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# Estimates of large-scale purse seine and longline fishing capacity in the western and central Pacific based on stock assessments of target species

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## 1. Introduction

The tuna fishery in the western and central Pacific Ocean (WCPO) is the largest of the world's regional tuna fisheries, with recent annual catches of main target species (skipjack, yellowfin bigeye and albacore tuna) approaching 2 million mt (Appendix 1). The fishery is complex, with multiple fishing methods (gear types), multiple species targeted and targeting most species, usually at different stages of their life histories. The main fishing methods are longline, pole-and-line, purse seine and a range of other net- and line-based gear types. The fishery began in the 1950s primarily as a longline (targeting larger albacore, bigeye and yellowfin tunas) and pole-and-line fishery (targeting skipjack tuna and albacore tuna in the North Pacific). In the 1980s, purse seine (targeting skipjack and yellowfin tuna) began to outstrip longline and pole-and-line as the major gear type. Purse seiners also have a small but significant by-catch of bigeye tuna in the WCPO. Currently, purse seine gear is responsible for approximately 60% of the total WCPO tuna catch and 75% of the WCPO skipjack tuna catch. Skipjack tuna is the dominant species caught (68% of the total tuna catch), followed by yellowfin tuna (21%), bigeye tuna (6%) and albacore tuna (6%). The purse seine catch is concentrated in tropical waters (Figure 1); longline catches of bigeye and yellowfin tuna are concentrated in tropical waters and albacore tuna in sub-tropical and temperate waters (Figure 2). A significant concentration of catch by purse seine and a range of net- and line-based gear types occurs in the waters of Indonesia and Philippines (Figure 1). Much of the tropical fishery occurs in the exclusive economic zones (EEZs) of Pacific Island and Southeast Asian Countries and Territories.

The size composition of the catch is strongly determined by the fishing methods used (Figure 3). For skipjack, yellowfin and bigeye tunas, the smallest fish are taken in the domestic fisheries operating in Indonesia and Philippines. The purse seine fishery takes mainly adult skipjack tuna (>40 cm FL) and juvenile (<100 cm FL; mainly in sets on fish aggregation devices (FAD) and on naturally occurring logs) and adult (mainly in sets on free-swimming schools) yellowfin tuna. The bigeye tuna captured by purse seine are mostly juvenile fish (<120 cm FL) taken in FAD/log sets. Longline captures adult yellowfin tuna and dominates the catches of bigeye and South Pacific albacore tuna. The FAD-based handline fishery in the Philippines and adjacent areas captures yellowfin and bigeye tuna of a size similar to longline (the larger-sized fish in the Indonesia/Philippines size composition in Figure 3).

Formal international management of the fishery is just beginning, with the establishment of the Western and Central Pacific Fisheries Commission (WCPFC). Management measures will need to be designed to address stock status issues (see section 2) while also promoting sustainable utilization of the stocks and the pelagic ecosystem of which they are part. Initial management measures have included a combination of effort (purse seine days fished and searched), catch (longline bigeye tuna catch) and capacity (longline vessel numbers fishing for albacore tuna). In this paper, we attempt to estimate capacity limits (in terms of vessel numbers) that would be consistent with the 2005 stock assessments, focusing on the purse seine and longline components of the fishery, and discuss various issues associated with the application of such measures.

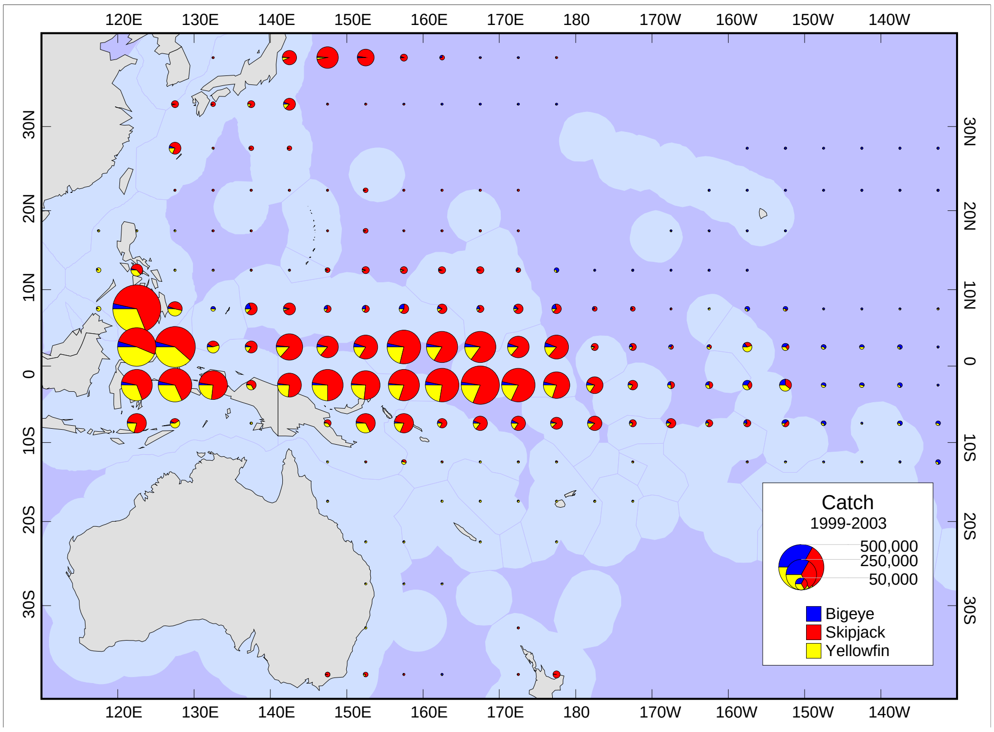


**Figure 1. Purse seine and pole-and-line catch distribution, 1999–2003.**

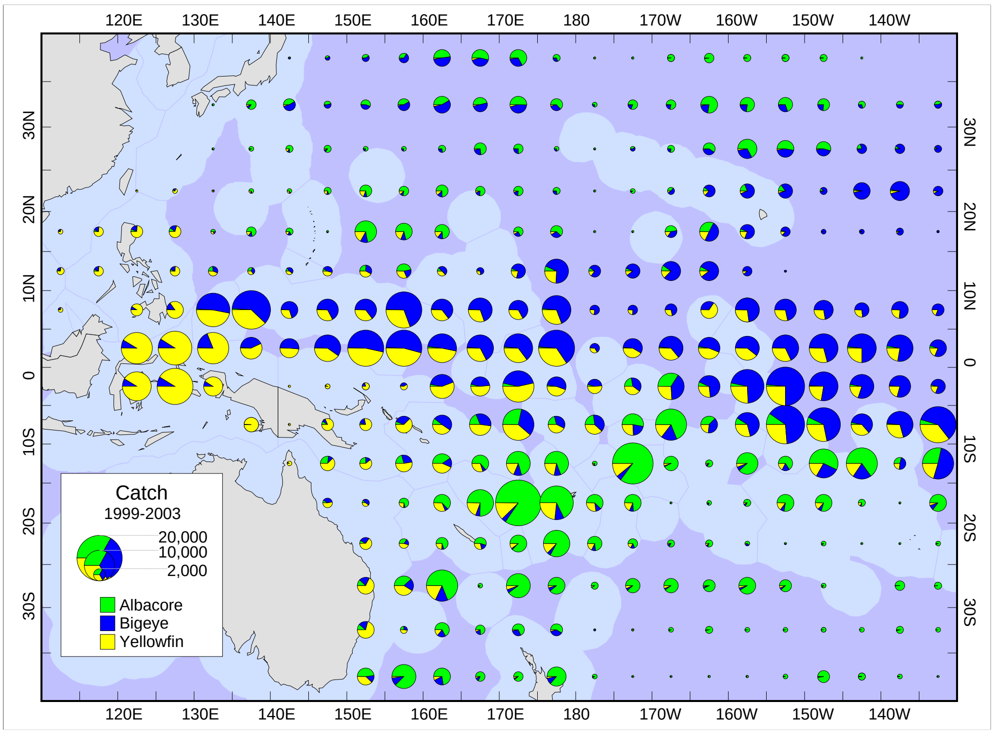


**Figure 2. Longline catch distribution, 1999–2003.**

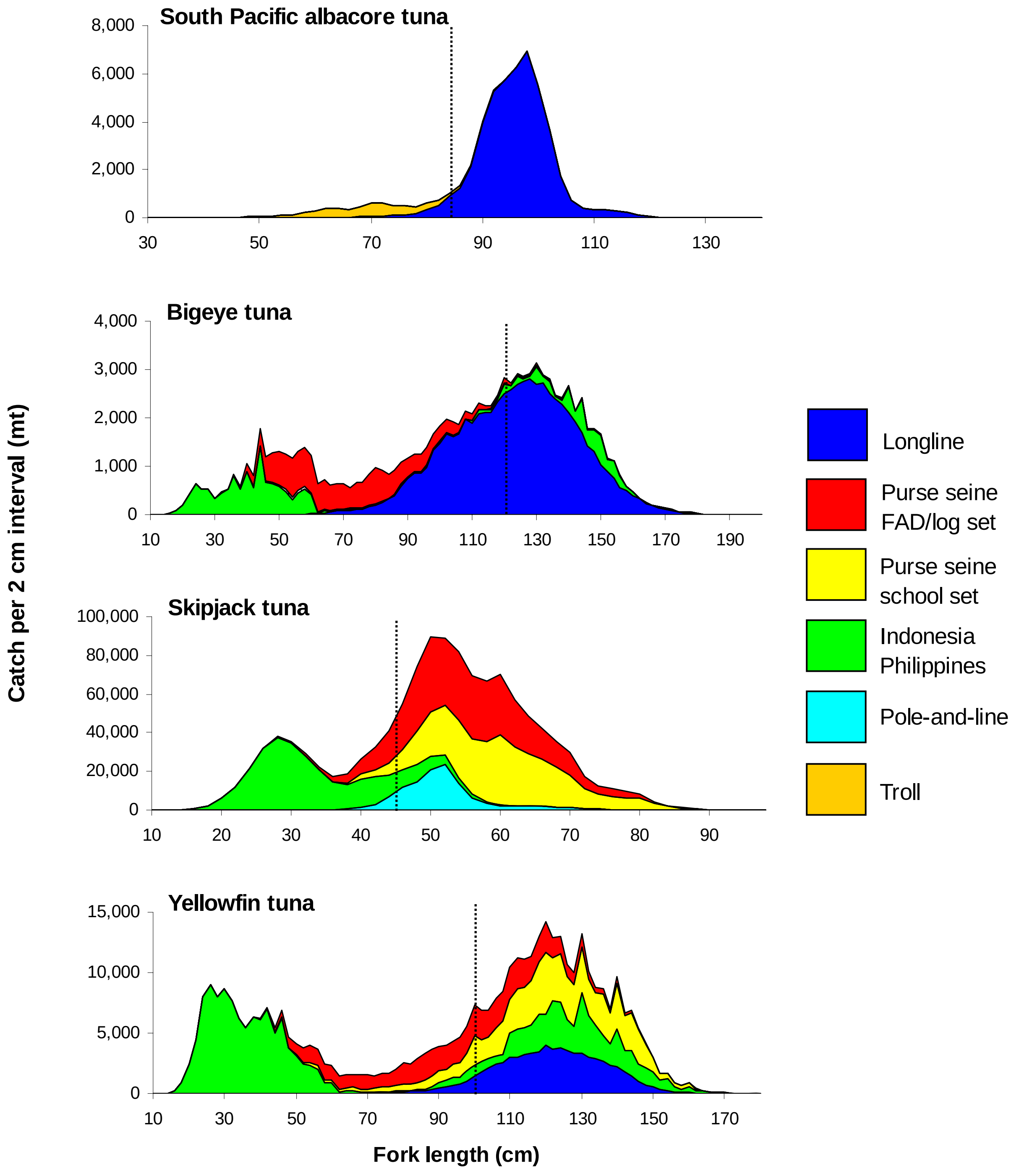


**Figure 3. Average size composition of the catch of main tuna species, by gear type, 2000–2004. The vertical dashed lines indicate the approximate size at 50% maturity.**

## 2. Stock Assessments in the WCPO

Stock assessments of tuna in the WCPO are routinely undertaken using MULTIFAN-CL, a statistical, length-based age-structured model. Most assessments incorporate spatial structure and multiple fisheries based on gear type (e.g. purse seine, longline), fishing method (e.g. purse seine FAD/log and school sets) and region. Fisheries may have unique or shared characteristics of selectivity and catchability. A feature of the assessments is that catchability may be allowed to vary over time if that is considered appropriate.

Assessments are undertaken routinely for skipjack (Langley et al. 2005), yellowfin (Hampton et al. 2005a), bigeye (Hampton et al. 2005b) and South Pacific albacore tuna (Langley and Hampton 2005).

Assessments of stock status are made using two principal biological reference points – the current (usually defined as a average over the most recent three years of the assessment but excluding the last year) level of age-specific fishing mortality is compared with that estimated to produce the maximum sustainable yield (MSY); and the current biomass is compared to the equilibrium biomass at MSY. If $F_{current}/F_{MSY} > 1$, overfishing is said to be occurring; if $B_{current}/B_{MSY} < 1$ the stock is said to be in an overfished state.

Based on the 2005 assessments, overfishing was estimated to be occurring for yellowfin and bigeye tuna but not for skipjack or South Pacific albacore tuna (Table 1). None of the stocks was estimated to be in an overfished state.

**Table 1. Biological reference points for the main WCPO tuna stocks based on the 2005 base-case assessments. "Current" refers to the period 2001–2003.**

| Stock | $F_{current}/F_{MSY}$ | $B_{current}/B_{MSY}$ |
|---|---|---|
| Skipjack | 0.17 | 3.01 |
| Yellowfin | 1.22 | 1.32 |
| Bigeye | 1.23 | 1.25 |
| South Pacific albacore | 0.05 | 1.69 |

# 3. Capacity Targets Consistent with Stock Assessments

Management measures are required to limit fishing mortality. It is theoretically possible, given suitable information on current levels of fishing capacity, to use the information from the stock assessments to derive appropriate levels of capacity for the major fleet categories fishing in the WCPO. In the following sections, we outline the various issues relating to the determination and application of capacity limits in the purse seine, longline and other fisheries operating in the WCPO. We also look at the issue of fishery interaction and allocation, and how this may impact on the estimation of capacity limits.

## a. Purse Seine Fishery

A possible methodology for relating stock assessment results to capacity limits in a simple sing-species fishery would be as follows:

- Assuming that fishing mortality is proportional to fishing effort, determine the level of fishing effort consistent with a target reference point. For example, if $F_{MSY}$ is a target reference point, an appropriate level of effort would be

$$E_{MSY} = E_{current} \div \left( F_{current} / F_{MSY} \right) \qquad (1)$$

- A capacity limit consistent with $E_{MSY}$ could then be determined, for example using an empirical relationship between fishing effort and fishing capacity. The relationship between WCPO purse seine vessel numbers (capacity) and vessel days fishing and searching (effort) is shown in Figure 4.

In the case of the WCPO purse seine fishery, there are several difficulties with such a simplistic approach. First of all, the fishery targets principally skipjack tuna, for which, according to the stock assessment, fishing mortality (and corresponding effort, capacity and catches) could be greatly increased. For example, the current (2001–2003 average) level of fishing effort of 40,949 days (equivalent to approximately 192 vessels based on the average days fished per vessel per year during 1992-2004 of 213 days) could be expanded six-fold by applying equation (1) to the skipjack stock status estimate. However, yellowfin tuna, which is a secondary target species, and bigeye tuna, which is essentially a by-catch species, are both currently subject to overfishing. In the absence of any additional measures to mitigate fishing mortality of those species, an increase in fishing effort or capacity designed to increase the catch of skipjack tuna would result in further overfishing of yellowfin and bigeye tuna. On the other hand, if the simplistic procedure described above were applied using yellowfin and bigeye tuna stock status estimates, fishing effort and capacity would need to be reduced on the order of 20% (to 33,291 days and 156 vessels) to be consistent with $F_{MSY}$ reference points for those species. Such a measure would be expected to slightly increase long-term average catches of yellowfin and bigeye tuna (according to the equilibrium yield model); however, it would be expected to reduce the average catch of skipjack tuna by approximately 20% because the skipjack yield-effort relationship is approximately linear at current levels of exploitation (Langley et al. 2005). Because skipjack tuna comprises the majority of the purse seine catch (exceeding 1,000,000 mt in 2004 – Appendix 1), a reduction in fishing effort and catch of this magnitude would have significant economic ramifications, and therefore such an option is not politically acceptable.

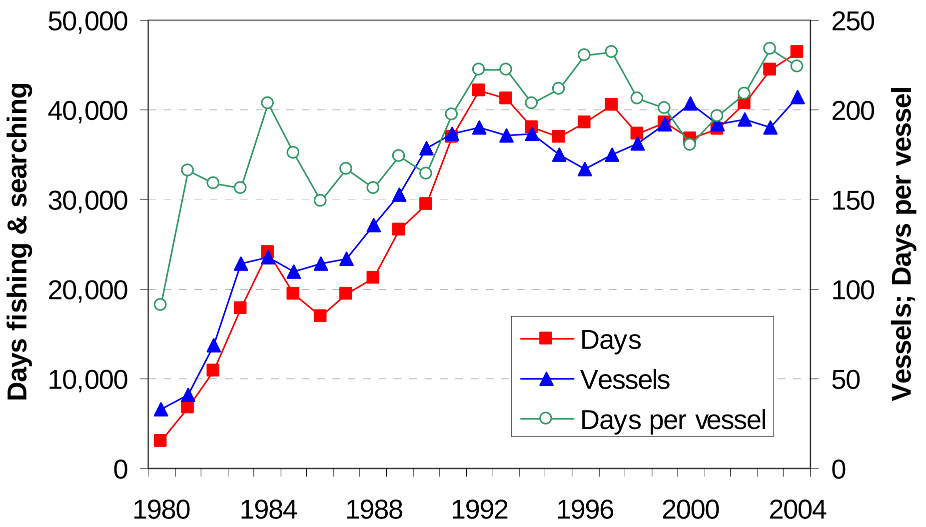


**Figure 4. Time series of annual purse seine effort (days fished and searched), annual vessel numbers (Lawson 2005) and average days per vessel.**

A second difficulty is that a limit on the number of purse seine vessels would not necessarily limit fishing effort and therefore fishing mortality. The average number of days fished per vessel per year has tended to increase over time in the WCPO purse seine fishery (Figure 4). Since 1992, the annual average has fluctuated between about 180 and 230 days per vessel per year. The advent of larger vessels with greater carrying capacity, more vessels basing in coastal states close to the fishing grounds, more modern unloading facilities, more options to select unloading ports and the use of at-sea transhipment and tendering could all allow vessels to spend more time per year fishing. At current levels of annual fishing effort per vessel, there would appear to be considerable potential to increase fishing effort even if the number of vessels was limited at the current level. If capacity limits were based on carrying capacity rather than vessel numbers, the capability to increase fishing effort per vessel would be somewhat more constrained.

A third difficulty is that even if fishing effort was constrained by capacity limitation, fishing mortality may still be increased by increased catchability (fishing mortality per unit effort). Increased catchability might result from the adoption of new technology that assists in the location and capture of tuna schools, such as the use of drifting or anchored FADs. Fishing mortality for the three species has increased over the past 25 years but catchability has shown less consistent variability (Figure 5).

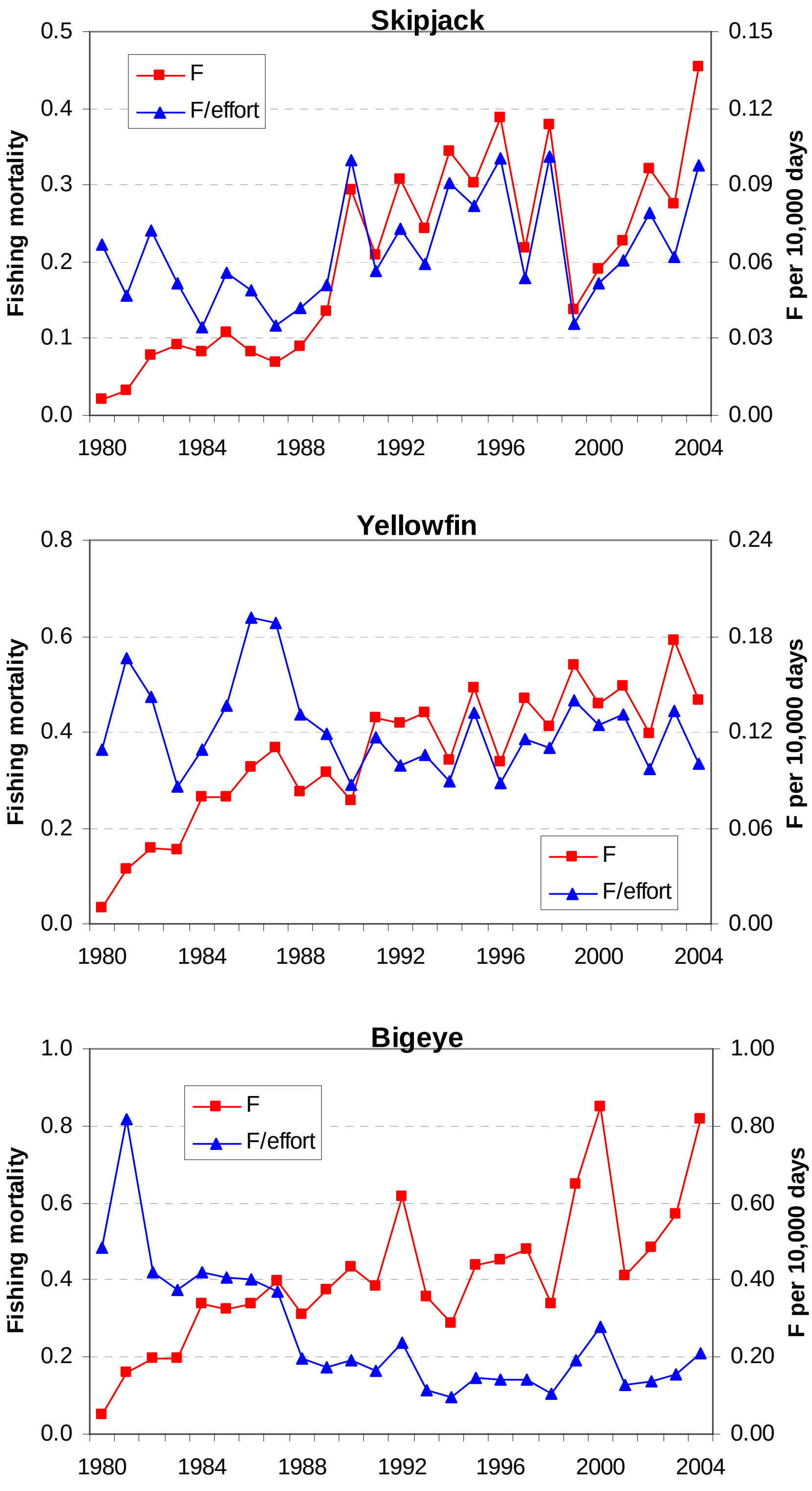


**Figure 5. Time series of estimated purse seine fishing mortality[1] and fishing mortality per unit effort (catchability) for skipjack, yellowfin and bigeye tuna.**

[1] In the stock assessments, purse seine fisheries are classified by region (east and west of 170°E) and set type (FAD/log and school sets). In order to characterize the purse seine fishery as a whole by species-specific fishing mortality and catchability, we have used total annual purse seine catch divided by purse seine exploitable biomass at the beginning of each year as a proxy for fishing mortality.

For skipjack, catchability by purse seine is estimated to have increased in the late 1980s, decreased in the late 1990s and has increased since that time. For yellowfin, catchability has been more stable over time, while for bigeye catchability is estimated to have decreased to the mid-1990s after which it has tended to increase. Some of the variability in catchability is no doubt related to environmental variation. However, other changes are due to changes in the operational characteristics of the purse seine fleet, in particular in relation to set type. For bigeye, set type is known to have a particularly profound effect on bigeye catchability and fishing mortality. The only significant purse seine catches of bigeye occur in FAD and log sets, with only small catches occurring in school sets (Figure 3). In the early 1980s, the purse seine fishery was highly dependent on FAD/log sets (Figure 6). With the arrival of the US fleet in the WCPO, the set-type profile of the fleet shifted more towards school sets, and by the early 1990s, more than half of the total purse seine sets were school sets. Since that time, the proportion of FAD/log sets in any given year has varied from 40% to 65% of the total sets (Figure 6). The resurgence in FAD/log sets in the past decade is due largely to the deployment of drifting FADs by purse seine vessels. Drifting FADs may be located electronically and in some cases may also transmit information on the size of tuna aggregations to assist vessel operators in FAD selection. These changes in the set-type characteristics of the fleet and the use of high-technology FADs in particular have been a major factor influencing catchability and fishing mortality of juvenile bigeye tuna (Figure 5). In this case, it is clear that simple capacity limits, or even limits on fishing effort, will not necessarily control fishing mortality effectively. The number of FAD/log sets rather than total purse seine effort or capacity will be the major factor influencing bigeye tuna fishing mortality.

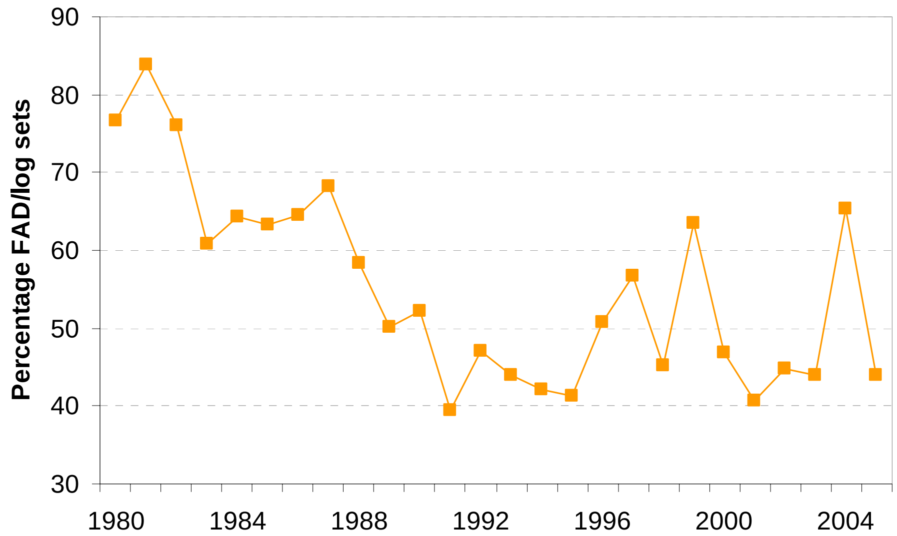


**Figure 6. The precentage of FAD/log sets in total annual purse seine sets in the WCPO purse seine fishery.**

To summarize, there are three key difficulties that would need to be addressed in determining and applying purse seine fishing capacity limits as a means of limiting fishing mortality:

- Capacity limits would not be able to recognise the differential stock status of skipjack tuna compared to yellowfin and bigeye tuna.
- Capacity limits may not limit fishing effort because of the potential of the fleet to increase the amount of fishing effort per vessel.
- Capacity limits may not limit fishing mortality because of increases in catchability over time.

The second and third issues above fall broadly into the category of "effort creep". These might be dealt with through continual (downwards) adjustment of fishing capacity if annual assessments indicate increased fishing mortality per capacity unit. However, capacity limitation, or indeed fishing effort limitation alone will not be able to deal with the issue of the multi-species nature of the fishery and differential stock status. Species-specific catch limitation or effort controls targeting FAD/log sets would appear to be the only means of effectively dealing with this issue.

## b. Longline Fishery

The longline fishery in the WCPO may be classified into two major groups: 1) large-scale ultra-low temperature (ULT) freezer longliners (typically larger than 24 m in length) operating throughout the WCPO targeting bigeye, yellowfin and, to a lesser extent, albacore tunas; and 2) vessels, commonly called offshore longliners, usually smaller than 24 m in length and without ULT freezing capability operating within restricted ranges of local fishing bases targeting bigeye, yellowfin, albacore and, in some areas, broadbill swordfish. The large-scale longline fleet consists mainly of vessels from Japan, Korea, Chinese Taipei and, more recently, mainland China. Offshore fleets are either flagged by the coastal states in which they are based or are foreign fleets originating in Japan, Chinese Taipei and mainland China but based in other coastal states under charter or other business relationships.

The species targeting characteristics of these fleets are complex (Figure 2). In the equatorial WCPO (10°N - 10°S), both large-scale and offshore longliners target primarily bigeye tuna, but also have significant catches of yellowfin tuna. At higher latitudes, catches of albacore tuna tend to dominate, although catches of other tuna, swordfish and striped marlin may also be locally important. Mostly offshore vessels operate in these areas, although large-scale longliners may also operate seasonally. The estimated numbers of longliners in each of these categories operating in 2001 - 2004 are shown in Table 3.

**Table 2. Estimated average longline vessel numbers for 2001 - 2004 by fleet category and main area of operation. Source: Lawson (2005).**

| Fleet | Equatorial | North Pacific | South Pacific | Total |
|---|---|---|---|---|
| Large-scale | | 788 | | 788 |
| Offshore | 2,209 | 1,091 | 647 | 3,947 |

The methodology for estimating appropriate capacity limits outlined earlier for purse seine could be applied to the longline fleets in Table 2. The large-scale and offshore equatorial longline fleets target primarily bigeye tuna, and therefore capacity limits consistent with bigeye stock status would be the vessel numbers reported in Table 2 divided by 1.23, i.e. 640 large-scale and 1,796 offshore equatorial vessels.

The offshore fleet operating in the South Pacific targets primarily albacore. Biological reference points for South Pacific albacore indicate a lightly exploited stock, mainly because longline gear targets the oldest age-classes in the population (Langley 2006). While it is unlikely that fishing mortality on these age-classes could be increased to the point that MSY-based reference points were threatened, the impact of the longline fishery on the longline-exploitable abundance of South Pacific albacore has been significant, approximately a 30% reduction from unexploited conditions in recent years (Langley and Hampton 2005). Appropriate levels of fishing capacity therefore need to be determined mainly on economic, rather than biological grounds. Any large increases in vessel numbers would likely reduce the average catch-per-unit-effort of albacore and impact profits. While there may be potential for expanded fishing effort in some areas, a conservative overall fishing capacity target, in the vicinity of the current fleet size, is probably appropriate. It should also be noted that a component of the offshore fleet in the South Pacific targets other species, e.g. swordfish off eastern Australia and southern bluefin tuna off New Zealand. There may well be local issues associated with these fisheries that warrant a more cautious approach to fishing capacity management.

Offshore longliners operating in the North Pacific are a mix of Japanese and US fleets targeting bigeye, yellowfin, albacore, Pacific bluefin and swordfish. The tuna-targeting versus swordfish-targeting fleets are not identified in Table 2; however, it would be possible to make this classification given access to complete catch statistics. If we take an approach consistent with that taken for the equatorial fleets, an appropriate limit for the tuna-targeting component of the North Pacific offshore fleet would be the current fleet size divided by 1.23. A formal assessment of North Pacific swordfish is yet to be undertaken, so it is not possible to nominate a capacity limit or target for the swordfish-targeting component of the fleet.

Some of the problems of using fishing capacity limits as a means of controlling fishing mortality identified for the purse seine fleet are also issues for the longline fleets. The multi-species nature of the fishery and differences in stock status among species poses similar difficulties as for purse seine. But in this case, a main target species, bigeye tuna, is the species for which there are overfishing concerns. Yellowfin tuna, a secondary target species of all longline fleets, is also estimated to be subject to overfishing; however, the assessments show that the impact of longline catches on yellowfin tuna stock status is minimal. Albacore tuna is considered to be at least fully exploited in the North Pacific, but, as noted above, is lightly exploited in relation to MSY-based reference points in the South Pacific. Unlike the purse seine fishery, it is possible to identify components of the fishery for which differential measures might be applied. Separate capacity limits could be applied to equatorial large-scale and offshore longliners (targeting bigeye tuna), and to large-scale and offshore fleets targeting albacore and other species in the North Pacific and South Pacific, based on the area of operation of those fleets. While this is certainly not a perfect means of identifying target species, it would allow capacity measures to at least approximately address the differential stock status of the species concerned.

If fishing capacity limits were used as a means of limiting fishing mortality of bigeye tuna, the issue of “effort creep” would need to be dealt with. As with purse seine, there have been developments in longline gear technology and deployment strategies that have improved the efficiency and productivity of vessels. It is likely that the catchability of target species has increased as a result. Therefore, it would be necessary to periodically revise capacity or other effort-based management measures in order to limit fishing mortality.

### c. Other Fisheries

Other significant fisheries in the WCPO include the domestic fisheries in Philippines and Indonesia, the predominantly Japanese pole-and-line fishery targeting skipjack and North Pacific albacore, and troll fisheries for albacore in the North and South Pacific. At this time there is no compelling need for management measures for the pole-and-line fishery targeting skipjack tuna or the troll fishery targeting albacore tuna in the South Pacific. However, there is a case for limiting the capacity of the pole-and-line and troll fisheries targeting albacore in the North Pacific to approximately current levels due to the fully exploited status of that stock (Stocker 2005).

The domestic fisheries in Philippines and Indonesia record large catches of skipjack, yellowfin and bigeye tuna, comprising mostly small juvenile fish (Figure 3). The impact of yellowfin and bigeye tuna catches on population biomass is substantial (Hampton et al. 2005a,b); therefore, management measures to control fishing mortality by these fleets will be necessary for effective stock-wide conservation. On the basis of the 2005 stock assessments, and applying across-the-board scaling of fishing mortality to achieve MSY-based reference points, fishing mortality (and fishing effort and fishing capacity) would need to be reduced in these fisheries on the order of 20% from 2001-2003 average levels. However, it is not possible to nominate specific fishing capacity or effort targets, because of a lack of data on current and historical levels of fishing capacity and effort.

## d. Fishery Interaction Considerations

The design of fishery management measures for WPCO tuna fisheries is complicated by the exploitation of the same stocks at different stages of their life histories in different areas by different fishing methods. Management measures need to recognise the potential for interaction among these different components of the fishery, and in particular, that the appropriateness of a measure in any one fishery component depends on what measures are being applied simultaneously in other components.

In the examples so far given in this paper, we have simply applied a common scaling factor to current levels of fishing effort or capacity across fishery components to derive fishing effort and capacity limits that would be consistent with stock status estimates. In so doing, the current structure of the overall fishery, in terms of spatial distribution and relative levels of fishing by different size-selective gear types, has been maintained. Implicitly, this process allocates portions of the particular effort or capacity limit to fishery components based on their recent (2001-2003 in the case of the 2005 assessments) levels. This is a relatively simple and arguably objective way to proceed, but there may well be combinations of fishing levels across the different fishery components that would result in more favourable outcomes for both the stock and for the fisheries overall. This can be illustrated in the cases of yellowfin and bigeye tuna. We have determined *MSY*, $B_{MSY}$ and $F/F_{MSY}$ for hypothetical fisheries comprising single components or combinations of components of the actual fishery (Table 3). *MSY* is estimated to be up to 90% higher for yellowfin tuna and up to 33% higher for bigeye tuna in situations where the catch is composed of mainly larger-sized fish (e.g. hypothetical fisheries 2, 4 and 6 in Table 3). Also, for these hypothetical fisheries, $F/F_{MSY}$ at the current levels of effort would be considerably below 1, hence overfishing would not be occurring. By contrast, if the fishery was composed only of components targeting small fish (e.g. hypothetical fisheries 3 and 5 in Table 3), *MSY* and $B_{MSY}$ would be reduced relative to the status quo.

These examples serve to illustrate that stock status reference points in complex fisheries are sensitive to the size composition of the catch, which in the case of the WCPO tuna fishery is determined mainly by the relative mix of different size-selective gear types. The implication for fishing capacity management is that the capacity limit for one gear type is dependent on the limits specified for other gear types. In the yellowfin and bigeye tuna examples, if effort (capacity) in the purse seine FAD/log component and/or the Indonesia/Philippines small-fish component is reduced, a larger amount of effort (capacity) in the longline component could be allowed while maintaining the overall level of fishing mortality and biomass within *MSY*-based reference points.

**Table 3. Comparisons of *MSY*, $B_{MSY}$ and $F/F_{MSY}$ for hypothetical fisheries consisting of one or more components. *MSY* and $B_{MSY}$ are expressed relative to the values obtained for the full assessment, i.e. using the actual fishery composition for 2001-2003. $F/F_{MSY}$ is the ratio of the fishing mortality in 2001-2003 for the component(s) specified to the $F_{MSY}$ estimated for that (those) components(s) alone.**

| Hypothetical fishery | Yellowfin tuna | | | Bigeye tuna | | |
|---|---|---|---|---|---|---|
| | *MSY* | $B_{MSY}$ | $F/F_{MSY}$ | *MSY* | $B_{MSY}$ | $F/F_{MSY}$ |
| 1. All components as in 2001-2003 | 1.00 | 1.00 | 1.25 | 1.00 | 1.00 | 1.25 |
| 2. Longline, Philippines handline | 1.91 | 1.12 | 0.08 | 1.33 | 1.03 | 0.32 |
| 3. Purse seine FAD/log sets | 0.88 | 0.71 | 0.12 | 0.40 | 0.63 | 0.24 |
| 4. Purse seine school sets | 1.55 | 0.98 | 0.06 | | | |
| 5. Indonesia/Philippines small-fish gears | 0.61 | 0.95 | 0.29 | 0.77 | 0.99 | 0.53 |
| 6. Longline, Philippines handline, purse seine school sets | 1.75 | 1.10 | 0.18 | 1.30 | 1.03 | 0.34 |

## 4. Discussion

This paper has outlined a relatively simple means of aligning fishing capacity limits to estimates of stock status of the main tuna stocks comprising the WCPO tuna fishery. However, several difficulties in applying such an approach to the WCPO tuna fishery have been identified.

The multi-species nature of the purse seine and longline fisheries and the differential stock status of the main species make it difficult if not impossible for single, gear-specific capacity limits, or indeed other broadly-specified effort-based measures, to equally address the stock status of all species simultaneously. In the longline fishery, separate consideration of longline fleets targeting bigeye tuna in the equatorial WCPO and albacore tuna at higher latitudes may be reasonably effective in dealing with this problem. However in the purse seine fishery, differential fishing mortality of juvenile yellowfin and bigeye tuna is strongly influenced by the number of FAD/log sets. Traditional capacity-based measures such as vessel numbers or carrying capacity are non-specific with respect to set type and therefore would not be effective in controlling fishing mortality of bigeye and yellowfin tuna without sacrificing a large amount of skipjack tuna catch. The current management measure put in place by the WCPFC limits purse seine effort to specified numbers of vessel days fishing and searching. This measure also is non-specific with respect to set type and is not likely to be effective in the long-term. Measures specific to FAD/log sets, or catch-based measures specific to juvenile yellowfin and bigeye tuna, will ultimately be required to achieve the dual objectives of yellowfin and bigeye conservation and the desired level of skipjack exploitation.

The problem of "effort creep" is significant for capacity and other effort-based management systems. At given levels of capacity or fishing effort, fishing mortality may increase through increased catchability, usually associated with the adoption of new technology. An additional problem for capacity limitation by vessel numbers is the potential for vessels to increase their effort per unit time by a variety of means. This was one of the reasons that prompted the Parties to the Nauru Agreement[2] to move from a limit on vessel numbers to a limit on vessel days. If capacity or other effort-based measures are employed, it is essential that limits are regularly reviewed and if necessary adjusted downwards to counter "effort creep".

WCPO tuna fisheries are complicated by multiple jurisdictions, multiple species and multiple size-selective gear types. For any given stock, *MSY* and associated biological reference points are sensitive to the composition of the fishery in terms of gear types (controlling overall size composition of the catch) in particular and in some cases to spatial and seasonal distributions of catch and effort. The implication of this is that the management measures in one component of the fishery will depend on measures applied to other components. Current stock assessments typically generate reference point estimates by scaling fishing mortality with the relative mix of gear types and the spatial and seasonal distributions of the fishery maintained at recent average levels. This procedure is implicitly allocating effort (or other management variable) consistent with recent average conditions. Other allocations among gear types, areas and seasons will have different fishery outcomes and impacts on the stocks. Such alternatives might best be considered in the context of an explicit allocation procedure.

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[2] The Parties to the Nauru Agreement are Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. Collectively, 75% of purse seine effort and catch occurs in their EEZs.

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## Appendix 1. Catch estimates of main tuna species in the WCPO.

| Year | Albacore tuna | | | | |
|---|---|---|---|---|---|
| | Longline | Pole-and-line | Purse seine | Other | Total |
| 1950 | 16,740 | 12,863 | 0 | 0 | 29,603 |
| 1951 | 11,408 | 14,500 | 0 | 0 | 25,908 |
| 1952 | 22,386 | 41,787 | 154 | 237 | 64,564 |
| 1953 | 23,627 | 32,921 | 38 | 132 | 56,718 |
| 1954 | 25,877 | 28,069 | 23 | 38 | 54,007 |
| 1955 | 21,188 | 24,236 | 8 | 136 | 45,568 |
| 1956 | 18,235 | 42,810 | 0 | 57 | 61,102 |
| 1957 | 24,117 | 49,500 | 83 | 151 | 73,851 |
| 1958 | 29,702 | 22,175 | 8 | 124 | 52,009 |
| 1959 | 26,635 | 14,252 | 0 | 67 | 40,954 |
| 1960 | 31,376 | 25,156 | 0 | 76 | 56,608 |
| 1961 | 32,599 | 18,639 | 7 | 268 | 51,513 |
| 1962 | 37,279 | 8,729 | 53 | 191 | 46,252 |
| 1963 | 26,370 | 26,420 | 59 | 218 | 53,067 |
| 1964 | 26,069 | 23,858 | 128 | 319 | 50,374 |
| 1965 | 28,342 | 41,491 | 11 | 121 | 69,965 |
| 1966 | 51,317 | 22,830 | 111 | 585 | 74,843 |
| 1967 | 57,903 | 30,481 | 89 | 525 | 88,998 |
| 1968 | 45,744 | 16,597 | 267 | 1,123 | 63,731 |
| 1969 | 37,909 | 32,148 | 480 | 935 | 71,472 |
| 1970 | 47,499 | 24,485 | 279 | 506 | 72,769 |
| 1971 | 44,286 | 53,451 | 1,751 | 308 | 99,796 |
| 1972 | 44,871 | 49,248 | 86 | 892 | 95,097 |
| 1973 | 59,707 | 62,026 | 262 | 1,018 | 123,013 |
| 1974 | 39,215 | 69,562 | 193 | 2,001 | 110,971 |
| 1975 | 30,926 | 48,032 | 153 | 1,040 | 80,151 |
| 1976 | 44,457 | 78,992 | 1,147 | 1,367 | 125,963 |
| 1977 | 48,488 | 35,385 | 611 | 1,664 | 86,148 |
| 1978 | 41,982 | 57,745 | 278 | 7,793 | 107,798 |
| 1979 | 36,189 | 45,611 | 131 | 4,796 | 86,727 |
| 1980 | 42,304 | 43,620 | 323 | 5,639 | 91,886 |
| 1981 | 47,109 | 26,235 | 246 | 13,117 | 86,707 |
| 1982 | 43,355 | 29,518 | 551 | 15,504 | 88,928 |
| 1983 | 36,271 | 19,997 | 224 | 7,986 | 64,478 |
| 1984 | 30,806 | 26,340 | 3,422 | 14,377 | 74,945 |
| 1985 | 37,880 | 21,346 | 1,538 | 17,275 | 78,039 |
| 1986 | 41,702 | 14,179 | 1,619 | 13,114 | 70,614 |
| 1987 | 33,340 | 19,274 | 1,445 | 13,248 | 67,307 |
| 1988 | 41,546 | 7,512 | 1,196 | 27,192 | 77,446 |
| 1989 | 29,608 | 11,208 | 2,120 | 47,541 | 90,477 |
| 1990 | 31,822 | 14,244 | 1,953 | 38,543 | 86,562 |
| 1991 | 35,118 | 6,577 | 3,518 | 17,337 | 62,550 |
| 1992 | 45,249 | 15,040 | 4,764 | 19,028 | 84,081 |
| 1993 | 55,941 | 12,919 | 1,680 | 5,520 | 76,060 |
| 1994 | 59,974 | 30,591 | 2,222 | 8,315 | 101,102 |
| 1995 | 60,869 | 23,143 | 1,279 | 9,055 | 94,346 |
| 1996 | 61,749 | 22,656 | 256 | 9,463 | 94,124 |
| 1997 | 72,742 | 35,063 | 1,099 | 7,852 | 116,756 |
| 1998 | 79,827 | 27,846 | 1,040 | 8,542 | 117,255 |
| 1999 | 68,391 | 55,122 | 6,445 | 4,937 | 134,895 |
| 2000 | 68,422 | 21,886 | 2,161 | 7,707 | 100,176 |
| 2001 | 78,336 | 29,309 | 979 | 6,960 | 115,584 |
| 2002 | 84,692 | 49,596 | 4,072 | 6,413 | 144,773 |
| 2003 | 79,200 | 34,731 | 837 | 7,712 | 122,480 |
| 2004 | 71,337 | 34,797 | 6,932 | 6,562 | 119,628 |

| Year | Bigeye tuna | | | | |
|---|---|---|---|---|---|
| | Longline | Pole-and-line | Purse seine | Other | Total |
| 1950 | 18,244 | 646 | 0 | 0 | 18,890 |
| 1951 | 12,808 | 729 | 1,095 | 0 | 14,632 |
| 1952 | 24,355 | 2,100 | 1,039 | 0 | 27,494 |
| 1953 | 23,025 | 2,400 | 619 | 0 | 26,044 |
| 1954 | 16,204 | 2,100 | 360 | 0 | 18,664 |
| 1955 | 24,749 | 4,000 | 285 | 0 | 29,034 |
| 1956 | 28,342 | 4,400 | 908 | 0 | 33,650 |
| 1957 | 35,463 | 5,200 | 49 | 0 | 40,712 |
| 1958 | 44,390 | 4,200 | 48 | 0 | 48,638 |
| 1959 | 39,789 | 1,700 | 36 | 0 | 41,525 |
| 1960 | 42,147 | 1,500 | 58 | 0 | 43,705 |
| 1961 | 36,135 | 1,800 | 63 | 0 | 37,998 |
| 1962 | 34,206 | 800 | 173 | 0 | 35,179 |
| 1963 | 40,727 | 1,800 | 6 | 0 | 42,533 |
| 1964 | 29,339 | 1,100 | 231 | 26 | 30,696 |
| 1965 | 28,392 | 1,300 | 201 | 29 | 29,922 |
| 1966 | 30,748 | 1,100 | 9 | 87 | 31,944 |
| 1967 | 32,233 | 2,800 | 60 | 252 | 35,345 |
| 1968 | 25,698 | 2,300 | 183 | 204 | 28,385 |
| 1969 | 30,245 | 1,700 | 48 | 62 | 32,055 |
| 1970 | 34,965 | 1,600 | 560 | 2,968 | 40,093 |
| 1971 | 38,359 | 900 | 690 | 3,243 | 43,192 |
| 1972 | 51,040 | 1,762 | 672 | 3,690 | 57,164 |
| 1973 | 42,412 | 1,258 | 847 | 4,449 | 48,966 |
| 1974 | 45,653 | 1,039 | 1,121 | 4,987 | 52,800 |
| 1975 | 61,488 | 1,334 | 1,054 | 5,212 | 69,088 |
| 1976 | 73,325 | 3,423 | 1,081 | 4,354 | 82,183 |
| 1977 | 72,083 | 3,325 | 1,260 | 5,954 | 82,622 |
| 1978 | 56,237 | 3,337 | 1,051 | 4,331 | 64,956 |
| 1979 | 63,704 | 2,540 | 1,680 | 4,966 | 72,890 |
| 1980 | 61,824 | 2,278 | 1,737 | 4,565 | 70,404 |
| 1981 | 45,823 | 2,596 | 3,888 | 5,298 | 57,605 |
| 1982 | 47,886 | 4,108 | 5,114 | 4,875 | 61,983 |
| 1983 | 45,270 | 4,055 | 9,109 | 5,320 | 63,754 |
| 1984 | 51,889 | 3,465 | 8,633 | 5,593 | 69,580 |
| 1985 | 57,436 | 4,326 | 6,329 | 6,725 | 74,816 |
| 1986 | 55,804 | 2,865 | 7,222 | 6,949 | 72,840 |
| 1987 | 67,818 | 3,134 | 10,926 | 5,852 | 87,730 |
| 1988 | 66,521 | 4,125 | 7,821 | 6,838 | 85,305 |
| 1989 | 62,997 | 4,298 | 12,281 | 7,572 | 87,148 |
| 1990 | 75,262 | 3,918 | 12,001 | 9,264 | 100,445 |
| 1991 | 58,185 | 1,991 | 13,271 | 11,270 | 84,717 |
| 1992 | 73,773 | 1,757 | 20,044 | 8,453 | 104,027 |
| 1993 | 64,123 | 2,330 | 13,990 | 7,206 | 87,649 |
| 1994 | 72,528 | 2,951 | 10,580 | 9,692 | 95,751 |
| 1995 | 61,137 | 3,776 | 11,487 | 9,666 | 86,066 |
| 1996 | 50,298 | 3,864 | 21,143 | 11,001 | 86,306 |
| 1997 | 63,374 | 3,611 | 37,674 | 10,298 | 114,957 |
| 1998 | 82,739 | 2,446 | 24,428 | 12,424 | 122,037 |
| 1999 | 71,632 | 2,176 | 38,152 | 13,184 | 125,144 |
| 2000 | 71,263 | 2,988 | 31,946 | 14,183 | 120,380 |
| 2001 | 73,533 | 2,349 | 28,257 | 13,038 | 117,177 |
| 2002 | 88,249 | 2,805 | 28,461 | 14,970 | 134,485 |
| 2003 | 77,849 | 1,786 | 27,238 | 15,481 | 122,354 |
| 2004 | 84,611 | 1,809 | 26,975 | 16,104 | 129,499 |

| Year | Skipjack tuna | | | | |
|---|---|---|---|---|---|
| | Longline | Pole-and-line | Purse seine | Other | Total |
| 1950 | 34 | 33,386 | 0 | 6,483 | 39,903 |
| 1951 | 12 | 96,214 | 1,748 | 8,602 | 106,576 |
| 1952 | 54 | 78,518 | 3,716 | 10,014 | 92,302 |
| 1953 | 1 | 65,546 | 3,371 | 11,403 | 80,321 |
| 1954 | 0 | 88,073 | 4,534 | 11,554 | 104,161 |
| 1955 | 157 | 92,524 | 2,906 | 12,664 | 108,251 |
| 1956 | 0 | 91,950 | 2,145 | 13,094 | 107,189 |
| 1957 | 17 | 92,156 | 2,813 | 11,955 | 106,941 |
| 1958 | 0 | 131,441 | 10,698 | 15,244 | 157,383 |
| 1959 | 33 | 145,447 | 16,941 | 14,853 | 177,274 |
| 1960 | 0 | 70,428 | 3,728 | 15,782 | 89,938 |
| 1961 | 0 | 127,011 | 11,693 | 18,032 | 156,736 |
| 1962 | 4 | 152,387 | 11,674 | 17,559 | 181,624 |
| 1963 | 0 | 94,757 | 9,592 | 18,354 | 122,703 |
| 1964 | 5 | 137,106 | 25,006 | 20,668 | 182,785 |
| 1965 | 11 | 129,933 | 4,657 | 20,459 | 155,060 |
| 1966 | 52 | 215,600 | 10,949 | 22,654 | 249,255 |
| 1967 | 124 | 168,846 | 10,931 | 24,621 | 204,522 |
| 1968 | 83 | 162,379 | 7,587 | 24,870 | 194,919 |
| 1969 | 154 | 168,084 | 5,057 | 30,008 | 203,303 |
| 1970 | 1,669 | 197,873 | 7,534 | 35,181 | 242,257 |
| 1971 | 1,526 | 180,945 | 13,769 | 32,361 | 228,601 |
| 1972 | 1,565 | 172,827 | 18,079 | 45,193 | 237,664 |
| 1973 | 1,896 | 253,217 | 19,271 | 53,929 | 328,313 |
| 1974 | 2,149 | 289,202 | 11,136 | 53,711 | 356,198 |
| 1975 | 1,934 | 218,271 | 13,579 | 54,553 | 288,337 |
| 1976 | 2,109 | 276,582 | 23,604 | 55,276 | 357,571 |
| 1977 | 3,142 | 294,641 | 35,320 | 69,473 | 402,576 |
| 1978 | 3,249 | 331,401 | 35,535 | 79,184 | 449,369 |
| 1979 | 2,208 | 285,859 | 59,367 | 65,412 | 412,846 |
| 1980 | 640 | 333,457 | 79,235 | 45,193 | 458,525 |
| 1981 | 800 | 294,292 | 90,206 | 50,421 | 435,719 |
| 1982 | 1,068 | 262,244 | 169,745 | 52,929 | 485,986 |
| 1983 | 2,147 | 299,762 | 319,025 | 56,658 | 677,592 |
| 1984 | 877 | 379,474 | 322,792 | 46,990 | 750,133 |
| 1985 | 1,210 | 250,010 | 293,744 | 55,486 | 600,450 |
| 1986 | 1,468 | 336,695 | 349,795 | 60,861 | 748,819 |
| 1987 | 2,363 | 262,466 | 363,206 | 53,265 | 681,300 |
| 1988 | 1,980 | 301,031 | 488,046 | 48,395 | 839,452 |
| 1989 | 2,580 | 289,706 | 472,376 | 50,508 | 815,170 |
| 1990 | 1,299 | 224,592 | 584,302 | 70,170 | 880,363 |
| 1991 | 1,549 | 282,397 | 755,019 | 67,509 | 1,106,474 |
| 1992 | 1,156 | 226,589 | 721,192 | 88,681 | 1,037,618 |
| 1993 | 1,069 | 270,671 | 569,364 | 74,055 | 915,159 |
| 1994 | 1,519 | 231,385 | 714,132 | 67,364 | 1,014,400 |
| 1995 | 1,415 | 266,736 | 698,570 | 89,398 | 1,056,119 |
| 1996 | 4,699 | 230,576 | 706,335 | 85,381 | 1,026,991 |
| 1997 | 4,819 | 250,685 | 634,417 | 86,527 | 976,448 |
| 1998 | 5,023 | 287,945 | 912,728 | 98,687 | 1,304,383 |
| 1999 | 4,232 | 293,269 | 760,951 | 98,477 | 1,156,929 |
| 2000 | 5,472 | 287,842 | 833,325 | 110,538 | 1,237,177 |
| 2001 | 5,447 | 228,336 | 812,499 | 89,823 | 1,136,105 |
| 2002 | 4,125 | 224,146 | 963,865 | 92,030 | 1,284,166 |
| 2003 | 4,543 | 247,291 | 941,261 | 101,970 | 1,295,065 |
| 2004 | 4,900 | 245,353 | 1,015,517 | 104,482 | 1,370,252 |

| Year | Yellowfin tuna | | | | |
|---|---|---|---|---|---|
| | Longline | Pole-and-line | Purse seine | Other | Total |
| 1950 | 12,844 | 799 | 0 | 8,919 | 22,562 |
| 1951 | 8,862 | 900 | 938 | 10,415 | 21,115 |
| 1952 | 17,453 | 2,595 | 2,565 | 10,539 | 33,152 |
| 1953 | 23,139 | 5,228 | 1,260 | 10,871 | 40,498 |
| 1954 | 22,662 | 4,268 | 4,001 | 11,763 | 42,694 |
| 1955 | 22,800 | 3,983 | 2,944 | 12,633 | 42,360 |
| 1956 | 25,336 | 4,399 | 724 | 12,818 | 43,277 |
| 1957 | 41,911 | 1,669 | 1,496 | 13,481 | 58,557 |
| 1958 | 41,804 | 2,934 | 3,338 | 14,682 | 62,758 |
| 1959 | 42,802 | 4,119 | 4,316 | 15,673 | 66,910 |
| 1960 | 53,617 | 1,872 | 1,438 | 15,919 | 72,846 |
| 1961 | 52,717 | 3,259 | 2,777 | 17,044 | 75,797 |
| 1962 | 58,049 | 4,225 | 6,975 | 18,150 | 87,399 |
| 1963 | 55,673 | 2,071 | 2,277 | 18,676 | 78,697 |
| 1964 | 48,000 | 5,073 | 3,647 | 20,183 | 76,903 |
| 1965 | 49,238 | 3,434 | 3,752 | 20,958 | 77,382 |
| 1966 | 65,973 | 2,192 | 5,844 | 23,409 | 97,418 |
| 1967 | 36,799 | 3,125 | 3,428 | 26,303 | 69,655 |
| 1968 | 47,467 | 2,706 | 7,106 | 26,084 | 83,363 |
| 1969 | 51,939 | 2,714 | 3,857 | 26,609 | 85,119 |
| 1970 | 55,806 | 2,674 | 7,811 | 30,933 | 97,224 |
| 1971 | 57,766 | 2,866 | 9,150 | 32,894 | 102,676 |
| 1972 | 61,175 | 7,465 | 10,002 | 37,506 | 116,148 |
| 1973 | 62,291 | 7,458 | 14,798 | 43,828 | 128,375 |
| 1974 | 58,116 | 6,582 | 17,130 | 49,441 | 131,269 |
| 1975 | 69,462 | 7,801 | 12,893 | 51,029 | 141,185 |
| 1976 | 77,570 | 17,186 | 14,976 | 42,766 | 152,498 |
| 1977 | 94,414 | 15,257 | 15,515 | 58,070 | 183,256 |
| 1978 | 110,329 | 12,767 | 13,292 | 39,401 | 175,789 |
| 1979 | 109,043 | 11,638 | 28,163 | 49,565 | 198,409 |
| 1980 | 122,444 | 13,168 | 31,849 | 47,758 | 215,219 |
| 1981 | 94,665 | 19,269 | 59,463 | 54,082 | 227,479 |
| 1982 | 84,988 | 13,835 | 73,738 | 49,477 | 222,038 |
| 1983 | 86,187 | 13,266 | 105,773 | 53,872 | 259,098 |
| 1984 | 73,036 | 13,558 | 111,474 | 57,537 | 255,605 |
| 1985 | 76,117 | 18,156 | 100,425 | 66,686 | 261,384 |
| 1986 | 65,014 | 13,074 | 105,901 | 69,134 | 253,123 |
| 1987 | 76,695 | 13,243 | 155,400 | 60,659 | 305,997 |
| 1988 | 88,767 | 13,433 | 95,536 | 69,337 | 267,073 |
| 1989 | 68,474 | 15,169 | 159,263 | 73,824 | 316,730 |
| 1990 | 75,522 | 13,103 | 175,432 | 93,998 | 358,055 |
| 1991 | 62,314 | 12,921 | 214,488 | 111,177 | 400,900 |
| 1992 | 73,271 | 15,225 | 252,062 | 79,038 | 419,596 |
| 1993 | 67,173 | 12,698 | 238,477 | 71,183 | 389,531 |
| 1994 | 75,436 | 13,742 | 214,278 | 95,588 | 399,044 |
| 1995 | 81,113 | 15,050 | 184,475 | 97,468 | 378,106 |
| 1996 | 77,827 | 15,492 | 114,011 | 107,390 | 314,720 |
| 1997 | 70,656 | 12,362 | 246,382 | 102,189 | 431,589 |
| 1998 | 68,636 | 13,110 | 263,230 | 122,025 | 467,001 |
| 1999 | 61,384 | 13,817 | 212,185 | 134,007 | 421,393 |
| 2000 | 79,791 | 13,745 | 196,339 | 143,176 | 433,051 |
| 2001 | 75,497 | 12,163 | 210,055 | 129,293 | 427,008 |
| 2002 | 75,290 | 13,357 | 183,902 | 146,315 | 418,864 |
| 2003 | 74,359 | 12,039 | 205,168 | 155,108 | 446,674 |
| 2004 | 71,483 | 11,855 | 171,098 | 158,295 | 412,731 |

| Year | Total tuna | | | | |
|---|---|---|---|---|---|
| | Longline | Pole-and-line | Purse seine | Other | Total |
| 1950 | 47,862 | 47,694 | 0 | 15,402 | 110,958 |
| 1951 | 33,090 | 112,343 | 3,781 | 19,017 | 168,231 |
| 1952 | 64,248 | 125,000 | 7,474 | 20,790 | 217,512 |
| 1953 | 69,792 | 106,095 | 5,288 | 22,406 | 203,581 |
| 1954 | 64,743 | 122,510 | 8,918 | 23,355 | 219,526 |
| 1955 | 68,894 | 124,743 | 6,143 | 25,433 | 225,213 |
| 1956 | 71,913 | 143,559 | 3,777 | 25,969 | 245,218 |
| 1957 | 101,508 | 148,525 | 4,441 | 25,587 | 280,061 |
| 1958 | 115,896 | 160,750 | 14,092 | 30,050 | 320,788 |
| 1959 | 109,259 | 165,518 | 21,293 | 30,593 | 326,663 |
| 1960 | 127,140 | 98,956 | 5,224 | 31,777 | 263,097 |
| 1961 | 121,451 | 150,709 | 14,540 | 35,344 | 322,044 |
| 1962 | 129,538 | 166,141 | 18,875 | 35,900 | 350,454 |
| 1963 | 122,770 | 125,048 | 11,934 | 37,248 | 297,000 |
| 1964 | 103,413 | 167,137 | 29,012 | 41,196 | 340,758 |
| 1965 | 105,983 | 176,158 | 8,621 | 41,567 | 332,329 |
| 1966 | 148,090 | 241,722 | 16,913 | 46,735 | 453,460 |
| 1967 | 127,059 | 205,252 | 14,508 | 51,701 | 398,520 |
| 1968 | 118,992 | 183,982 | 15,143 | 52,281 | 370,398 |
| 1969 | 120,247 | 204,646 | 9,442 | 57,614 | 391,949 |
| 1970 | 139,939 | 226,632 | 16,184 | 69,588 | 452,343 |
| 1971 | 141,937 | 238,162 | 25,360 | 68,806 | 474,265 |
| 1972 | 158,651 | 231,302 | 28,839 | 87,281 | 506,073 |
| 1973 | 166,306 | 323,959 | 35,178 | 103,224 | 628,667 |
| 1974 | 145,133 | 366,385 | 29,580 | 110,140 | 651,238 |
| 1975 | 163,810 | 275,438 | 27,679 | 111,834 | 578,761 |
| 1976 | 197,461 | 376,183 | 40,808 | 103,763 | 718,215 |
| 1977 | 218,127 | 348,608 | 52,706 | 135,161 | 754,602 |
| 1978 | 211,797 | 405,250 | 50,156 | 130,709 | 797,912 |
| 1979 | 211,144 | 345,648 | 89,341 | 124,739 | 770,872 |
| 1980 | 227,212 | 392,523 | 113,144 | 103,155 | 836,034 |
| 1981 | 188,397 | 342,392 | 153,803 | 122,918 | 807,510 |
| 1982 | 177,297 | 309,705 | 249,148 | 122,785 | 858,935 |
| 1983 | 169,875 | 337,080 | 434,131 | 123,836 | 1,064,922 |
| 1984 | 156,608 | 422,837 | 446,321 | 124,497 | 1,150,263 |
| 1985 | 172,643 | 293,838 | 402,036 | 146,172 | 1,014,689 |
| 1986 | 163,988 | 366,813 | 464,537 | 150,058 | 1,145,396 |
| 1987 | 180,216 | 298,117 | 530,977 | 133,024 | 1,142,334 |
| 1988 | 198,814 | 326,101 | 592,599 | 151,762 | 1,269,276 |
| 1989 | 163,659 | 320,381 | 646,040 | 179,445 | 1,309,525 |
| 1990 | 183,905 | 255,857 | 773,688 | 211,975 | 1,425,425 |
| 1991 | 157,166 | 303,886 | 986,296 | 207,293 | 1,654,641 |
| 1992 | 193,449 | 258,611 | 998,062 | 195,200 | 1,645,322 |
| 1993 | 188,306 | 298,618 | 823,511 | 157,964 | 1,468,399 |
| 1994 | 209,457 | 278,669 | 941,212 | 180,959 | 1,610,297 |
| 1995 | 204,534 | 308,705 | 895,811 | 205,587 | 1,614,637 |
| 1996 | 194,573 | 272,588 | 841,745 | 213,235 | 1,522,141 |
| 1997 | 211,591 | 301,721 | 919,572 | 206,866 | 1,639,750 |
| 1998 | 236,225 | 331,347 | 1,201,426 | 241,678 | 2,010,676 |
| 1999 | 205,639 | 364,384 | 1,017,733 | 250,605 | 1,838,361 |
| 2000 | 224,948 | 326,461 | 1,063,771 | 275,604 | 1,890,784 |
| 2001 | 232,813 | 272,157 | 1,051,790 | 239,114 | 1,795,874 |
| 2002 | 252,356 | 289,904 | 1,180,300 | 259,728 | 1,982,288 |
| 2003 | 235,951 | 295,847 | 1,174,504 | 280,271 | 1,986,573 |
| 2004 | 232,331 | 293,814 | 1,220,522 | 285,443 | 2,032,110 |