in ASEAN Region. 2-5 May 2001, Haiphong, Vietnam.

Supongpan, M. 2003. Simple and Practical Indicators to Monitor the Fishery Status and Fishery Trend for ASEAN Countries. *In*: Chee (Ed.) 2003. Proceedings of the Regional Technical Consultation on the Use of Indicators for the Sustainable Development and Management of Capture Fisheries in the ASEAN Region, Kuala Terengganu, Malaysia, 16-18 September 2002.

Umali, A. 1950. Guide to the Classification of Fishing Gear in the Philippines. Research Report 17. Fish & Wildlife Service, United States Department of the Interiors. U.S. Government Printing Office.