



**SCIENTIFIC COMMITTEE
THIRD REGULAR SESSION**

13-24 August 2007
Honolulu, United States of America

RECALCULATION OF THE PHILIPPINE TUNA PRODUCTION FROM THE WCPO
WCPFC-SC3-FT SWG/IP-10

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Introduction

The Philippines is considered one of the major tuna producing countries in the Western and Central Pacific Ocean (WCPO) region. Official records from the Western and Central Pacific Fisheries Commission (WCPFC) indicate that the country's tuna fishing fleet contribute a total of 306,512 MT in 2004, roughly 15% of the total tuna production from the WCPO region. The catch is mainly composed of 170,431MT (55.6%) skipjack tuna, 122,858 MT (40%) yellowfin tuna and 13,223 MT (4.3%) bigeye tuna.

Recently, the Bureau of Agricultural Statistics (BAS) estimated the country's total annual tuna production in 2006 at approximately 560,000 MT, which includes neritic species. BAS' estimates apparently also show a progressively increasing annual production trend but with a sudden increase starting in 2002. From 2002 to 2004, this marked change in production was allegedly due to higher contribution of the commercial fisheries sector, meaning purse seines and ringnets. The handline municipal fisheries sector meanwhile accounted for the rising annual tuna production from 2005 to 2006, largely due to an increase in bigeye tuna catch from about 10,000 MT in 2005 to about 29,000 MT in 2006. It is important to clarify this finding because the information could be misused to indicate the impact of the Philippine fishing fleet on the major tuna species (skipjack, yellowfin and bigeye) in the WCPO region. Unless clarified, this result implies that overfishing of these tuna resources is taking place, which could be used as leverage against the Philippines' fishing fleets in the allocation of declining harvestable resources from the WCPO region. Naturally, this condition does not augur well for the country's position in a regime that is regulated by the WCPFC, because these are sensitive issues that could again be linked to the traditional use of payaos as an auxiliary device for capturing tuna and small pelagic fish.

Indeed, the Philippine tuna fishing fleet had been a dominant player in the WCPO region since the early 1970s. It has been a major exporter of tuna since the late 1980s, or years before the formal grouping of countries under the WCPFC. However, unless the impact of the Philippine tuna fleet is properly considered, this could be a reason for proposals to cut back on the country's tuna fishing fleet in the coming years, which could have dire implications on the local economy. This concern is particularly true in

Mindanao where economic and security issues are closely linked. It is quite likely that concerns about sampling in fisheries, which have made the estimation of tuna production, difficult during the past several decades is just coming to the fore, and that the marked increase in fisheries production is likely due to better estimates of production recently.

This study aims to make an independent estimate of the annual production of large tuna species (skipjack, yellowfin and bigeye) by the Philippine tuna fishing fleet, including domestic fleets operating within Philippine territorial waters. It relies on historical catch data still available from the Philippine tuna industry, additional data from previously conducted research and even normal outputs of existing fisheries database like NSAP. The objectives of the study are a) to estimate the historical tuna fisheries production of the Philippines and b) to validate the country's production of skipjack, yellowfin and bigeye tuna from the WCPO region.

Materials and Methods

Data requirements and sources

The data requirements for this study to calculate production are a) catch rates of fishing vessels; b) number of fishing vessels operating per year; and, c) number of fishing days per year. Catch per unit effort (CPUE) is also necessary to preliminarily classify the different vessels into similar groups before estimating production; together with data on the number of fishing days, it is also used alternatively to calculate production when catch rates are unknown. The fishing vessels of interest are purse seine, handliners and ringnet because these are the major fishing gears that target tuna. In this study, only the production of the major tuna species (skipjack, yellowfin and bigeye) are calculated.

The main sources of data for this study are 1) the members of the fishing industry, particularly members; 2) the Bureau of Fisheries and Aquatic Resources (BFAR) and 3) MARINA.

Period covered

The main focus of this research is to recalculate historical tuna catch data, that is, covering periods before 2000. The year 2000 is of special interest because according to the recent report by BAS, it marks the end of a production trend that seems distinct from the trend after this year. However, the calculations extend beyond 2000 up to 2006 because data are more readily available; the calculation of annual production for this period allows the use of data that are regularly gathered by BFAR, through its National Stock Assessment Program (NSAP), and readily provides a means to verify the estimates recently given by BAS. The baseline year for the 'historical' period was arbitrarily set at 1990, not because it marks the beginning of the tuna fishing in the Philippines, but rather because it is the year for which data is still available from cooperating members of the tuna fishing industry. Filipino fishermen were already fishing for tuna before the 1970s, which marked the early years of the tuna industry that exists to this day.

Initial classification of fishing gears

A classification of purse seines is imperative due to the large variability in the size of catchers. Samples of catch data from fishermen, fishing corporations and unpublished data were gathered and categorized by gross tonnage according to their CPUE. This classification of the data set is necessary because the catching ability of fishing gears depends on net size of the net, which, in turn, may be related to its gross tonnage. Purse seine vessels were classified into the following groups based on gross tonnage: <30, 30 - <50 GT, 50 - <250 GT, 250 – 500 GT, >500 GT. It is not necessary to apply a similar classification of handline fishing vessels because CPUE is not dependent on gross tonnage but probably by the number of fishermen in a given fishing vessel, or of ringnet vessels because these are generally less than 30 GT.

Calculation of production

Production is calculated in two ways, depending on the types of data available. It is calculated from

$$P = \Sigma(\text{CPUE}_{i,j}N_{i,j}D), \quad i=1, 2, \dots, 5 \text{ boat classes}; j = 1, 2, 3 \quad (1)$$

where CPUE = catch per trip; N = number of operating vessels, D = number of fishing days, i = index for the boat classes, j = index for fishing gears (i.e., purse seine, ringnet, handline).

In cases where catch rates data are available, total production was alternatively estimated using

$$P = \Sigma(C_{r,i,j}N_{i,j}), \quad i=1, 2, \dots, 5 \text{ boat classes}; j = 1, 2, 3 \quad (2)$$

where C_r = catch rate.

In this study, Equation (1) is applied to handline and ringnet data because landed catch data by each vessel represents the catch for the trip, which is defined here as the unit of effort. Equation (2), meanwhile, is used for purse seine data that came from industry, which are not segregated in terms of catch per cast of the purse seine gear but instead are tallied based on the cumulative catch of a given vessel for the entire year, irrespective of the number of actual sets during a given trip. Moreover, for purse seine data, Equation (1) is not applicable for the catch landed by carriers because this represents the combined catch of one or more catchers over a period of several days.

The resulting value for P sums up the estimated tuna production from both the commercial and municipal sectors from all sources. However, since some vessels of the country operate in other countries that require their catch to be credited to their host

countries, as the case is with Papua New Guinea, these should be excluded from this estimate. Moreover, some vessels operate in non-WCPFC covered areas, such as the Indian Ocean. The corresponding catch from these fishing grounds should also be excluded from this estimate. However, it may be difficult to get an estimate of the latter, unless members of the tuna fishing sector report where they derive their catch.

Results and Discussion

Ringnet

Ringnet fishing is commonly used within Philippine archipelagic waters to target small pelagic species like sardines and carangid species. Skipjack and yellowfin are only included in the catch at certain times of the year. Since the 1980s, the number of ringnet vessels had been increasing progressively, and in 1986, the estimated number of ringnet vessels reached 386. This figure increased further to 531 in 1997, and 943 in 2006 (*unpublished data*). Based from a separate analysis of empirical data, ringnet vessels operate over a period of 266 days annually. The remaining days of the year are used for maintenance while no operations are scheduled whenever a typhoon approaches or actually enters the country's area of responsibility.

Figure 1 presents the estimated total annual production of large tuna species by the Philippine ringnet fleet from 1993 to 2006. In making this estimate, the number of vessels in operation per year was derived by assuming that the increase in the number of vessels follows a linear trend. On the average, the total catch of all species by a ringnetter per fishing day ranged from 0.5 MT to 2.76 MT between 1997 and 2006. The percentage occurrence of large tuna species in the catch was only about 10%, while the proportion of all tuna of the total catch is only about 55%, which is divided into skipjack tuna (33%) and yellowfin tuna (22%). Catch of bigeye tuna by ringnet is practically nil. This is probably due to the proximity of their areas of operation near coastal areas where salinity

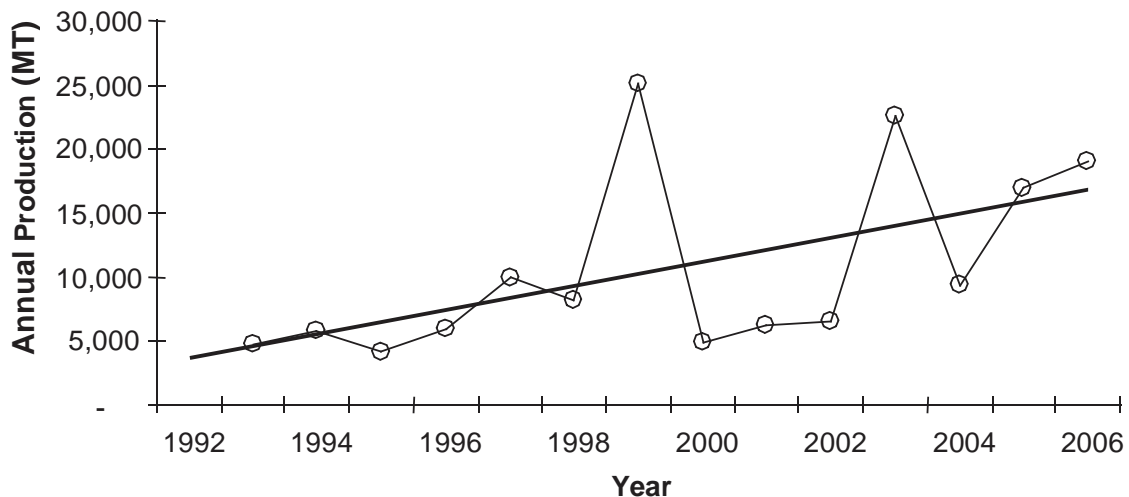


Figure 1. Estimated production of skipjack and yellowfin tuna of the Philippine ringnet fleet (1992-2006). The proportion of bigeye tuna is practically nil.

is generally lower compared to open oceanic waters. Ringnet catch shows a gradually increasing trend. The highest production of slight over 25,000 MT was attained in 1999 after an extended El Niño event in 1997/1998. The increasing catch trend apparently reflects the progressive increase in the number of vessels in operation.

Purse seine

The total number of purse seiners operating in 1994 was 569 (NCSO, 1994), with the majority operating out of General Santos City (431) to capture the major tuna species. This number essentially remained the same (567) (*unpublished data*) in 2006 but the number of vessels for tuna fishing declined to 309. The other 258 vessels operate in internal waters and mainly target small pelagic species. The fleet structure did not vary much between these two periods (Fig. 2). Majority of the vessels had displacements less than 250 GT, with the smaller sized vessels usually made of wood.

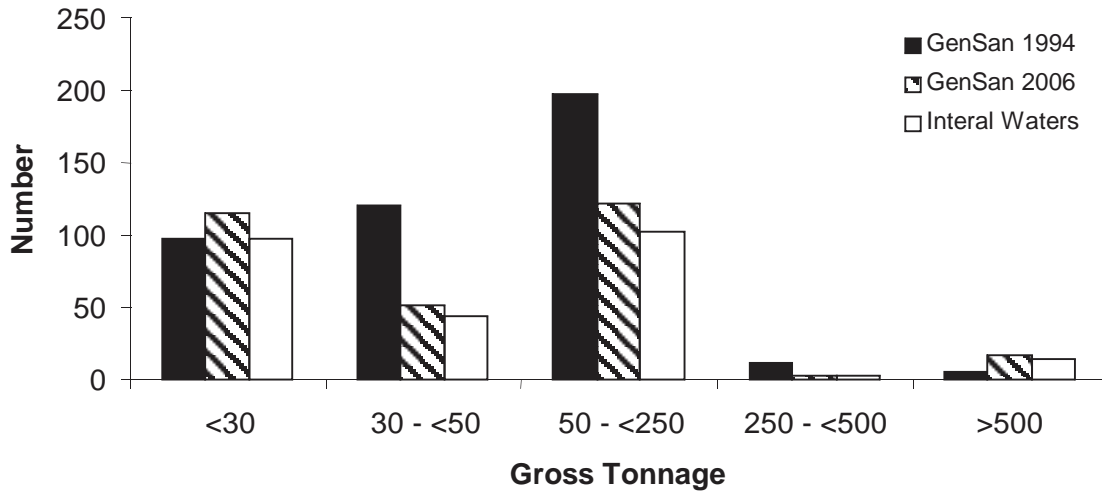


Figure 2. Structure of the Philippine purse seine fleet operating in WCPO area (solid and hatched) and internal waters (open).

The average annual catch rates of purse seine catchers by vessel size are different (ANOVA, $p < 0.05$). Mean catch rates generally increase with vessel size (Fig. 3). Mean catch rates of vessels less than 30 GT, which were calculated based from the catch per unit of effort (CPUE) and the total number of fishing days with set due to the absence of actual data, generally landed from 500 to 700 MT annually. Meanwhile, vessels with displacements between 30 and 50 GT landed on the average 1114 MT annually. These groups include “baby purse seines” that are rigged just like ringnets. Larger vessels landed over 1200 MT annually.

In estimating the total annual production from the Philippine purse seine fleet using Equation (2), it is assumed that the number of vessels operating out of General Santos City declined linearly and that the number of vessels operating within internal waters did not change from 1994 to 2006. The result shown in Figure 4 consolidates the

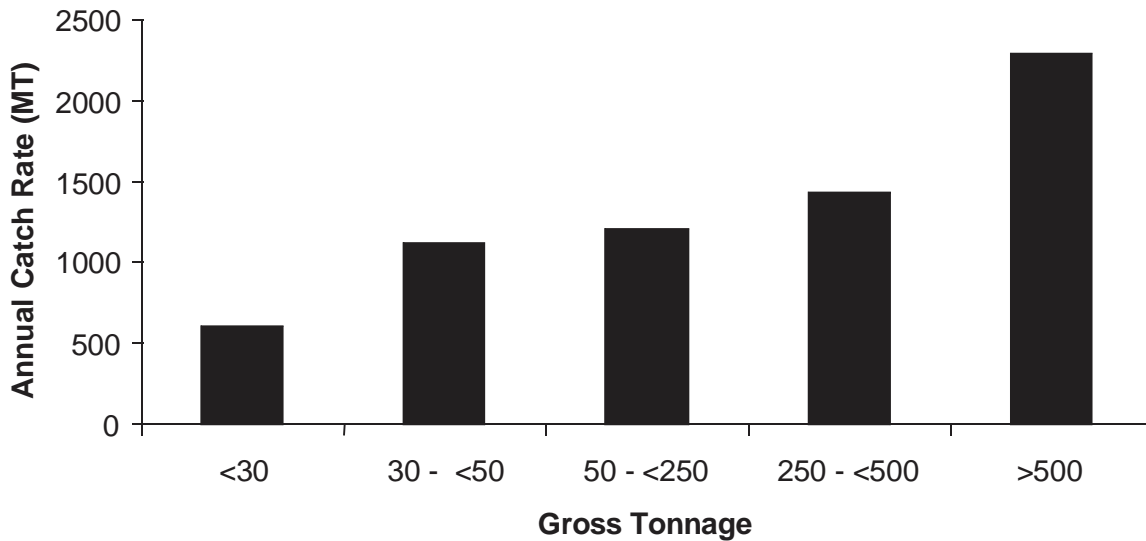


Figure 3. Annual catch rate of large tuna (skipjack, yellowfin and bigeye) by Philippine purse seine vessels (1990 - 2006).

contribution of purse seine catchers operating in the WCPO region and internal waters. Production from the latter are was very minimal, ranging from about 19,000 MT to 28,600 MT, due to the low occurrence rate (10%) and almost the same proportion of the tuna species (55%) when they form part of the catch. Moreover, the result reveals fluctuations, reflecting periods of good and bad fishing years. Higher catch was realized in 1999/2000, 2002 and 2004 while low catch was realized in 1997/1998, 2003 and 2005. These fluctuations seem to follow El Niño/La Niña events. This result also indicates that traditionally the level of fishing by the Philippine purse seine fleet was already at a high level before 1991. This finding is important because it would provide new inputs that may be useful to assess the impacts of purse seine fishing on tuna stocks in the WCPO region. Finally, Figure 4 shows a declining trend, apparently due to the decline in the number of purse seines targeting tuna. It suggests that the production of tuna peaked sometime in the late 1980s.

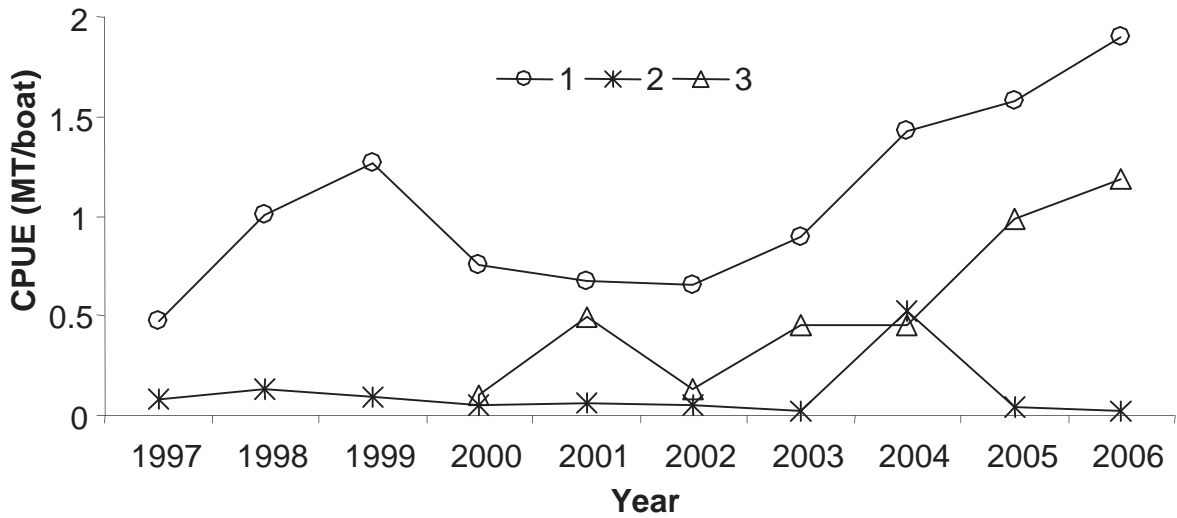


Figure 5. CPUE of handline fishing vessels operating in Celebes Sea (1), Sulu Sea (2) and coastal waters of Davao and China Sea off Zambales (3).

Handlines

The most critical data gap in estimating tuna production by handline fishermen is the unreliability of data on the number of operating fishing boats. Because of this uncertainty, it may be difficult to get a good estimate of their contribution to the country's total tuna production. Most of the tuna handliners in the Philippines are based in General Santos City and target yellowfin and bigeye tuna in Moro Gulf, Celebes Sea and Indonesian Waters. Industry estimates suggest that the number of boats landing their catch in General Santos City is currently about 2000 units. Members of the industry believe this number was about 500 in the 1970s, reached its maximum at about 5000

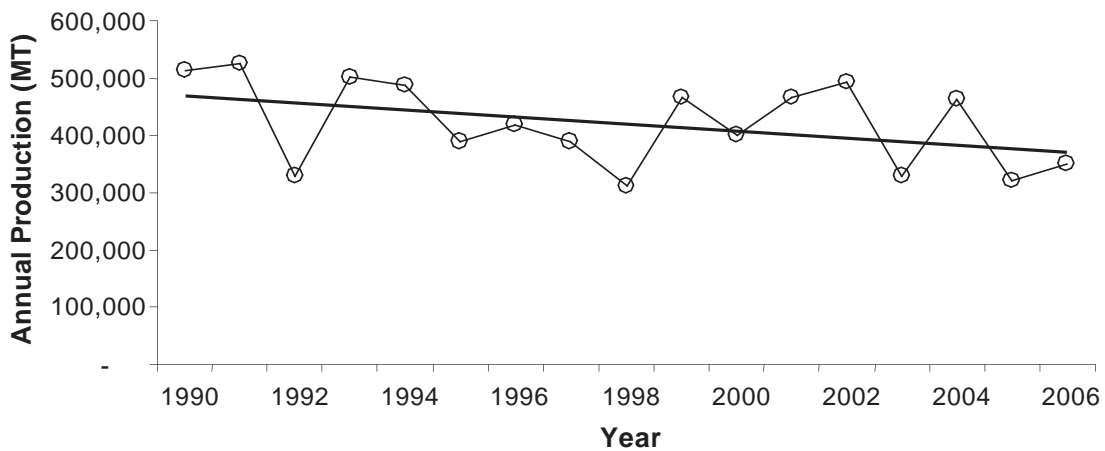


Figure 4. Annual production of skipjack, yellowfin and bigeye tuna by the Philippine purse seine fleet (1990 - 2006)

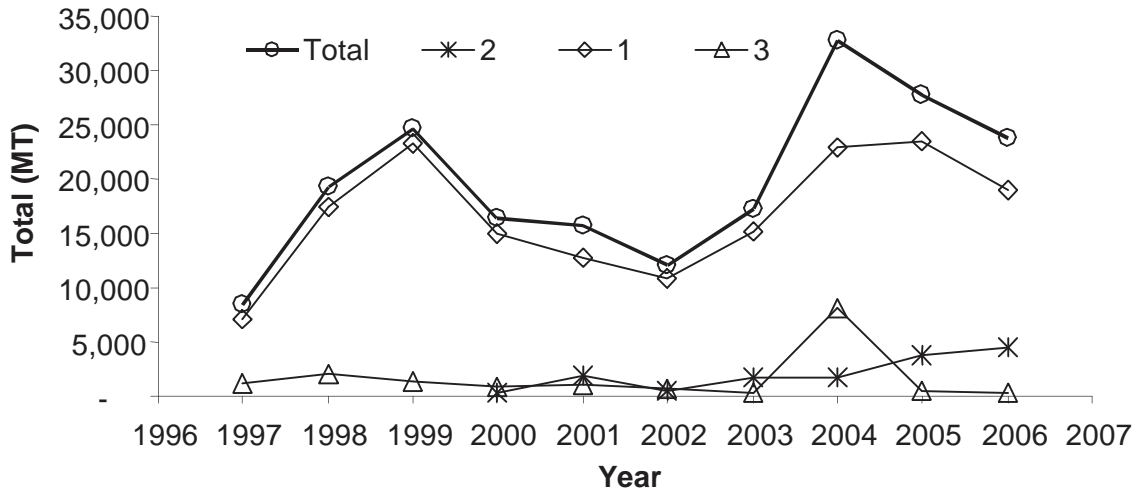


Figure 6. Tuna production of handline fishing vessels operating in Celebes Sea (1), Sulu Sea (2) and coastal waters off Davao and South China Sea off Zambales Coast (3).

between 1991 and 1995, which marked the massive influx of new entrants into the fishery, before declining to this level. These estimates apparently included unregistered vessels because published estimates put the number of boats in the early 1970s through the 1980s at about 100 (BFAR, 1976-1986). In this study, compiled data by the industry on the number of vessels, which stands at slightly over 1,200 in 2006, was used.

A smaller number of vessels using the fishing technique of General Santos-based handliners operate in other parts of the country, also targeting tuna species in coastal waters. About 172 vessels are based in Regions 3, 4 and 11, and another 42 units have their base operations in Region 6. Handline fishermen from Regions 3 derive their catch from China Sea while those in Region 4 and 6 conduct their operations in Sulu Sea.

It is not possible to estimate tuna production by handline fishing vessels using Equation (2) because data is available only for one year (2005) involving 48 vessels. Instead, CPUE from this data set was determined and combined with the landed catch data of BFAR. Figure 4 presents the catch rates of handliners operating in different fishing grounds in the Philippines and neighboring waters. The average CPUE of the vessels operating Celebes Sea, Sulu Sea and coastal waters off Zambales and Davao Gulf are significantly different ($p < 0.001$).

The number of fishing days per trip varies with the distance of the fishing ground. In the 1970s, handline fishing vessels could make up to 70 short trips annually due to the proximity of the fishing ground. However, apparently with declining catch rates from traditional fishing grounds, handline vessels were forced to move much farther. Currently, large handline vessels can now only make about 8 trips per year. The duration of each trip is about 30 days. For smaller handliners operating within archipelagic waters, the duration of each trip is usually smaller (typically 5 days), reflecting the closer distance of the fishing grounds, and the target species is not always tuna.

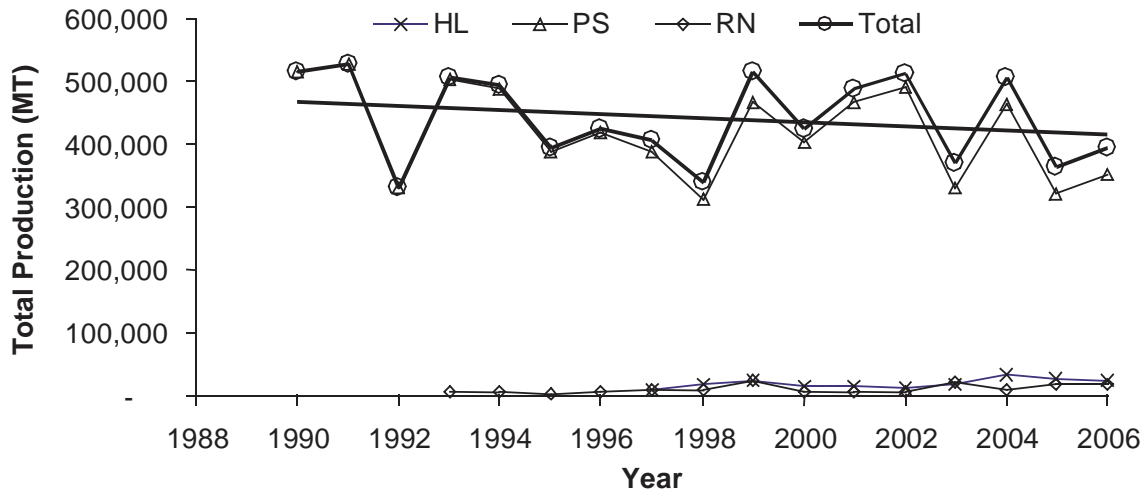


Figure 7. Total production of skipjack, yellowfin and bigeye tuna by the Philippine tuna fishing fleet from 1990 to 2006. Linear fit shows stable but slightly declining trend. (PS = purse seine; RN = Ringnet; HL = Handline).

Figure 6 presents the tuna production of handline fishermen from 1997 to 2006. The plot of cumulative tuna production reflects the dominance of the handline fleet operating out of General Santos. Overall handline production shows an increasing trend but total catch declined after 2004, when total production was about 32,759 MT. The estimated total production in 2006 is 23,819 MT, which is slight lower than the estimate of BAS (29,000 MT). The proportion of bigeye tuna in the handline catch was previously estimated at about 6% (Babaran 2006).

Overall tuna production

Figure 7 shows the consolidated production of skipjack, yellowfin and bigeye tuna by the Philippine commercial and municipal fishing fleets. The contribution of the purse seine fleet is more dominant than both ringnet and handliner fleets. For 2006, the estimated total production was 393,526 MT; this is consistent with the estimate by BAS totaling 630,000 MT that includes neritic tuna species. The total production is relatively stable from the 1990s up to the present with overall production apparently showing a slightly declining trend despite the increasing contributions of the ringnet and handline fishery sectors. Relative to official production figures used by the WCPFC, tuna produced by the Philippine tuna fleet is higher (Figure 8). The difference between these estimates would be lower if the catch landed in other countries were excluded.

Conclusions

This study presents overall estimates of tuna production by the Philippine tuna commercial and municipal fisheries sectors. The results show a relatively stable production trend from the 1990s to the present, indicating the long tradition of tuna fishing in the Philippines. Variability in the tuna production is attributed to changing

weather patterns associated with El Niño/La Niña events. The declining production trend reflects the reduction in the number of purse seine catchers.

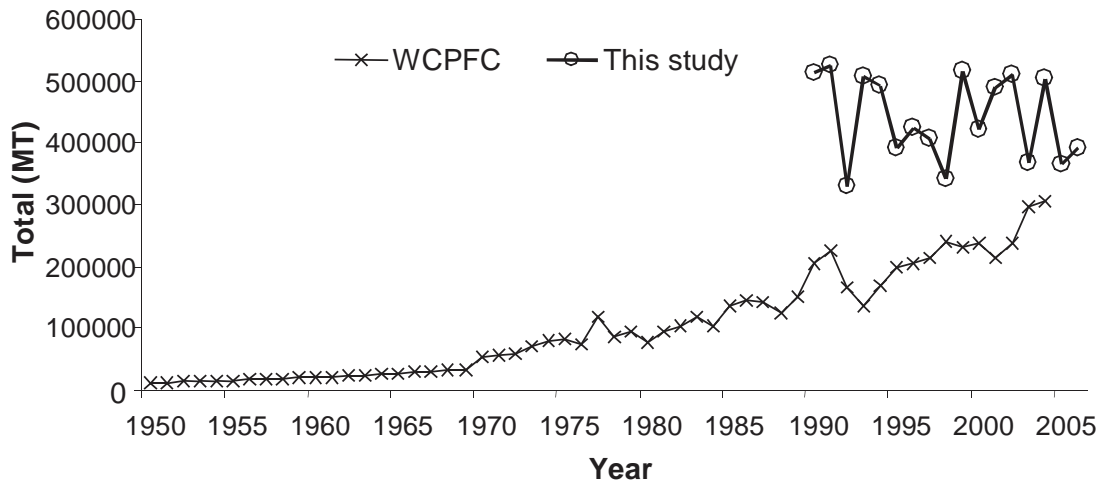


Figure 8. Philippine tuna (skipjack, yellowfin and bigeye) production from the WCPO region.

Acknowledgment

The Socksargen Federation of Fishing and Allied Industries, Inc. (SFFAI) commissioned this study through the financial support of USAID/Growth with Equity in Mindanao Program. Anonymous members of the industry, the Bureau of Fisheries and Aquatic Resources (BFAR) and the National Fisheries Research and Development Institute (NFRDI), provided the data used.

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