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THE FISHERIES AND BIOLOGY OF ROUNDSCADS MACKERELS AND NERITIC TUNAS IN THE PHILIPPINES

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I. INTRODUCTION

The Philippines is one of the major fishing nations of the world and was ranked 11th by weight of landings in the Food and Agriculture Organization (FAO) Fisheries Yearbook for 1988 (FAO 1988).

The Fisheries sector accounted for about 5.0% of the Country's Gross Domestic Product and about 17.0% of the Gross Value Added in Agriculture. It provides livelihood to about a million people; 5% of the country's labor force are in fisheries (Bureau of Fisheries and Aquatic Resources [BFAR], 1994).

The fisheries sector is classified into municipal and commercial fisheries and aquaculture. The municipal fisheries or small-scale, nearshore fisheries refers to fishing activities which utilize boats of less than three gross tons and those which use gears that do not require motorized boats. The municipal waters wherein municipal fishers operate extend up to 15 km (as embodied in the Local Government Code). The commercial fisheries or offshore fisheries refers to fishing activities that utilize fishing vessels over three gross tons and operate from over 15 km to the EEZ and international waters.

The Philippine marine waters is divided into 24 statistical fishing areas as recommended by FAO **(Figure 1)** for the collection of catch data. Landed catch by species (following ISSCAP) and by gear from major and minor commercial and municipal landing centers are monitored at regular intervals every month. The catches by species by gear by statistical fishing area are summarized and raised to obtain the monthly totals. The annual values are obtained from the monthly totals.

The Philippine fisheries is a multi-species, multi-gear and multi-vessel fisheries. Fishing activities is dependent on the monsoon season and are, in general, associated with *payaos*, a fish aggregating device.

The total annual marine fish landings from 1978 to 1993 ranged from 1.2 metric tons to 1.7 metric tons with a mean of 1.4 metric tons, 43% of which came from the commercial fisheries sector **(Table 1, Fig. 2).**

The roundscad, mackerels and neritic tunas form about 28% of the total marine fish landings and are generally consumed locally. However, there are undocumented values of frozen roundscads exported as baits, frigate and kawakawa as raw materials for canning.

Very few studies have been conducted on the fisheries and biology of roundscad, mackerels and neritic tunas as well as in oceanography of Philippine waters. Oceanographic cruises were conducted in some areas of the Philippines **(Figure 3).**

This paper presents a collation of all the available data and information on these pelagic fish groups and oceanography. Possible collaborrative research undertakings between and among SEAFDEC member countries are presented.

II. FISHERIES AND BIOLOGY

a. *Status of the fisheries, catch-effort information and fishing gears*

ROUNDSCADS

From 1978 to 1994, the catch of roundscads ranged from 105,013 metric tons to 274,017 metric tons with a mean of about 163,911 metric tons from the commercial fisheries. These accounted for an average of 26.4% of the commercial catch 13.3% of the total marine fish catch. The annual catches gradually increased from 1988 to 1992 but gradually decreased from 1992 to 1994 **(Table 2, Fig. 4).**

The major gears used to exploit the roundscads are purse seines, bagnet, trawl, ringnet for the commercial fisheries sector. Under the municipal fisheries sector, the gillnet is the most important. Other municipal gears are hook and line, baby purse seine/ringnet, baby bagnet, beach seine, fish corral, round haul seine and baby trawl.

The 10 most important fishing grounds are West Sulu Sea, Visayan Sea, Moro Gulf, East Sulu Sea, South Sulu Sea, Lamon Bay, Cuyo Pass, Tayabas Bay, Batangas Coast and Bohol Sea. The fishing season is throughout the year with peaks during summer, March to May, particularly in the Sulu Sea area. In Lamon Bay facing the Pacific side, the peak season is from June to August (Calvelo, *et al.* 1987).

In the regular tuna landed catch monitoring under the Philippine Tune Research Project (PTRP) conducted in Moro Gulf and South Sulu Sea areas, from 1993 to 1994, the roundscad catches were likewise recorded. Total catch and catch per unit effort were computed for purse seine, ringnet and handline. These data are presented in **Tables 6 to 11.**

The catch-per-unit effort (CPUE), expressed in metric tons (mt) per trip day (derived from the individual vessel unloadings only), in Moro Gulf ranged from 0.1 to 1.9 mt/trip day for purse seine vessels. The monthly CPUE seems to be declining from February to May 1993 but increasing from March to July 1994. The total catch in May of 1993 is higher than that of the same period in 1994; and those in July/August 1994 **(Fig. 5a).** The CPUE for ringnet vessels is very variable. The highest was 1.3 mt/trip day obtained in June and September 1994. The total catch for 1994 was better than that of 1993 (Fig. 5b).

In the South Sulu Sea area, based on landings at Puerto Princesa, Palawan, the CPUE of purse seine vessels vary greatly from 0.1 mt/trip day to 10.3 mt/trip day in April 1994 (Fig. 5c). The CPUE of ringnet vessels in 1994 ranged from 0.1 mt/trip day in January to 0.7 mt/trip day in August (Fig. 5d). Although these data are preliminary, variations in the monthly total catch and CPUE for both years may indicate the seasonality of the species.

MACKERELS

The annual catches of mackerels ranged from 43,736 mt to 90,023 mt with a mean of 68,554 mt. The annual catches from the commercial and municipal sectors did not vary much from year to year **(Table 3, Fig. 6).** The mackerels contribution to the total marine fish production for the last 16 years was 4.6% and 5.8% to the commercial fisheries sector.

The ten most important fishing grounds for mackerels are Sulu Sea, Visayan Sea, Lamon Bay, Sibuyan Sea, Moro Gulf, Samar Sea, Tayabas Bay, Bohol Sea, Camotes Sea and Cuyo Pass.

For the period 1978-1987, the most important commercial fishing gears were purse seine, trawl and ringnet. Gillnet, hook and line and baby purse seine/ringnet were the most important municipal fishing gears.

The mackerels occur seasonally in almost all fishing grounds depending on the prevailing monsoon wind.

Data for total catch and catch-per-unit effort obtained from the PTRP landed catch and effort monitoring indicated that the mackerels occurred only in South Sulu Sea and caught by ringnets. The CPUE ranged from 0.1 to 0.3 mt/trip day **(Fig. 7).**

FRIGATE/BULLET TUNA

The landings of the two species of *Auxis* were not separated in the fisheries statistics report. The statistical enumerators are not able to recognize one from the other.

The total annual landings of frigate/bullet tunas from 1978 to 1994 ranged from 45,975 mt in 1978 to 125,655 mt in 1992 with a mean of 91,460 mt **(Table 4, Fig. 8).** It was observed that 8.4% of the total marine fish landed by the commercial fisheries sector is contributed by this group. Of the tuna species, the *Auxis* spp. is the most important in terms of landed weight. The catch trends of *Auxis* and kawakawa from 1978 to 1987 for shallow-water and deep-water fishing areas are shown in **Figures 9** and **10,** respectively. The *Auxis* landings in shallow-water fishing areas show marked annual fluctuations, especially in Guimaras Strait, Ragay Gulf, Samar Sea and, to a lesser extent, in Tayabas Bay and Visayan Sea. On the other hand, *Auxis* landings in the deeper areas are more stable. The most productive shallow-water and deep-water fishing areas for *Auxis* are Visayan Sea and Moro Gulf, respectively (Yesaki *et al.* 1991).

The major gears exploiting the frigate/bullet tunas are purse seine/ringnet, and bagnet for the commercial fisheries sector while hook and line, baby purse seine/ringnet and gillnet are for the municipal fisheries sector.

The catch-per-unit effort of purse seine vessels in Moro Gulf frigate tuna ranged from 0.1 mt/trip day to 0.9 mt/trip day for January 1993 to December 1994. The total catch in 1993 was higher than that of 1994 by about 120 mt but the CPUE for 1994 was higher. For the ring net vessels, the CPUE declined from March to July but seem to be improving on the latter half of the year and became very varia in 1994 **(Figs. 11 a & b).**

For the bullet tuna, the CPUE of purse seine vessels ranged from 0.2 mt/trip day to 3.5 mt/trip day in 1993 and from 0.1 mt/trip day to 1.2 mt/ trip day in 1994. The total catch decreased from 867 mt in 1993 to 275 mt in 1994 with a corresponding decrease in CPUE also **(Fig.12a).** For the ringnet vessels, the CPUE for bullet tuna seem to be very variable which probably indicate effects of seasonality in recruitment **(Fig. 12b).**

In the South Sulu Sea, the CPUE of purse seine vessels for frigate tuna ranged from 0.1 to 0.8 mt/trip day in 1993 and from 0.1 to 3.9 mt/trip day in 1994 **(Fig. 13a).** The ringnet catch of frigate tuna was high in September 1993 but the CPUE was only 0.1 mt/trip day **(table 10).** For the bullet tuna it was from 0.1 to 1.9 mt/trip day. The CPUE increased abruptly from 0.1 mt/trip day in January 1994 to 1.9 mt/trip day in March 1994 (Fig. 14a). For the ring nets the monthly total catch of bullet tuna was exceptionally high at 30 mt in April 1993 but decreased to 0.2 mt in February 1994 **(Fig. 14b).** The total catch of handline vessels was highest in October 1993 with a corresponding high CPUE **(Fig. 14c).**

KAWAKAWA

Historical catch data for the kawakawa from 1978 to 1994 ranged from 7,269 mt in 1979 to 36,056 mt in 1994 with a mean value of 17,331 mt for the commercial sector. Those of the municipal sector ranged from 9,546 mt in 1994 to 36,421 mt in 1993 with a mean at 22,723 mt **(Table 5).** The commercial landings increased gradually from 1978 to 1989, declined in 1990 and started to increase again from 1992 to 1994. The municipal landings steadily increased from 1978 to 1983, declined slightly in 1984 and started to increase again from 1986 to 1989 **(Fig. 15).**

The kawakawa landings are generally higher in the shallow-water than in the deep-water fishing areas (Yesaki *et al,* 1991). The catch trends of kawakawa from 1978 to 1987 for shallow-water and deep-water fishing areas are shown in **Fig. 9 & 10,** respectively.

The ten most important fishing grounds for kawakawa are Cuyo Pass, Ragay Gulf, Visayan Sea, Moro Gulf, Sibuyan Sea, Davao Gulf, Bohol Sea, Tayabas Bay, Guimaras Strait and Sulu Sea.

The gears exploiting the kawakawa are similar to that for all the tunas. All commercial fishing gears catch various groups of fishes and operate under *payaos* or free school. Generally, there is no target species, but depending on the demand, they can choose which species to capture particularly if they are fishing under *payaos.*

The total catch and catch-per-unit effort purse seine, ring net and handline vessels in Moro Gulf is presented in **Figure 16.** Seasonality in the catch is indicated and CPUE trends are very variable.

In the South Sulu Sea area, the total catches from purse seine vessels were high only in February 1993 at 70 mt and December 1994 at 80 mt. The CPUEs were as low as 0.1 mt/trip day to as high as 1.2 mt/trip day **(Fig. 17a).** For the ring net vessels the total catch was highest in August 1993 at 81 mt but the CPUE was only 0.3 mt/trip day. In August 1994, the total catch was only about 13 mt but the CPUE was also 0.3 mt/trip day **(Fig. 17b).**

b. Status of exploitation and potential yield of the stock

Recent studies conducted on the small pelagic fisheries which include roundscad and mackerels concluded that the present stocks are fully exploited (Dalzell *et al.*, 1988). Even small bays have been found to be overexploited. Unless appropriate management measures are implemented, the resources may not be able to recover.

However, the resources in the northeastern, eastern, southeastern and western Philippines are believed to be under-exploited yet. Further, even the resources in the EEZ are not explored.

c. *Biology*

ROUNDSCADS

Five species of roundscads are recorderdin Philippine waters, namely: *Decapterus macrosoma, D. maruadsi, D. kurroides, D. russelli and D. macarellus.*

Dalzell *et al.* (1987) stated that there is a probability that the northern and central Philippine roundscad fishery rely on the stocks of D. *macrosoma* and D. *russelli.* Low salinity lower than 30 ppt and the density of zooplankton strongly influences the distribution and movement of roundscad. They are caught at water depths ranging from 20-25 fathoms to 100 fathoms. (Tiews, *et al.,* 1970). Ronquillo (1975) stated that roundscad are around the periphery of the Sulu Sea Basin which lies within the 200-m isobath. Tiews (1962) suggested that as the roundscad increase in size they change from a pelagic to a demersel habitat.

The growth and mortality parameters for the roundscad species in the Philippines are given in Table 12. The life span of the species of roundscad is 2.8 years for *D. russelli,* 2.8 years for *D. macrosoma* (Ingles & Pauly, 1984) and 4.2 years for *D. maruadsi* (Corpuz *et al.,* 1985).

The mean lengths at first capture for D. russelli was 4.5 cm and 12.9 cm for *D. macrosoma* by ringnets in Camotes Sea (Jabat & Dalzell, 1988).

The computed values for length-weight relationships for *D. macrosoma* was 0.005639 $L^{3.159}$ and for *D. russelli* was 0.0099771 $L^{3.015}$ indicating that both species grow isometrically.

The spawning period for *D. macrosoma* and *D. russelli* is protracted from November to March in Palawan waters and extend up to May in Manila Bay (Tiews, *et al.*, 1970). Around Calagua Island of Lamon Bay, *D. macrosoma* and *D. maruadsi* are in the maturing and immature stages with very few matured individuals during the south west monsoon (Calvelo, *et al.,* 1991). The presence of fish eggs and larvae of the family Carangidae in Lamon Bay and approaches indicate that these areas are their spawning grounds. The extensive fishing grounds for roundscads may as well be their spawning areas as very small sizes are captured thereat.

D. macrosoma and *D. russelli* are recruited into the fishery between 10 to 12 cm in length towards the end of their first year of life (Tiews, *et al.,* 1970; Ingles & Pauly, 1984). Recruitment occurs from January to April (Dalzell, *et al.,* 1987). For the Camotes ringnet fishery, two recruitment peaks were observed in a year, suggesting that these peaks were associated with the two major monsoon periods in the Philippines (Jabat & Dalzell, 1988).

The sex ratio of *Decapterus* differed by species and by area. There was more male *D. russelli* but more female *D. macrosoma* observed in Manila bay. In palawan waters there was a one-to-one ratio between males and females of both species (Tiews, *et al.,* 1970). In Camotes Sea, the male-to-female ratio was 1:05 : 1.0 for *D. russelli* while the females dominated the males by a ratio of 1.2 : 1 in *D. macrosoma* and *D. maruadsi* (Calvelo, 1991). For the Sulu Sea stocks, male to female ratio was 1.04:1.0 for *D. macrosoma* and 1.8:1 for *D. maruadsi* while that of *D. macarellus* in Moro Gulf is 1.8 : 1 (Calvelo, MS).

Fecundity (number of eggs/fish) values obtained for *D. macrosoma* were from 67,900 to 106,200 eggs while for *D. russelli* were from 28,700 to 48,000 (Tiews, *et al.,* 1970).

D. macrosoma is a rypical zoopplankton feeder while *D. russelli* feeds on smaller fishes and larger species of *Decapterus* spp. feed on benthic organisms. Both species also consume stolephorid eggs (Tiews, *et al.,* 1970).

MACKERELS

Three species belonging to the genus *Rastrelliger*, namely: *Rastrelliger brachysoma, R. kanagurta* and *R. faughni* are present in Philippine waters. The latter two species appcar to be offshore or open-water forms (manacop, 1956; Tiews, 1958). Two species of *Scomber* are also present, namely: *Scomber australasicus* and *S. japonicus.*

They were widely distributed in Philippine waters but their occurence is seasonal. Little information on the identity of the various stocks of mackerels in Philippine waters is available. FAO (1985) suggested that the mackerel population of the Southern Sulu Sea and Northern Palawan are contiguous with those of the northern Celebes Sea and western coast of Borneo. However, the degree of mixing between Rastrelliger populations from adjacent waters and the Philippines will remain unknown unless tagging experiments are carried out.

R. brachysoma is a coastal or inshore fish and subsists principally on microplankton while *R. kanagurta* is an open-sea fish and feeds mostly on macroplankton such as larval shrimps and fishes as determined from stomach content analysis (Manacop, 1956).

The spawning grounds were presumably in deeper waters since no fish with fully ripe gonads were captured from the commercial fishing grounds (Buzeta, 1978). *R. brachysoma* spawn from June to February in Manila bay. The fecundity of *R. brachysoma* in Manila Bay was estimated to be 11,300 to 119,300 eggs for fishes 16-22 cm TL (Tan, 1970).

The exploited population of *R. kanagurta* in Camotes Sea consisted of fishes from 9.0 cm to 25 cm and those of R. faughni, from 10.0 cm to 26 cm.

The recuitment patterns for these sepcies vary from area to area even within the same species but are generally either unimodal or bimodal (Dalzel, & Ganaden, 1988).

The growth and mortality parameters for *R. bracysoma, R. kanagurta* and *R. faughni* are presented in **Table 13.** The growt parameter estimates for *R. kanagurta* and R. brachysoma suggest that the life span of these mackerels is between 1.5 and 2 years (Ingles & Pauly, 1984; Dalzell & Ganaden, 1987).

NERITIC TUNAS

The neritic tunas of the Philippines consisted mainly of two species of *Auxis, A. thazard* and A. rochei (frigate/bullet tunas) and *Euthynnus affinis* (kawakawa or eastern little tuna). These are locally referred to as "tulingan, turingan or aloy". Two other species have been occasionally observed: *Thunnus tonggol* (longtail tuna) and *Sarda orientalis* (oriental bonito) but they are not recorded in the fisheries statistics and probably included under any of the tuna species on record.

Very few studies on the biology of the neritic tunas, *Auxis thazard, A. rochei* and *Euthynnus affinis* have been conducted in the Philippines.

The tuna sampling program established by FAO/UNDP/IPTP in the Philippines from 1980 to 1991 was able to generate a volume of length measurements for these species but we are not able to process and analyze these data. Barut (1988) tabulated the size ranges of the tuna species from 1985 to 1987. Following has been extracted from that table for the size ranges from ringnet catches at various landing sites:

SPECIES	1985	1986	1987	AREA
A. thazard	21 - 39 cm	21 - 39 cm	12 - 44 cm	Labuan Zamboanga
A. rochei	11 - 39	21 - 30	12 - 34	Labuan Zamboanga
E. affinis	21 - 49	21 - 48	11 - 54	Labuan Zamboanga
A. thazard	14 - 29	20 - 33	24 - 38	Opol, Mis. Or.
A. rochei	15 - 29	16 - 29	20 - 23	Opol, Mis, Or.
A. thazard	20 - 43	13 - 28	—	Sta Cruz, Davao
A. rochei	17 - 29	10 - 20	—	Sta Cruz, Davao
A. thazard	18 - 37	20 - 31	17 - 37	Gen. Santos City
A. rochei	17 - 28	19 - 27	16 - 37	Gen. Santos City
E. affinis	16 - 31	20 - 25	18 - 29	Gen. Santos City

Using the size limits for these species, *i. e.,* 38.0 cm for *A. thazard* and *A. rochei* and 42.0 cm for *E. affinis,* the exploited stocks are more or less juveniles. The catches of purse seines in 1984 are 94% juvenile frigate, 27% juvenile bullet and 62% juvenile kawakawa. Those of the ringnets were 69%, 97% and 74% respectively. However, it appears that there is continuous recruitment into the fishery of these species as through the years the size composition did not differ.

Estimation of growth and mortality parameters were not attempted for *A. rochei* and *A. thazard* as the length distributions are truncated. *A. rochei* were reported to reach 17, 29, 35 and 42 cm (FL) at age of 1 to 4 years, respectively. The modal size of *A. rochei* captured around payaos in Camotes Sea is 21 cm which suggest that the fishery may be based on fish of 1 to 2 years of age, assuming similarity in growth rates (Jabat & Dalzell, 1988).

The spawning season of *A. rochei* in Batangas, occur in March, May to July and November to Desember. The male to female ratio is 1.2 : 1.0 and the length-weight relationship is $4.529 \times 10^{-3} L^{3.36}$ (Yesaki, *et al.,* 1991).

Tunas captured by trolling during exploratory fishing were examined for maturity. The smallest ripe, spawning and spent female kawakawa found during the survey were 40, 45 and 40 cm, respectively (Wade 1950b). Bunag (1956) measured ova diameters of 30 fish (to determine maturity) and correlated the development of ova to the various maturity stages. The smallest mature and spent females examined were 49.0 cm and 47.7 cm, respectively. Ronquillo (1963) collected 144 kawakawa with lengths ranging from 33.1 to 65.2 cm and observed that females from 38.5 to 65.0 cm have gonad indices greater than 3.0 which indicates that kawakawa attains maturity at 38.0 cm.

Wade (1950b) concluded that spawning occurred throughout the year. Spawning or spent females were found in January-July and October-November. The highest gonad index occurred in March (Ronquillo, 1960). Bunag (1956) concluded from the polymodal distribution of ova diameters that kawakawa spawned more than once during a spawning season but was not able to determine the spawning frequency.

Wade (1950b) found males and females from 30 cm to 69 cm but the males were dominant in sizes 50 cm and above.

Kawakawa larvae were collected in Ragay Gulf, Burias Pass and Ticao Pass at temperatures ranging from 24.7° C and at salinities 33.53 o/oo to 34.66 o/oo (Abuso, 1988).

III. OCEANOGRAPHIC AND ENVIRONMENTAL PARAMETERS RELATED TO MARINE FISHERIES

Very few environmental data are available in the southern Philippine waters where most of the shared stocks are located . Most of the more recent data are from areas with toxic red tide problems such as Manila Bay, Masinloc Bay, Zambales and Maqueda Bay, Samar.

In the early 1950's, Megia and Villadolid (1953) analyzed the oceanographic data gathered by *Spencer F. Baird* from 1947-1950. The paper analyzes the water mass movement, including that of southeastern Mindanao waters.

In 1965 to 1969, the Cooperative Study of the Kuroshio was undertaken jointly by several government agencies. The study collected data on water temperature, salinity and zooplankton, among other things.

During the Winter Cruise, Eastern Mindanao waters had one of the maximum densities of zooplankton. Fish eggs density was also high but not for fish larvae. The same pattern of abundance for zooplankton was noted for the Summer Cruise but the exact opposite of the Winter Cruise was observed for fish eggs and larvae.

A few hydrological data are available in April and May 1976 from Balabac Strait, Cagayan de Sulu and Turtle Island. The data, however, are limited to surface water temperature, salinity and dissolved oxygen.

The surface water temperature was almost uniformly distributed with the exception of a station near Tawi-tawi Island which had relatively high temperature despite its reading at 0800 hrs. Similar to surface water temperature, surface water salinities and dissolved oxygen concentration were high with ranges from 33.18 ppt to 34.91 ppt and 4.23 ml/L to 4.82 ml/L, respectively.

In addition, a one-year bimonthly oceanographic data were taken in 1977-1978 in Malampaya sound, northern Palawan. The surface temperature showed a decreasing trend from the onset of the northeast monsoon season, reaching its minimum values in February. The temperature increased considerably in May 1978, attaining its peak in June, then it exhibited a decreasing trend towards the end of the southwest monsoon period.

The vertical profile of water temperature for October and December 1977 showed a water mass which appears to be an upwelling near the central islands. The occurrence of an upwelling which was noted from the temperature profile in October and December 1977 in the central part of the Sound was also noted from the vertical distribution of salinity in the area for the same period.

The average dissolved oxygen values were above 4 ml/L and practically uniform throughout the survey period.

The zooplankton biomass higher in the Inner Sound than in the Outer Sound in all survery months, except in February 1978. The increase of zooplankton volume in February in the Outer Sound may be due to the increase in its volume near the entrance during the period.

Due to scarcity of hydrological data that will be correlated with the distribution and abundance of shared resources in the area, it is important that an environmental assessment within the region be carried out collaboratively.

IV. RECOMMENDATIONS FOR COLLABORATIVE RESEARCH

In line with the Region's implementation of the provision of the UNCLOS regarding shared/straddling stocks of species between and among ASEAN and SEAFDEC member countries, it is imperative that information on these resources, as well as the environmental conditions affecting their distribution and abundance are obtained.

Collaborative research efforts then should focus on the assessment of the resources in the EEZ and international waters to serve as the scientific basis for recommending management options which can be agreed upon to properly utilize and share these resources. The possibility of contiguity of and interactions between the shared/straddling/transboundary stocks of some species of roundscads, mackerels, neritic tunas and other pelagic groups between and among neighboring countries in the SEA region connot be discounted. To prove this, there is a need to do tangging and/or electrophoretic and mitochondril DNA (mt DNA) studies to determine similarity/dissimilarity in stocks and structure of their population. These could be carried out collaboratively or individually by countries through exchange of experimental materials and information.

Very limited information on the relationship between production and environmental parameters particularly in the Philippines and SEAFDEC member countries is available. It has been observed that the environment has affected production of small pelagic fishes in Southeast Asia and the South Pacific. In view thereof, collaborative oceanographic cruises and experimental fishing in contiguous areas of the Region should be conducted. A Regional Program can be developed and source funds for its implementation with member countries, sending scientists to participate in the implementation. Consultants can be hired to effectively and efficiently generate the information required by the Program.

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Table 1: Annual marine fish production trends (mt) from Philippine waters (1978-1993)

Year	*Commercial*	*Municipal*	*Total*
1978	505,840	775,932	1,281,772
1979	500,747	737,587	1,238,334
1980	488,478	762,405	1,250,883
1981	494,768	709,989	1,204,757
1982	526,273	708,016	1,234,289
1983	519,316	770,988	1,290,304
1984	513,335	789,975	1,303,310
1985	511,987	785,132	1,297,119
1986	546,230	807,275	1,353,505
1987	591,192	816,247	1,407,439
1988	599,995	838,366	1,438,361
1989	637,138	882,369	1,519,507
1990	700,564	895,040	1,595,604
1991	759,815	913,524	1,673,339
1992	804,866	854,687	1,659,553
1993	845,431	803,194	1,648,625
X	596,623	803,170	1,399,794

Table 2: Annual production trends of roundscads (mt) from Philippine waters (1978-1994)

Table 3 : Annual production trends of mackerels (mt) from Philippine waters (1978-1994)

Year	*ROUNDSCADS*			*MACKERELS*		
	Commercial	*Municipal*	*Total*	*Commercial*	*Municipal*	*Total*
1978	115,030	18,939	133,969	30,459	27,798	58,257
1979	114,868	31,338	146,206	24,537	32,349	56,886
1980	111,316	20,813	132,129	22,129	24,384	46,513
1981	120,857	29,090	149,947	24,344	23,046	47,390
1982	150,266	32,987	183,253	22,001	21,735	43,736
1983	131,261	33,792	165,053	34,684	28,214	62,898
1984	105,013	26,570	131,583	29,127	31,715	60,842
1985	106,262	25,446	131,708	33,759	32,615	66,374
1986	151,298	24,557	175,855	33,454	32,022	65,476
1987	154,059	30,352	184,411	36,613	31,440	68,053
1988	149,213	29,474	178,687	39,621	40,470	80,091
1989	179,873	29,948	209,821	38,032	36,930	74,962
1990	220,379	28,921	249,300	51,910	37,399	89,309
1991	246,960	30,370	277,330	49,299	40,724	90,023
1992	274,017	22,962	296,979	37,287	48,811	86,098
1993	245,504	26,545	272,049	44,692	38,788	83,480
1994	210,312	22,901	233,213	46,803	38,221	85,024
X	163,911	27,353	191,264	35,221	33,333	68,554

*Preliminary values only (BAS)

Sources of basic data: BFAR Fisheries Statistics of the Phil. 1978-1983.
BAS Fishery Statistics, 1984-1993.

Table 4: Annual production trends of frigate/bullet (mt) from Philippine waters (1978-1994)

Table 5: Annual production trends of eastern little tuna (kawa-kawa) (mt) from Philippine waters (1978-1994)

Year	*FRIGATE/BULLET TUNAS*			*EASTERN LITTLE TUNA*		
	Commercial	*Municipal*	*Total*	*Commercial*	*Municipal*	*Total*
1978	20,897	25,078	45,975	9,444	14,410	23,854
1979	39,694	40,215	79,909	7,269	15,825	23,094
1980	53,310	43,564	96,874	9,958	14,772	24,730
1981	47,141	31,107	78,248	13,071	17,820	30,891
1982	39,862	27,501	67,363	14,442	32,082	46,524
1983	34,097	40,122	74,219	12,459	36,421	48,880
1984	47,360	32,945	80,305	18,832	23,067	41,899
1985	53,478	42,240	95,718	18,673	22,387	41,060
1986	44,196	43,029	87,225	20,348	22,097	42,445
1987	57,670	40,362	98,032	22,613	24,321	46,934
1988	66,746	38,690	105,436	22,192	34,074	56,266
1989	75,683	41,862	117,545	25,169	32,730	57,899
1990	46,026	42,775	88,801	8,519	35,243	43,762
1991	49,997	43,239	93,236	17,017	30,833	47,850
1992	60,214	65,441	125,655	21,447	10,496	31,943
1993	56,897	53,460	110,357	17,124	9,546	26,670
1994	58,276	51,653	109,929	36,056	10,166	46,222
X	50,091	41,370	91,460	17,331	22,723	40,054

*Preliminary values only (BAS)

Sources of basic data: BFAR Fisheries Statistics of the Phil., 1978-1983.
BAS Fishery Statistics, 1984-1993.

Table 6: Monthly landings and catch per unit effort data from Moro Gulf based on landings of purse seine vessels (1993-1994) 1/

MONTH and YEAR	*ROUNDSCAD*		*FRIGATE TUNA*		*BULLET TUNA*		*KAWAKAWA*		*ALL SPECIES*	
	Total Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*
January '93	0.4	—	9.7	0.4	—	—	—	—	49.2	1.8
February	112.2	1.9	49.7	0.8	74.9	1.3	26.0	0.4	386.1	6.5
March	52.7	0.8	35.1	0.5	91.5	1.3	16.0	0.2	366.0	5.3
April	50.0	0.8	24.3	0.4	211.6	3.5	2.8	0.1	482.2	8.0
May	151.0	0.2	147.7	0.2	140.3	0.2	4.1	—	29641.1	45.5
June	23.9	0.6	16.1	0.4	—	—	—	—	322.4	8.1
July	7.8	0.1	12.2	0.2	20.2	0.4	2.7	0.1	262.1	4.9
August	11.5	0.1	10.9	0.1	87.3	0.9	14.2	0.1	755.5	7.4
September	43.2	0.3	71.1	0.6	98.6	0.8	55.8	0.4	807.2	6.3
October	4.4	0.1	41.9	0.6	95.9	1.5	27.9	0.4	519.9	7.9
November	8.6	0.1	47.9	0.7	26.3	0.4	9.7	0.1	464.5	6.8
December	6.6	0.1	10.5	0.2	20.6	0.4	4.7	0.1	372.0	6.5
TOTAL	472.2	0.5	477.0	0.4	867.2	0.9	163.8	0.2	34428.2	11.4

MONTH and YEAR	ROUNDSCAD		FRIGATE TUNA		BULLET TUNA		KAWAKAWA		ALL SPECIES	
	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)
January '94	50.4	0.5	57.3	0.6	15.4	0.2	3.4	—	662.0	6.4
February	6.4	0.1	22.6	0.4	33.5	0.6	4.3	0.1	284.5	5.3
March	3.5	0.1	9.4	0.4	14.6	0.6	1.9	0.1	117.4	4.7
April	5.4	0.2	20.9	0.9	12.6	0.5	4.0	0.2	202.3	8.3
May	16.8	0.4	10.3	0.2	8.2	0.2	1.2	—	186.7	3.9
June	39.2	0.5	59.9	0.8	90.6	1.2	6.5	0.1	447.7	5.9
July	57.2	0.6	40.8	0.4	39.1	0.4	26.4	0.3	628.7	6.2
August	57.3	0.4	40.8	0.3	8.9	0.1	40.8	0.3	658.5	4.5
September	7.9	0.2	30.0	0.8	7.2	0.2	27.0	0.7	179.6	4.9
October	7.7	0.4	16.1	0.8	2.8	0.1	4.1	0.2	85.5	4.4
November	0.5	—	12.7	0.3	13.9	0.4	2.5	0.1	85.7	2.3
December	3.9	0.1	32.5	0.6	28.0	0.5	10.7	0.2	267.0	5.1
TOTAL	256.2	0.3	353.4	0.5	274.9	0.4	32.8	0.2	3805.7	5.4

1/ Preliminary data from the tuna landed catch monitoring under PTRP (unpublished).

* Raised catch from sample boat total catches using % coverage and % days sampled.

** Catch per unit effort derived from the individual vessel unloaded catch only.

*** 98.3% of this (29,126.2 mt) is Yellowfin and Skipjack>.

Table 7: Monthly catch and catch per unit effort from Moro Gulf based on landings of ringnet vessels (1993-1994) 1/

MONTH and YEAR	ROUNDSCAD		FRIGATE TUNA		BULLET TUNA		KAWAKAWA		ALL SPECIES	
	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)
January '93	55.7	0.5	97.0	0.8	168.6	1.4	46.0	0.4	1082.5	8.9
February	—	—	166.3	0.8	255.5	1.3	37.7	0.2	840.2	4.2
March	68.1	0.3	241.1	0.9	272.5	1.0	21.9	0.1	1547.4	5.7
April	35.2	0.2	83.8	0.5	13.4	0.1	2.5	—	667.9	3.8
May	32.4	0.1	84.6	0.3	213.0	0.6	36.5	0.1	1039.1	3.0
June	12.7	—	96.4	0.3	128.1	0.4	40.7	0.1	949.4	3.2
July	166.5	0.4	89.9	0.2	148.1	0.4	0.5	—	2387.9	6.3
Augst	42.6	0.2	76.7	0.3	241.7	0.9	21.2	0.1	1145.0	4.3
September	19.8	0.1	112.8	0.8	155.0	1.1	57.9	0.4	1353.4	9.8
October	216.7	0.6	167.5	0.5	193.9	0.5	35.1	0.1	2212.8	6.2
November	70.4	0.3	103.7	0.5	62.2	0.3	4.3	—	1167.2	5.7
December	94.4	0.7	134.6	1.0	156.6	1.2	9.3	0.1	1245.8	9.3
TOTAL	814.3	0.3	1454.2	0.5	2008.4	0.7	313.5	0.1	15638.6	5.7
January '94	63.9	0.6	55.4	0.5	46.8	0.5	4.9	0.1	783.6	7.6
February	45.1	0.2	217.4	0.9	122.2	0.5	22.5	0.1	1373.2	5.4
March	27.1	0.1	132.7	0.5	255.0	0.9	16.6	0.1	1514.7	5.2
April	117.1	0.5	109.3	0.5	172.7	0.8	4.1	—	960.7	4.4
May	130.7	0.5	227.1	0.9	119.3	0.5	9.3	—	1660.0	6.6
June	239.2	1.3	303.5	1.7	290.6	1.6	36.8	0.2	1844.0	10.2

MONTH and YEAR	ROUNDSCAD		FRIGATE TUNA		BULLET TUNA		KAWAKAWA		ALL SPECIES	
	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE*8 (mt/trip day)
July	108.1	0.4	147.8	0.5	235.4	0.8	6.7	—	1453.5	4.8
August	212.1	1.2	148.0	0.8	189.8	1.1	34.2	0.2	2718.8	15.1
September	480.8	1.3	266.4	0.7	853.6	2.2	28.0	0.1	2708.5	7.1
October	268.7	0.6	235.1	0.5	974.6	2.1	30.6	0.1	3084.2	6.6
November	160.2	0.6	172.9	0.6	904.1	3.4	28.3	0.1	2268.5	8.5
December	62.4	0.2	160.2	0.6	429.1	1.6	21.3	0.1	1803.8	6.6
TOTAL	1915.6	0.6	2175.8	0.7	4593.1	1.4	243.1	0.1	22174.0	7.3

1/ Preliminary data from the tuna landed catch monitoring under PTRP (unpubli shed).

* Raised catch from sample boat total catches using coverage and dau sampled.

** Catch per unit effort derived from the individual vessel unloaded catch only.

Table 8: Monthly catch and catch per unit effort from Moro Gulf based on landings of handline vessels (19)

MONTH and YEAR	FRIGATE TUNA		BULLET TUNA		KAWAKAWA		ALL SPECIES	
	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)	Total* Catch (mt)	CPUE** (mt/trip day)
January '93	6.8	2.0	9.7	3.0	6.6	2.0	266.6	69.0
February	6.6	2.0	3.3	1.0	3.7	1.0	246.5	61.0
March	2.9	1.0	—	—	3.9	1.0	300.2	59.0
April	0.3	—	—	—	—	—	174.4	117.0
May	2.7	1.0	3.4	1.0	2.4	—	367.2	77.0
June	2.8	—	1.9	—	0.9	—	397.0	66.0
July	8.7	2.0	3.2	1.0	3.5	1.0	403.0	75.0
Augst	0.6	—	—	—	3.6	1.0	213.9	48.0
September	7.0	1.0	2.3	—	8.3	1.0	316.5	48.0
October	6.8	1.0	1.9	—	15.1	2.0	530.4	69.0
November	0.4	—	3.9	1.0	4.4	1.0	433.9	73.0
December	—	—	—	—	—	—	402.0	68.0
TOTAL	45.4	1.0	29.5	1.0	52.2	1.0	4051.5	67.0
January '94	3.2	1.0	4.3	1.0	0.5	—	266.2	56.0
February	5.0	1.0	9.8	2.0	14.3	3.0	306.8	57.0
March	15.8	2.0	12.2	2.0	1.1	—	482.8	61.0
April	5.0	—	5.6	—	3.6	—	676.6	59.0
May	4.8	1.0	1.5	—	1.6	—	367.3	6380
June	7.1	1.0	5.1	1.0	1.4	—	321.5	63.0
July	3.5	—	2.5	—	9.2	1.0	479.6	52.0
August	2.1	—	0.3	—	2.8	—	191.9	33.0
September	5.7	1.0	5.7	1.0	11.5	2.0	219.6	35.0
October	2.7	—	0.6	—	2.8	—	318.2	39.0
November	17.2	1.0	16.5	1.0	3.5	—	560.6	45.0
December	6.8	1.0	14.8	1.0	3.9	—	570.1	52.0
TOTAL	78.8	1.0	78.7	1.0	56.2	1.0	4761.2	50.0

1/ Preliminary data from the tuna landed catch monitoring under PTRP (unpublished).

* Raised catch from sample boat total catches using % coverage and % days sampled.

** Catch per unit effort derived from the individual vessel unloaded catch only.

Table 9: **Monthly catch and catch per unit effort data from South Sulu Sea based on the landings of handline vessels (1993-1994)1/**

MONTH and YEAR	*FRIGATE TUNA*		*BULLET TUNA*		*KAWAKAWA*		*ALL SPECIES*	
	Total Catch (mt)*	*CPUE** (kg/trip day)*	*Total* Catch (mt)*	*CPUE** (kg/trip day)*	*Total* Catch (mt)*	*CPUE** (kg/trip day)*	*Total* Catch (mt)*	*CPUE** (kg/trip day)*
1993								
January	—	—	—	—	—	—	131.2	36.0
February	3.3	2.0	1.3	1.0	6.5	4.0	125.6	71.0
March	6.7	4.0	4.9	3.0	5.1	3.0	190.6	103.0
April	2.7	1.0	—	—	0.5	—	254.1	88.0
May	1.4	—	0.9	—	0.3	—	202.9	57.0
June	—	—	—	—	0.6	—	114.5	82.0
July	—	—	0.1	—	—	—	189.9	87.0
August	4.5	3.0	4.0	3.0	12.4	9.0	151.4	104.0
September	4.0	3.0	2.0	1.0	12.0	9.0	131.7	94.0
October	3.3	3.0	8.7	7.0	9.5	8.0	150.0	121.0
November	2.9	1.0	3.1	1.0	1.7	1.0	222.1	83.0
December	5.9	3.0	4.8	2.0	1.4	1.0	198.4	92.0
TOTAL	34.7	2.0	29.8	2.0	50.0	3.0	2062.4	85.0
1994								
January	4.6	3.0	2.9	2.0	3.1	2.0	144.7	80.0
February	4.2	2.0	2.8	2.0	2.1	1.0	107.0	62.0
March	10.5	3.0	5.7	2.0	4.9	2.0	232.2	71.0
April	3.7	2.0	1.9	1.0	1.7	1.0	136.2	79.0
May	1.8	1.0	2.8	1.0	—	—	147.2	59.0
June	5.3	1.0	4.0	1.0	4.0	1.0	261.7	74.0
July	3.0	1.0	1.9	1.0	3.4	2.0	148.8	69.0
August	2.4	2.0	0.5	—	2.3	2.0	55.9	53.0
September	2.1	3.0	2.2	4.0	4.3	7.0	39.7	66.0
October	3.2	4.0	3.4	4.0	1.1	1.0	61.2	68.0
November	1.0	1.0	0.6	410	0.8	1.0	44.5	58.0
December	1.9	8.0	0.9	4.0	0.3	1.0	44.1	178.0
TOTAL	43.7	2.0	29.6	2.0	28.0	2.0	1423.2	73.0

1/ Preliminary data from the tuna landed catch monitoring under PTRP (unpublished).

* Raised catch from sample boat total catches using % coverage and % days sampled.

** Catch per unit effort derived from the individual vessel unloaded catch only.

Table 10: Monthly catch and catch per unit effort data from South Sulu Sea based on the landings of ringnet vessels (1993-1994)1/

MONTH and YEAR	*ROUNDSCAD*		*MACKERELS*		*FRIGATE TUNA*		*BULLET TUNA*		*KAWAKAWA*		*ALL SPECIES*	
	Total Catch (mt)*	*CPUE** (kg/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (kg/trip day)*
1993												
January	0.7	—	—	—	12.1	0.1	5.1	0.1	7.4	0.1	32.9	
February	1.3	—	—	—	2.3	—	—	—	17.9	0.1	39.5	
March	20.3	0.1	0.5	—	6.7	—	7.4	—	13.4	0.1	72.4	
April	3.4	—	—	—	18.2	0.1	30.0	0.2	15.3	0.1	125.3	
May	2.0	—	16.6	0.1	18.5	0.1	2.6	—	25.3	0.1	136.6	
June	—	—	0.6	—	1.3	—	1.4	—	5.5	0.1	30.3	
July	—	—	11.6	0.1	20.7	0.1	—	—	10.8	0.1	96.1	
August	—	—	1.3	—	41.1	0.1	—	—	80.6	0.3	154.7	
September	—	—	2.1	—	45.7	0.1	5.0	—	27.4	0.1	100.0	
October	—	—	13.3	0.1	3.8	—	3.6	—	25.1	0.2	62.6	
November	—	—	34.1	0.2	15.1	0.1	—	—	27.5	0.1	101.3	
December	—	—	55.1	0.2	6.1	—	—	—	40.5	0.2	175.6	
TOTAL	27.7	0.1	135.2	11.3	191.6	0.1	55.1	—	296.7	0.1	1127.3	
1994												
January	8.0	0.1	13.7	11.3	7.2	0.1	0.4	—	8.5	0.1	57.4	
February	48.8	0.3	14.6	0.2	3.4	—	0.2	—	12.6	0.1	133.5	
March	62.8	0.2	53.3	0.1	1.4	—	—	—	19.3	0.1	169.5	
April	13.2	0.3	6.6	0.2	0.1	—	1.0	—	6.8	0.2	45.4	
May	16.8	0.4	3.4	0.2	0.1	—	0.7	—	5.3	0.1	37.6	
June	85.9	0.3	8	0.1	—	—	5.7	—	31.9	0.1	167.1	
July	38.4	0.6	8.6	—	—	—	2.5	—	22.3	0.4	100.3	
August	25.5	0.7	5.1	0.1	—	—	2.1	0.1	12.7	0.3	56.1	
September	11.2	0.2	2.9	0.1	—	—	2.0	—	10.6	0.2	34.2	
October	21.0	0.6	5.7	—	—	—	1.4	—	10.7	0.3	45.8	
November	20.9	0.2	3.1	0.2	7.3	0.1	1.9	—	10.6	0.1	53.8	
December	10.2	0.5	—	—	—	—	0.5	—	4.2	0.2	25.0	
TOTAL	362.7	0.3	125.0	0.1	19.5	—	18.4	—	155.5	0.2	925.7	

1/ Preliminary data from the tuna landed catch monitoring under PTRP (unpublished).

* Raised catch from sample boat total catches using % coverage and % days sampled.

** Catch per unit effort derived from the individual vessel unloaded catch only.

Table 11: Monthly catch and catch per unit effort data from South Sulu Sea based on the landings of purse seine vessels (1993-1994) 1/

MONTH and YEAR	*ROUNDSCAD*		*FRIGATE TUNA*		*BULLET TUNA*		*KAWAKAWA*		*ALL SPECIES*	
	Total Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*	*Total* Catch (mt)*	*CPUE** (mt/trip day)*
1993										
January	1.8	—	—	—	18.1	0.2	—	—	443.7	3.9
February	17.4	0.1	77.6	0.2	21.6	0.1	67.4	0.2	4357.3	12.2
March	99.2	0.6	19.1	0.1	15.3	0.1	11.3	0.1	594.3	3.8
April	—	—	—	—	—	—	—	—	347.4	2.3
May	12.7	1.1	9.6	0.8	—	—	—	—	107.1	9.3
June	51.9	0.2	13.8	—	—	—	27.6	0.1	*** 27322.1	85.0
July	—	—	—	—	—	—	—	—	471.3	8.2
Augst	0.7	—	—	—	—	—	6.7	0.1	726.2	11.3
September	21.8	0.2	58.4	0.5	26.4	0.2	31.7	0.3	801.9	7.3
October	8.4	0.1	15.6	0.1	—	—	9.6	0.1	663.7	5.4
November	—	—	27.3	0.3	37.1	0.2	17.9	0.2	698.9	8.7
December	—	—	—	—	—	—	—	—	3751.8	18.2
TOTAL	213.9	0.2	221.4	0.1	118.5	0.1	172.2	0.1	40285.7	14.2
1994										
January	0.5	—	0.8	0.1	0.9	0.1	0.3	—	79.0	6.3
February	79.7	3.6	16.7	0.9	20.7	0.9	14.0	0.6	1030.9	45.9
March	—	—	39.3	3.9	19.3	1.9	—	—	88.6	8.8
April	280.8	10.3	3.1	0.1	9.3	0.3	—	—	1122.4	411.3
May	52.3	1.2	15.9	0.4	28.3	0.6	5.3	0.1	507.1	11.4
June	20.4	0.4	24.0	0.5	13.0	0.3	15.9	0.3	319.5	6.9
July	2.3	0.1	—	—	5.9	0.2	2.1	0.1	836.9	26.8
August	21.1	0.5	6.1	0.2	0.7	—	5.1	0.1	151.6	3.7
September	3.1	—	5.1	0.1	47.2	0.5	56.0	0.6	2384.9	24.7
October	11.6	0.1	6.9	0.1	16.6	0.2	30.4	0.3	2124.6	21.6
November	31.5	0.4	—	—	2.5	—	9.8	0.1	263.2	3.4
December	44.9	0.7	—	—	6.7	0.1	80.5	1.2	1230.5	17.7
TOTAL	548.2	1.1	117.9	0.2	171.1	0.3	219.4	0.4	10139.2	18.2

1/ Preliminary data from the tuna landed catch monitoring under PTRP (unpublished).
* Raised catch from sample boat total catches using % coverage and % days sampled.
** Catch per unit effort derived from the individual vessel unloaded catch only.
*** 99.4% (27,161.8) of this yellowfin and skipjack.

Table 12: Growth and mortality parameters for roundscad species in the Philippines1/

Species	*Location*	*Loo*	*K*	*Lmax*	*Tmax*	*Q*	*M*	*Reference*
Decapterus macrosoma	Cmotes Sea	25.0	0.88	—	—	2.74	1.73	Jabat and Dalzell (1988)
	Manila Bay	31.5	0.65	28.0	3.63	2.81	1.33	Ingles and Pauly (1984)
	Manila Bay	31.5	0.71	28.0	3.32	2.85	1.41	Ingles and Pauly (1984)
	Palawan	27.0	0.90	25.0	3.10	2.82	1.72	Ingles and Pauly (1984)
	Palawan	26.8	0.71	25.0	4.04	2.71	1.47	Ingles and Pauly (1984)
	Palawan	26.5	1.00	25.0	3.04	2.85	1.85	Ingles and Pauly (1984)
	Palawan	27.8	0.83	25.0	2.50	2.81	1.61	Ingles and Pauly (1984)
	Palawan	33.0	0.50	31.0	5.92	2.74	1.10	Ingles and Pauly (1984)
	Palawan	27.5	1.25	21.0	1.30	2.88	2.12	Ingles and Pauly (1984)
	Palawan	25.0	1.20	20.0	1.50	2.88	2.12	Ingles and Pauly (1984)
	Palawan	25.5	0.85	22.0	2.20	2.74	1.68	Ingles and Pauly (1984)
	Palawan	25.50	0.80	22.0	2.20	2.72	1.62	Ingles and Pauly (1984)
	Palawan	33.0	0.65	30.0	3.90	2.85	1.31	Ingles and Pauly (1984)
	Palawan	30.0	0.74	27.0	3.30	2.82	1.47	Ingles and Pauly (1984)
	Samar Sea	23.0	1.25	22.0	—	2.82	2.19	Corpuz et al (1985)
	Ragay Gulf	25.5	1.26	23.0	—	2.91	2.12	Corpuz et al (1985)
D. maruadsi	Burias Pass	27.7	0.82	22.0	—	2.63	1.67	Corpuz et al (1985)
	Samar Sea	23.55	0.81	23.0	—	2.65	1.64	Corpuz et al (1985)
	Ragay Gulf	23.5	0.52	22.0	—	2.46	1.22	Corpuz et al (1985)
D. kurroides	Davao Gulf	25.0	0.80	—	—	2.39	1.62	Gonzales (1991)
D. russelli	Manila Bay	27.0	0.80	23.0	2.60	2.77	1.59	Ingles and Pauly (1984)
	Manila Bay	30.0	0.54	26.0	4.00	2.69	1.19	Ingles and Pauly (1984)
	Manila Bay	26.9	0.69	24.0	3.40	2.70	1.44	Ingles and Pauly (1984)
	Manila Bay	26.0	0.73	24.0	3.80	2.69	1.51	Ingles and Pauly (1984)
	Manila Bay	33.0	0.45	28.0	4.54	2.69	1.03	Ingles and Pauly (1984)
	Camotes Sea	33.7	0.36	—	—	2.61	0.89	Jabat and Dalzell (1988)

1/ Lifted from Dalzell *et. al.*

Table 13: Growth and mortality parameters for the mackerel species in the Philippines

Species	*Location*	*Loo*	*K*	*Lmax*	*Tmax*	*Q*	*M*	*Reference*
Rastrelliger brachysoma	Samar Sea	24.5	1.28	22.0	1.7	2.89	2.17	Corpuz et al (1985)
	Samar Sea	25.0	1.30	23.0	2.1	2.91	2.32	Corpuz et al (1985)
	Samar Sea	25.5	1.45	23.0	1.7	2.97	2.19	Corpuz et al (1985)
	Manila Bay	34.0	1.10	30.0	2.1	3.10	1.84	Ingles and Pauly (1984)
	Samar Sea	25.0	1.60	22.0	1.4	3.00	2.56	Ingles and Pauly (1984)
	Manila Bay (1958-60)	34.0	0.98	—	—	—	—	BFAR files (unpublished)
	Visayan Sea (1983)	34.0	0.98	—	—	—	—	BFAR files (unpublished)
	Visayan Sea (1984)	32.5	1.20	—	—	—	—	BFAR files (unpublished)
	Samar Sea (1984)	29.75	1.30	—	—	—	—	BFAR files (unpublished)
	Leyte Gulf (1985)	34.0	0.98	—	—	—	—	BFAR files (unpublished)
R. faughni	Camotes Sea	25.9	1.45	—	—	2.99	2.44	Jabat and Dalzell (1988)
R. kanagurta	Illana Bay (1984)	39.0	0.72	—	—	3.04	—	BFAR files (unpublished)
	Illana Bay (1983)	39.0	0.72	—	—	3.04	—	BFAR files (unpublished)
	Guimaras Strait (1985)	27.8	1.65	—	—	3.10	—	BFAR files (unpublished)
	Samar Sea (1984)	26.5	1.60	—	—	3.05	—	BFAR files (unpublished)
	Visayan Sea (1984)	37.0	0.70	—	—	2.98	—	BFAR files (unpublished)
	Visayan Sea (1983)	29.5	1.50	—	—	3.12	—	BFAR files (unpublished)
	Visayan Sea (83-87)	38.0	0.80	—	—	3.06	—	Guanco (1991)
	Samar Sea	27.5	1.30	25.0	2.0	2.99	2.11	Corpuz et al (1985)
	Samar Sea	28.0	1.31	26.0	2.0	3.01	2.13	Corpuz et al (1985)
	Palawan waters	28.0	1.55	25.0	1.5	3.08	2.43	Ingles and Pauly (1984)
	Camotes Sea	25.5	1.50	—	—	2.99	2.45	Jabat and Dalzell (1988)

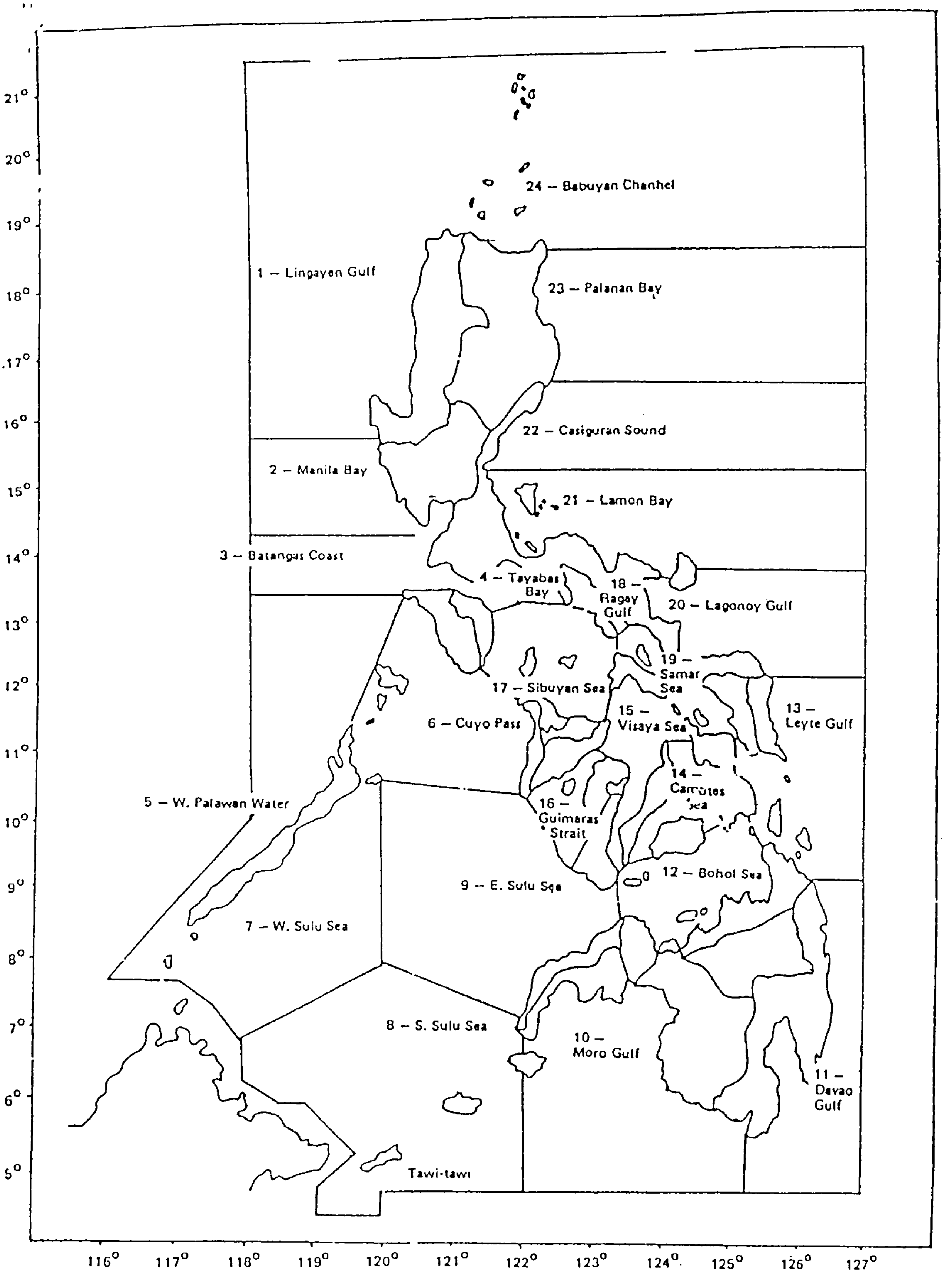

Figure 1. Map pf the Philippines showing the 24 statistical fishing areas.