

International Seafood Sustainability Foundation

STATUS OF THE WORLD FISHERIES FOR TUNA

SECTION D – CONSERVATION AND MANAGEMENT

This section summarizes the institutional arrangements for the management and conservation of tunas in each of the ocean areas covered by the four regional fisheries management organizations (RFMOs), the measures taken for each one of the four principal species of tunas – yellowfin, bigeye, skipjack, and albacore – and the effect of these measures.¹

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¹ This report is based on data available on 15 April 2009

A color code is used to denote the status of the various stocks of tuna and whether there are management programs in effect for those stocks for which management has been recommended by the scientific committees of the corresponding RFMO. Red denotes a stock that is overfished and for which there is no management scheme in effect; orange denotes a stock that is currently below the level at which it can support the MSY, management measures have been recommended, and such measures are in effect; yellow denotes a stock that is at the MSY level; and green denotes a stock that is above the MSY level.

CONSERVATION AND MANAGEMENT

Tunas are like any other renewable resource: the rate at which they are harvested affects their abundance and their ability to sustain various levels of exploitation. As fishing pressure on tuna increases on a global scale, it is essential that mechanisms be implemented to maintain the degree of exploitation at levels that will ensure that the populations of tunas and other large predators are maintained at desired levels of abundance. However, effective management of the tunas and billfishes is complicated by the fact that they are great wanderers, and during the course of their travels pass through waters under the jurisdiction of many different nations as well as on the high seas; therefore, no nation can unilaterally manage tuna in an effective manner. International law calls on states to co-operate, directly or through appropriate international organizations, to ensure the conservation of highly-migratory species. Currently there are five regional fisheries management organizations (RFMOs) responsible for tuna fisheries: the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Indian Ocean Tuna Commission (IOTC), the Western and Central Pacific Fisheries Commission (WCPFC), and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). These bodies have as an objective the maintenance of the populations at or above levels of abundance that can support the maximum sustainable yield (MSY) on a sustained basis.

When discussing MSY, it should be kept in mind that there is no single value for any stock of fish that is static and constant. Fishing effort is generally changing and fish of different sizes are targeted at different times as gear and markets change; the recruitment of young fish to a fishery is variable, responding to natural changes in the environment. Therefore, most fish populations are in a continual state of flux, with an equilibrium condition never really being reached or maintained for any length of time. Hence, values such as MSY are “liquid targets,” and not fixed quantities, and in the discussions presented below, they should always be considered as averages over time. Also, when discussing overfishing, it must be kept in mind that there are two types of biological overfishing: growth overfishing and recruitment overfishing. Growth overfishing results when fishing mortality is directed at smaller fish, and the yield per recruit declines. For example, for a hypothetical stock of tuna, if the average weight of the fish caught during 1985-1995 was 15 kg, and the yield per recruit for that size-specific fishing mortality is 5 kg, then the age-specific fishing mortality is shifted towards smaller fish for a period of years, say 1995-2005, and the average size of fish drops to 5 kg, the yield per recruit would drop to about 2.5 kg. Thus, if the annual recruitment stayed constant at 60 million fish per year, the total annual yield would drop from 300 thousand tons during 1985-1995 to 150 thousand tons during 1995-2005; growth overfishing has taken place. Recruitment overfishing occurs when the spawning stock of a species is reduced to a level that results in a reduction of the number of recruits entering the fishery. For example, for the same hypothetical stock of tuna, if there is a direct correlation between the size of the spawning stock and the number of recruits that stock can produce, and the fishery re-

duces the biomass of the spawning stock by 25 percent, assuming no change in the age-specific mortality, the total annual yield would drop by 25 percent; recruitment overfishing has taken place.

1. THE EASTERN PACIFIC OCEAN

For the purposes of this study, the eastern Pacific Ocean (EPO) is that area of the Pacific Ocean which lies eastward of 150°W longitude. Commercial fishing for tunas began in the region shortly after the turn of the 19th century. By 1950 catches of yellowfin and skipjack reached about 150 thousand tons annually, most of the catch being taken by U.S.-flag pole-and-line vessels. In 1956 the first modern purse-seine vessels entered the fishery, and by 1961 they accounted for most of the catch. With growing fleets, the catch continued to increase, reaching about 800 thousand tons in 2003 (Figure D-1). Due to substantial reductions in the catch of yellowfin, total tuna catches from the EPO declined from the high in 2003 to just under 500 thousand tons in 2007. During 2006-2007 yellowfin accounted for 32 percent of the catch, skipjack for 46 percent, and bigeye for about 19 percent. A wide variety of gear types are used to harvest tuna in the EPO, but purse-seine vessels account for 88 percent of the catch, longline for 11 percent, and other gear for less than 1 percent. In recent years about 20 nations have participated in the harvest of tuna from the EPO. Purse-seine vessels target yellowfin, skipjack and bigeye, and generally employ three styles of fishing: sets on schools of tuna associated with dolphins, sets on schools of tunas associated with floating objects, and sets on unassociated free-swimming schools of tuna. Most of the yellowfin catch from the EPO is taken from schools associated with dolphins, and most of the skipjack and surface-caught bigeye from schools associated with floating objects. Longline vessels target bigeye, yellowfin and a variety of other tuna like fishes, but catch very few skipjack.

1.1. Inter-American Tropical Tuna Commission

The Inter-American Tropical Tuna Commission (IATTC), the oldest of the regional tuna management bodies, was created in 1949 by a Convention between Costa Rica and the United States. The Commission's geographic area of competence is the eastern Pacific Ocean east of 150°W longitude. It is responsible for monitoring the fisheries for tunas, billfishes, tuna-like species, and marine mammals and other species taken by tuna vessels fishing in the EPO, conducting scientific studies of the populations of animals supporting these fisheries, and based on these studies to make recommendations to the governments of the High Contracting Parties, which are designed to maintain the populations of tunas and tuna-like fishes at levels of abundance that can sustain maxim catches year after year. The scientific studies are conducted by an independent scientific staff that works under the direction of a Director, who is appointed by the Commission and serves at its pleasure. The Convention is open to all states whose nationals participate in the fishery for tunas in the EPO; to become a member such state must receive the unanimous approval of all current members of the Commission. There are currently 16 nations that have adhered to the Convention, and six nations that have cooperating party status with the Commission. The Commission's budget is funded by contributions from its members, and contributions are generally in proportion to how much tuna is caught and/or utilized by each member.

Over the years the Commission has initiated programs to manage the fisheries for tunas and other bycatch species, as well as measures to limit fleet capacity. In 1966 the Commission initiated a conservation program to limit the annual catch of yellowfin tuna. This program was the first time any international tuna fishery had been managed any where in the world. Currently there are a few management measures in effect, which will be discussed below. The process that

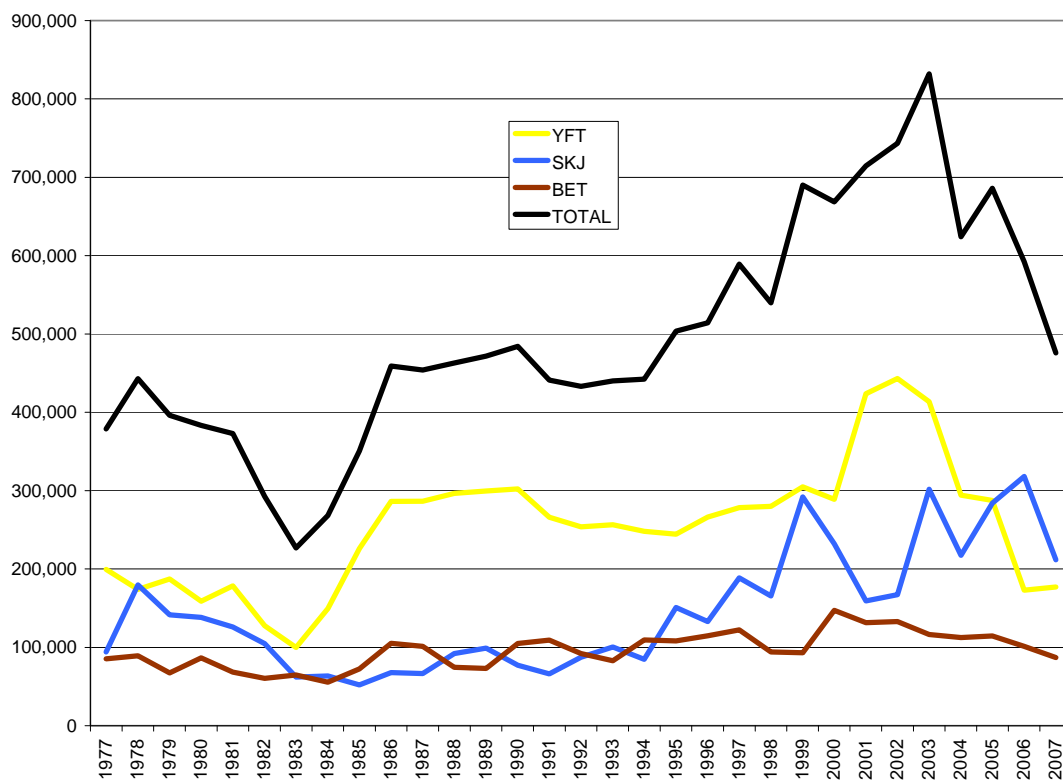


FIGURE D-1. Catches of tuna from the eastern Pacific Ocean, in thousands of tons, 1977-2007.

the Commission utilizes for implementing a management program is as follows. Catch-statistical data on sizes of fish, quantities and locations of catch, and the amount of fishing effort generated to make the catches are collected by the staff of the Commission (such records in the archives of the Commission date back to 1934). To supplement these data, biological information for estimating such things as age, growth, and reproduction are collected and analyzed. All of this information, along with information on various environmental parameters, is used to formulate statistical/mathematical models that can be used to estimate the impact of fishing on the stock being modeled. If the studies indicate that fishing mortality needs to be reduced in order to maintain the populations at levels that can sustain maximum yields the Director formulates conservation recommendations to present to the Commission plenary. The Commission can accept the recommendations, accept them with modifications, or reject them. If the recommendation is to be accepted it must be by unanimous vote of all parties, whether present at voting or not. Cooperating parties may not vote, but can choose to be bound by the decisions of the Commission. The decision is then binding on the members as well as any cooperating party that agrees to be bound by it. It is then the responsibility of each member government to implement national legislation and/or rules to ensure that vessels flying their flag comply with the program. Enforcement has been the responsibility of the flag state regarding its vessels, but compliance is monitored by the Commission.

1.2. Conservation and management

1.2.1. Yellowfin

The stock of yellowfin tuna in the EPO was first placed under management or conservation con-

trols in 1966, when catch quotas were set on the harvest of the stock. In 2002 the Commission moved away from setting catch quotas and established a closed fishing season. Although the closure was implemented primarily to halt overfishing and to rebuild the overfished stock of bigeye, it also served to control effort on yellowfin so as to prevent overfishing of that stock. All purse-seine fishing was prohibited in the EPO between December 1 and December 31, 2002. For 2003 this program was expanded to include a closure to purse-seine fishing for the entire EPO from August 1 to September 11, and a closure for a smaller area off Central America from December 1 to 31.

The Commission approved setting a 6-week closed season to purse-seine fishing throughout the EPO for the years 2004 to 2007. After four plenary meetings of the Commission, the member states could not agree to a conservation program for 2008, and have not agreed to one so far for 2009. During 2008, most of the nations with fleets fishing in the EPO took unilateral measures to implement a closed season to purse-seine fishing. The period of closure, and how the closures were implemented and monitored, varied among countries, but in general, compliance was not good.

The IATTC staff conducted an analysis to estimate what the impact of no restrictions might be on the stock. The population was projected forward 5 years using current levels of fishing mortality. The result of no restrictions on fishing were that SBR would decline to levels slightly lower than they currently are, to about the level corresponding to MSY.

1.2.2. Bigeye

Prior to 1993 most bigeye in the EPO were taken by longline vessels, and the tuna captured were large and near the size at which they could support high yields. When the purse-seine fishery on fish-aggregating devices (FADs) began, large numbers of very small bigeye were captured. Because small bigeye were not previously available for study there was much uncertainty about how they grew, reproduced, and died. Nevertheless there was a great deal of concern expressed by the governments over what the impact of these large catches of small bigeye might be having on the abundance of the bigeye stock. Because of this concern, and notwithstanding this uncertainty, and citing their “commitment to the application of the precautionary approach, which establishes that lack of scientific evidence should not be used as a reason for not taking management measures for fisheries resources,” the member governments of the IATTC recommended measures to control the catch of bigeye in the surface fishery of the EPO during 1998. Because almost all surface-caught bigeye is taken in association with floating objects, the first conservation measures for bigeye stipulated that when the surface catch in 1998 reached 45 thousand tons, all fishing on floating objects within the EPO would be prohibited. In 1998 the surface bigeye catch reached only 35 thousand tons, so the prohibition was not implemented. For 1999 the Commission recommended the same measures for controlling the surface catch of bigeye, except that it reduced the trigger for prohibiting floating-object sets from 45 thousand to 40 thousand tons. The surface catch of bigeye reached 40 thousand tons on 8 November 1999, and the purse-seine fishery was prohibited from setting on floating objects for the rest of the year. This represented the first time that conservation measures had been placed on bigeye in the EPO. The 1999 measures for controlling the catch of bigeye were applied again in 2000, and the purse-seine fishery was prohibited from setting on floating objects in the EPO after 15 September. Because of the mounting concern over the increasing catches of small bigeye, for 2001 the Commission agreed to close the fishery to floating object fishing if and when the catch of bigeye smaller than 60 cm equaled the catch of similar size fish in the 1999 fishery. Since the fishery in

2001 did not exceed the limit, the fishery was not closed.

As was explained above under the discussion on yellowfin, for 2002 the Commission moved away from setting catch quotas and established a closed fishing season. All purse-seine fishing was prohibited in the EPO between December 1 and December 31, 2002, thereby reducing the fishing mortality on bigeye as well as yellowfin. For 2003 this program was expanded to include a closure to purse-seine fishing for the entire EPO from August 1 to September 11, and a closure for a smaller area off Central America from December 1 to 31.

The Commission approved a resolution establishing a 6-week closure of the entire EPO for purse-seine fishing for the years 2004-2007. A nation could choose to restrict its purse-seine vessels during one of two periods, 1 August to 11 September or 20 November to 31 December. Several attempts to implement management measures for 2008 and beyond have failed and there has been no closure to fishing for tunas in the EPO since the end of 2007^{Error! Bookmark not defined.}.

In addition to the conservation and management measures taken for the purse-seine fishery, measures to control the harvest of bigeye by longline vessels fishing in the EPO were also implemented. The first such measures were taken in 2004, and required each member and cooperating non-member (CPC) to take the measures necessary to ensure that its total annual longline catch of bigeye in the EPO did not exceed that taken in 2001. For 2005-2007, the following catch limits for longline vessels were set: China 2,639 tons, Japan 34,076 tons, Korea 12,576 tons and Chinese Taipei 7,953 tons; additionally, catches of longline fleets of other states were not to exceed 500 tons each. There have been no restrictions implemented for longline vessels since the end of 2007^{Error! Bookmark not defined.}.

1.2.3. Skipjack

Skipjack tuna in the EPO are not fully exploited, and increased fishing effort would on the average most likely result in sustained increases in catch. Because the abundance of skipjack in the EPO varies greatly from year to year due to natural changes in abundance and/or catchability, catches show similar variability. Although there is no need for limiting fishing mortality of skipjack, there was nevertheless a reduction in fishing mortality as a result of the controls established for yellowfin and bigeye. The closures which were implemented in 2004-2007 for those two species were also closures for skipjack, since purse-seine vessels are prohibited from fishing in the EPO during the closure. The impact of these closures is a reduction in fishing mortality applied to skipjack and a corresponding decrease in catch. The foregone benefits from the loss of potential skipjack catch should be mitigated somewhat by the benefits the closures provide to the stocks of yellowfin and bigeye.

The status of the stocks of yellowfin, bigeye, and skipjack in the EPO is summarized in Table D-1.

1.3. Limiting fishing capacity

Species	$B_{\text{current}} < B_{\text{MSY}}$	$B_{\text{current}} \approx B_{\text{MSY}}$	$B_{\text{current}} > B_{\text{MSY}}$
Yellowfin		$B_c > B_{\text{MSY}}, F_c > F_{\text{MSY}}$	
Bigeye	$B_c < B_{\text{MSY}}, F_c > F_{\text{MSY}}$		
Skipjack			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$

TABLE D-1. Status of yellowfin, bigeye and skipjack in the EPO, where $B_c = B_{\text{current}}$ the current biomass and $F_c = F_{\text{current}}$ the current fishing mortality rate, and F_{MSY} and B_{MSY} are the corresponding values for levels when the population is at a level corresponding to the MSY.

Because of concern over the rapidly increasing numbers of vessels fishing for tuna in the EPO, the IATTC initiated efforts to introduce mechanisms to limit fleet growth. The first such measures to limit purse-seine fleet capacity were implemented in 1999, at which time the scientific staff estimated that a carrying capacity of about 158 thousand cubic meters of fish-well volume for the purse-seine fleet was adequate to take current levels of catch. Purse-seine capacity limits were assigned to each of the 13 nations involved in the fishery. These limits, which totaled about 180 thousand cubic meters, were in force for only one year, because the governments could not agree to extend them. At the time the limits were introduced the fleet capacity was at about 158 thousand cubic meters. By the end of 2002 capacity had increased to about 200 thousand cubic meters of well volume.

In 2002 the IATTC approved a resolution to limit purse-seine fleet capacity in the EPO. The governments agreed (1) to establish a definitive list of purse-seine vessels authorized by the participants to fish for tunas in the EPO (the Regional Vessel Register, RVR), (2) that any purse-seine vessels fishing for tunas in the EPO that are not on the RVR would be considered to be undermining IATTC management measures, (3) that only vessels flying the flags of participating nations could be entered on the RVR, (4) that carrying capacity would be measured as the volume of a vessel's fish wells, (5) to prohibit the entry of vessels not included in the RVR to the purse-seine fleet operating in the EPO, except to replace vessels removed from the RVR, (6) to make provision for five coastal states bordering the EPO to add vessels to the RVR, with a total combined carrying capacity not to exceed 20 thousand tons, (7) to define a participant as a member of the IATTC, and states and regional economic integration organizations, and fishing entities that have applied for membership or that cooperate in the conservation programs of the Commission.

The clear intent of this capacity limitation program was to fix the number of vessels that are authorized to fish in the EPO at the then current levels, notwithstanding the special provisions for certain coastal states to acquire additional capacity. It was also the intent of the program to allow vessels in the RVR to transfer to any of the other participants, thereby allowing the nation to which the vessels transfers to increase its capacity by the amount of the transferred vessel, but requiring the nation from which the vessel transferred to reduce its capacity by that amount. If a vessel on the RVR is replaced, or its capacity increased, then a vessel of equal capacity, or an amount of capacity equal to the increase in capacity, must be removed from the RVR. In a manner of speaking, if implemented as initially intended, the RVR would create a market for trading capacity. A person or a nation desirous of increasing capacity can offer to purchase vessels listed on the RVR. When purchased, the vessel, which would remain on the RVR, along with its capacity, would go to the purchaser. Theoretically, once the RVR was established through political negotiation, any transfers of vessels among nations would result from market forces.

Since the inception of the RVR system there has been disagreement among the participants with respect to the initial intent of the resolution regarding transferability. Although this provision for transfer is not abundantly clear in the resolution, it was clarified in a document presented during 2003 by the Director of the IATTC: "The Secretariat's understanding of how the Resolution was intended to work with respect to transfers was to allow vessels on the Register to simply transfer flag from one participant to another. The participant the vessel was transferring from would not be able to replace the vessel, and there would be no restrictions on any participant being able to receive the transferring vessel."

Because of the confusion over whether there is transferability among the participants, several

vessels were dropped from the RVR by their flag states. When they are dropped from the RVR by the flag state they are leaving, the owners are informed that the vessels could not be authorized to fish by the flag they are transferring to unless that flag had unused capacity. Unless some arrangement by the participants was made to increase capacity, the vessel would be declared to be engaged in illegal, unregulated and unreported (IUU) fishing. There are vessels that have fallen into this situation. In some cases the participating governments agreed to increase the capacity limits for the states to which the vessels were transferring, and to allow the states from which they transferred to retain the capacity quotas for the departed vessels. This, of course, has resulted in the total capacity limited being increased, exacerbating an already serious overcapacity problem.

In a recent document, the Commission staff has attempted to clarify these apparently confusing issues. The document states that the capacity management system does not establish national capacity allocations or limits; instead, fleet limitations are essentially determined by the RVR. It goes on to state that, therefore, the key elements of the Resolution address how vessels may be added to or removed from the RVR. It has now been made clear that transferability of vessels is allowed under the system, but in order to transfer, a vessel must have the authorization of both the flag state from which it is exiting the register and the flag state to which it is entering on the register. A flag state cannot receive a vessel if it does not have capacity equal to the amount of the transferring vessel on the RVR, or if the state from which the vessel is leaving does not relinquish an equivalent capacity to the receiving state.

When the Resolution was approved in 2002 fleet capacity was 218 thousand cubic meters; it is currently 229 thousand cubic meters, an increase of more than 5 percent, and about 45 percent greater than the optimum fleet size of 158 thousand cubic meters determined by the staff. There has been no action to reduce capacity to the recommended level of 158 thousand tons.

1.4. Effectiveness of the conservation and management measures in reducing fishing mortality

The conservation program established for 2004-2007 implemented a 6-week closure in each year to purse-seine fishing, and limits on the catch of bigeye by longline vessels. The rationale behind the closures was that this would reduce the overall fishing effort and fishing mortality on both bigeye and yellowfin. Similarly, the rationale for the bigeye catch quotas for longliners was to reduce the catch and hence the fishing mortality of that species. The staff of the Commission investigated the effectiveness of the management measures by looking at the changes in purse-seine fishing effort and the longline catches of bigeye before and after the regulations were implemented, and by conducting simulation studies to examine what the catches and effort would have been had the conservation measures not been implemented.

The analysis by the scientists of the Commission compares the number of days fished during 2004-2006 with the number of days fished during 2003, before the implementation of the closures for purse-seine vessels. The analysis suggests that the closures for purse-seine fishing did not have as much of an impact on reducing fishing effort as anticipated. This is not too surprising when one considers that the strategy of the fishermen would be to undertake normal annual repairs during the closures, and reduce normal turnaround times during the open season in order to make up for lost fishing time during the closure. Additionally, contributing to this increased fishing effort is the fact that the capacity of the purse-seine fleet increased by about 11 percent between the beginning of 2003 and the end of 2006.

The simulation studies show a slightly better story regarding the positive effects of the closures. For example, if the closures had not been implemented, the spawning biomass of bigeye would have decreased by about 35 percent by the end of 2006, and that of yellowfin by about 15 percent. Correspondingly, without restrictions the catch of bigeye by purse-seine vessels would have been about 13 percent greater during 2004-2006, and that for longliners about 39 percent greater. The corresponding figures for yellowfin would have been about 6 percent and 26 percent, respectively. The IATTC scientists caution that the simulation probably overestimates the effect of the management measures, and note that growth in capacity, together with other adaptations to the closures, is constraining the effect of the management measures.

The staff makes conservation recommendations to the Commission each year at its Annual Meetings. The staff's recommendations for yellowfin, which were presented to the Commission during its October 2007 meeting, are:

- Examine means to reduce the capacity of the purse-seine fleet toward the target of 158,000 cubic meters as soon as possible.
- Establish, for purse-seine vessels, a 12-week closure in the entire EPO from 20 June through 11 September, and a closure of an offshore area from 12 September through 31 December. Set catch levels for longline vessels of 2.2, 28.3, 10.4, and 6.6 thousand tons for China, Japan, Korea, and Chinese Taipei, respectively.
- Require vessels using FADs to mark them in accordance with a Commission program, and provide the information to the Commission staff.
- Continue the program to limit current fishing mortality to 2002-2004 levels, and CPCs to report all catches and effort every six months.

As already noted, neither these recommendations nor any other conservation recommendations were implemented in 2008.

1.5. Compliance and enforcement

The 1949 Convention establishing the IATTC is silent on the issue of compliance and enforcement, but that fact has not kept the governments from treating the issue with respect to their conservation and management initiatives.

To facilitate their efforts to ensure compliance with the conservation programs, the member governments of the IATTC approved a resolution in 1999 which established a permanent working group on compliance with conservation and management measures adopted by the IATTC. The functions of the working group are to review and monitor compliance with the conservation and management measures, recommend means of promoting compliance, including infractions and sanctions, and inform the IATTC of its work. In carrying out its work, the group is provided information by port states, flag states, IATTC observers, and any other relevant source, on the activities of vessels suspected of contravening the conservation and management measures. When a possible infraction is identified by the working group that information is passed on to the Commission, which in turn advises the member states and notifies the flag state of the alleged infraction and requests a response as to what actions are taken by the flag state. The working group is comprised of representatives of each of the Parties, and because representatives of non-parties, industry and non-governmental organizations (NGOs) may participate as observers in the activities of the working group, its deliberations are transparent.

To carry out its mandate to adopt trade restrictive measures, the IATTC approved resolutions in 2004 and 2006 to establish 1) a list of vessels presumed to have carried out IUU fishing in the EPO, and 2) specifications for the adoption of trade measures to promote compliance. With respect to 1), the resolution allows for the presumption that a vessel has carried out IUU fishing if there is evidence that it has carried out any of nine fishing activities listed in the resolution as IUU fishing. The Director of the IATTC is required to include all such vessels in a list which he distributes to all CPCs and non-parties. Governments are requested to take a series of actions against IUU vessels and their flag state designed to deter IUU fishing, including *inter alia*, denial of port privileges and prohibition of commercial transactions, imports, landings and/or transshipments of species covered by the IATTC Convention from vessels on the IUU list. With respect to 2), the resolution on the adoption of trade measures lays out a series of steps to be taken by the Commission, through its working group on compliance and its joint IATTC/AIDCP working group on fishing by non-parties, to identify CPCs and non-parties that fail to comply with the conservation and management measures. After such parties are identified, they are contacted by the Commission and requested to comply with the program. Failing compliance, there are a series of actions that can be taken against the non-complying party, including the imposition of non-discriminatory trade restrictive measures.

The IUU vessel list is posted on the IATTC website and to date, two purse-seine vessels and 22 longline vessels have been identified as IUU vessels. The various notifications to governments have been distributed, but to date no punitive actions have been taken. There are 11 longline vessels flying the Indonesian flag on the IUU list, and 11 of unknown nationality.

In contrast to the 1949 Convention, the Antigua Convention, which will replace the 1949 Convention in August 2010, specifically addresses in Article XVIII the issues of compliance and en-

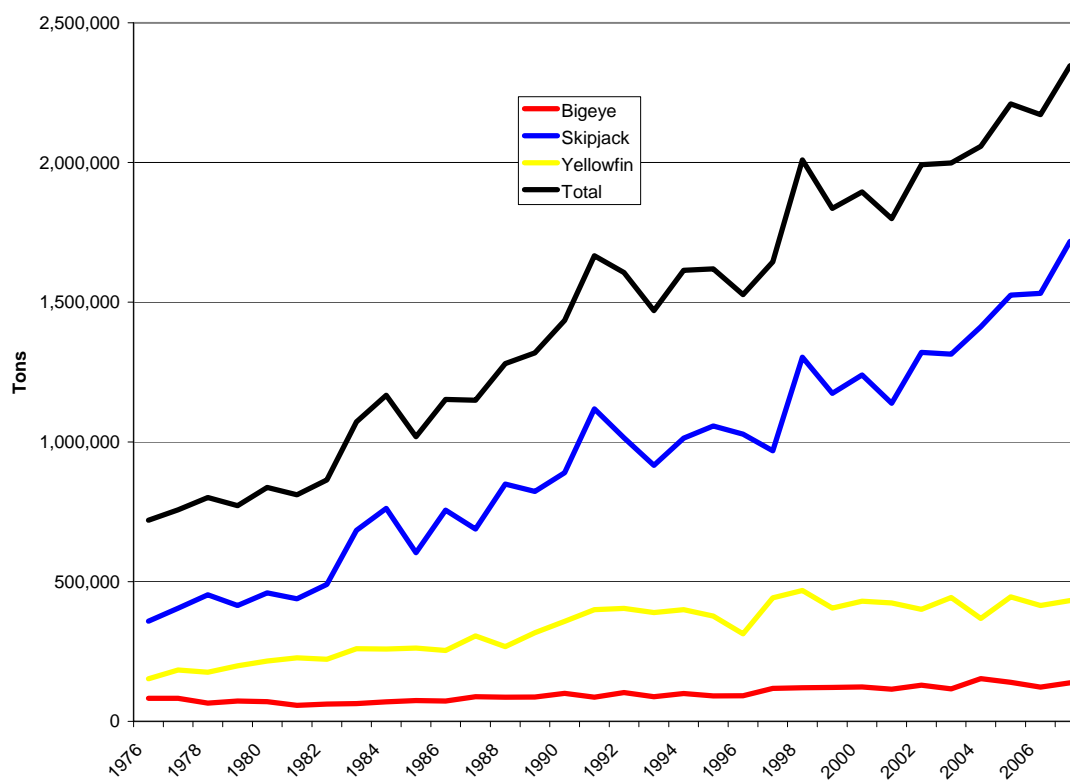


FIGURE D-2. Catches of tuna from the WCPO, 1976-2006

forcement. The article goes into great detail respecting the duties and obligations of members respecting these issues, and calls on them to apply appropriate sanctions against nations that contravene IATTC measures for conservation and management of the tuna resources of the EPO..

2. WESTERN AND CENTRAL PACIFIC OCEAN

The western and central Pacific Ocean (WCPO) is generally considered to be the area bounded to the east by 150°W and to the west by the continent of Asia, the eastern shore of Indonesia, the Malaysian Peninsula, and eastern shore of Australia

As would be expected, based on its enormous size, the WCPO supports the largest tuna fishery of the world (Figure D-2). In 2007 approximately 2,358 thousand tons of tuna were caught from the WCPO, which represents slightly 56 percent of the world production, and about 77 percent of the total catch of tuna from the Pacific Ocean. Of this amount, skipjack accounted for 1,727 thousand tons (73 percent), yellowfin 432 thousand tons (18 percent), bigeye 140 thousand tons (6 percent), and albacore 59 thousand tons (3 percent).

A wide variety of fishing gear is used to harvest tuna in the western Pacific, including purse-seine, pole-and-line, longline, handline, troll, ring-nets, and gill-nets. Purse-seine vessels account for about 72 percent of the total catch, followed by longline with 11 percent, pole-and-line 10 percent, and a variety of other gears at about 7 percent.

These percentages have shifted remarkably since the advent of the fishery. Prior to 1984 pole-and-line fishing took the greatest portion of the catch and in 1984 peaked at slightly less than 400 thousand tons, whereas currently this gear accounts for about half that amount. At about this time, purse-seine vessels began fishing in increasingly greater numbers in the western Pacific, and have dominated the catch since then.

Almost 30 nations harvest tuna from the WCPO, but 6 account for about 80 percent of the catch. These are, in order of capture, Japan, the Philippines, Indonesia, Chinese Taipei, Korea, and Papua New Guinea (PNG). The U.S. fleet had been among the leading producers in the area, but due to a recent reduction in fishing effort its catch has declined significantly.

When fishing in the WCPO, purse seiners usually make two general types of sets, associated and unassociated. Unassociated sets, which account for about 60 percent of all sets, are made on free-swimming schools of fish, while associated sets, which account for about 40 percent of all sets, are made on schools of fish that are associated with drifting objects such as logs, floating and anchored FADs, and animals such as large sharks and whales. Many of the sets are made on mixed schools of skipjack, yellowfin, and bigeye.

2.1. The western and central Pacific fisheries organizations

There are several arrangements and institutions that deal with the tuna fisheries of the WCPO. Some of these are based on formal international treaties and others on informal agreements among governments. The Western and Central Pacific Fisheries Commission has primary responsibility for managing the tuna and tuna like species in the region, but because several other arrangements impact the fisheries they are discussed under this section.

2.1.1. The Secretariat of the Pacific Community

One of the longest standing arrangements dealing with tuna in the WCPO is the program established by the former South Pacific Commission, now called the Secretariat of the Pacific Community (SPC). The initial work of the tuna program, which was named the Skipjack Survey and

Assessment Program (SSAP), was to collect catch statistical and biological information on the tuna fisheries of the WCPO. During the early 1970s the SSAP undertook an extensive tagging program to learn more about the skipjack and yellowfin in the region. A major result of this program was an estimate of biomass for skipjack that showed an unexpectedly enormous population in the area. These results were important in the developments that led to the present fishery. The SSAP was eventually replaced by the Tuna and Billfish Assessment Program (TABP), whose responsibilities were to provide information on the tunas and billfishes to the member governments of the SPC. In 1988 the Standing Committee on Tuna and Billfish (SCTB) was created to provide advice to the TABP. The SCTB was open to scientists from any of the SPC members. The TABP was eventually replaced by the Oceanic Fisheries Program (OFP) of the SPC, whose responsibilities were to “provide member countries with the scientific information and advice necessary to rationally manage fisheries exploiting the region’s resources of tuna, billfish and related species,” and the SCTB continued to serve the same function to the OFP as it did to the TABP. Among the many duties of the OFP is the maintenance of a list of vessels that fish in the region. The list is compiled from information provided by member governments, and supplemented with data collected by the staff of the OFP. The OFP, with support from the SCTB, has done an excellent job of providing scientific information to the member countries of the SPC.

2.1.2. The Forum Fisheries Agency

The Forum Fisheries Agency (FFA) was created in 1979 in response to the ongoing negotiations to create a United Nations Convention on the Law of the Sea and the certainty that the Convention would formalize into international law an Exclusive Economic Zone (EEZ) of 200 nautical miles. Recognizing that this extension of jurisdiction would result in most of the tuna resources of the WCPO falling within the EEZs of Pacific island states, the 16 member governments of the Pacific Forum created the FFA to harmonize the exercise of jurisdiction by the Pacific island states within their EEZs. The main focus of interest of the FFA was on the tuna resources of the region; its principal activities deal with licensing arrangements for vessels to fish within the EEZs of Pacific Island states, and developing monitoring and enforcement capabilities. The FFA maintains a regional register of foreign fishing vessels that are eligible to apply for access licenses for fishing in the EEZs of the FFA members. To be on the list, vessels must meet a series of criteria set down by the FFA, including a willingness to participate in a vessel monitoring system (VMS), which involves the use of an electronic positioning device that reports the location of the vessel, via satellite to the FFA. A vessel not on the list would not be permitted to fish in the area. A vessel can be on the register but not licensed to fish. Any vessel that has been found to be engaged in illegal, unregulated, and unreported (IUU) fishing with respect to the EEZ of any FFA member country is blacklisted, and cannot obtain an access agreement.

2.1.3. The Nauru Agreement

The Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest, which entered into force in 1982, has the objective of coordinating and harmonizing the management of fisheries with regard to common stocks within the EEZs of the contracting Parties. The Parties to the Nauru Agreement (PNA) agreed to establish guidelines for granting priority to fishing vessels of the parties, over non-party vessels, to fish within the EEZs of the parties, and to establish a coordinated approach to fishing by foreign vessels within their EEZs by the establishment of uniform terms and conditions under which the Parties may license such foreign fishing vessels. The FFA provides much of the advisory, administrative, and secretariat support for the Agreement.

2.1.4. The Palau Arrangement

The Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery (the Palau Arrangement) was created in 1992 by the PNA in response to a growing fleet of purse-seine vessels in the WCPO and the desire of Pacific Island states to develop domestic purse-seine fleets.

It was the intention of the drafters of the Arrangement to set a cap on the amount of fishing effort generated by large purse-seine vessels fishing in the EEZs of the PNA by limiting to 205 the number of purse-seine vessels that could be licensed to fish within their EEZs. Because more than 80 percent of the tunas taken in the WCPO are taken in the EEZs of the PNA, the 205-vessel cap could have a significant impact on the successful operation of any purse-seine vessel not included in the 205 limit and therefore restricted to fish on the high seas in the equatorial western Pacific fishery for tunas.

2.1.5. The Federated States of Micronesia Arrangement

The Federated States of Micronesia Arrangement (FSM Arrangement) was created to promote the development of domestic purse-seine fisheries within the region of the PNA. Eligible vessels, defined as those that have met certain criteria such as level of investment, employment of national crew members, utilization of ports of landings of PNA, would be allowed to obtain preferential access to the EEZ of more than one PNA. The FFA is responsible for the centralized administration of the Arrangement.

2.1.6. The multilateral treaty with the United States

In 1988 the United States government signed a treaty with 16 Pacific island states that provided access for 50 U.S.-flag purse-seine vessels plus 5 joint-venture vessels to fish for tuna in the EEZs of those states. In 2003 this was changed to 40 U.S. flag vessels and 5 joint-venture vessels. The number of U.S. vessels fishing under this agreement has been declining, and in 2005 only 15 operated, but since that date has been increasing.

2.1.7. The Western and Central Pacific Fisheries Commission

As already mentioned, the tuna fishery of the western and central Pacific Ocean (WCPO) is the greatest in the world, accounting for nearly 55 percent of the world catches of the principal market species of tunas, and the single largest purse-seine fishery is prosecuted there. Less than 20 percent of the catch in the WCPO is taken on the high seas, so the coastal and island states control access to most of the catch in the region. This potentially has a large impact on how management arrangements will be formulated. Nevertheless, the tuna resources are highly migratory, and the principles defined in Article 64 of the United Nations Law of the Sea Convention (LOSC) and the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stocks Agreement) apply with respect to cooperation among nations, and with management requirements throughout the range of the species. In response to the mandates of these international instruments, the nations with interest in the tuna and tuna-like resources of the WCPO, through a series of multilateral high-level conferences initiated by the FFA, drafted a convention dealing with the conservation and management of highly migratory fish stocks in the WCPO. The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Western and Central Pacific Fisheries Convention) was subsequently signed, ratified, and entered into force on 19 June, 2004. The Convention established the Western and Cen-

tral Pacific Fisheries Commission (WCPFC), whose inaugural session was held in December 2004. The convention is responsive to the need for managing and conserving the fish stocks falling within its area of competence. Article 2 of the Convention notes that the objective is to ensure, through effective management, the long-term conservation and sustainable use of the stocks of fish covered by the Convention. Article 5 states that the Commission members “shall” adopt measures to ensure the stocks are maintained at levels capable of producing maximum sustainable yield, including measures to prevent or eliminate excess fishing capacity. Article 10(g) states that the Commission shall develop criteria for allocating the allowable catch or the total level of fishing effort. It is clear that the Convention provides the legal authority for the Commission to deal with all aspects of conservation and management. Because of differences over how tunas should be managed in the northern portions of the WCPO, particularly around Japan, a Northern Committee was established for dealing with management and conservation issues to the north of 20° North. The Northern Committee will refer any conservation recommendations to the Plenary where they will be considered. The WCPFC format for conducting scientific studies is different than that of the IATTC, which has an independent staff. The WCPFC conducts its science through a Scientific Committee (SC) and a Technical and Compliance Committee (TCC). Membership in these committees is open to all CPC and other qualified persons. The WCPFC currently includes 28 members, 5 cooperating non-member, and 7 participating territories. The SC meets at least once a year and utilizes a number of special working groups to conduct various aspects of their investigations. Scientists of the OFP of the SPC are responsible for leading much of the scientific research utilized by the Committees. The SC is required to work closely with the IATTC, particularly in areas of overlap, and with the International Scientific Committee (ISC), which has certain responsibilities for scientific investigation of highly migratory species in the north Pacific area.

2.2. Conservation and management

2.2.1. Yellowfin

The WCPFC utilizes two mechanisms for addressing the issue of conservation and management measures: 1) Resolutions, which are non-binding statements and recommendations addressed to members and cooperating non-members; and 2) Conservation and Management measures (CMMs), which are binding decisions relating to conservation and management measures.

In order to monitor the number of vessels fishing in the convention waters of the WCPFC, CMM 2004-01 requires each Commission member, cooperating non-member and participating territory (CCM) to submit to the Executive Director, by 1 July 2005, particular information, including vessel specifications and call letters and signs, with respect to each vessel listed in its national record of fishing vessels entitled to fly its flag and authorized to fish in the Convention Area beyond its area of national jurisdiction. From 1 July 2005, each CCM is required to notify the Executive Director within 15 days, or in any case within 72 hours before commencement of fishing activities in the Convention Area of: 1) any vessel added to its Record along with vessels specifications; 2) any change in the vessel specification information with respect to any vessel on its Record; and 3) any vessel deleted from its Record along with the reason for such deletion.

Resolution 2007-01 set up a regional observer program, with national and sub-regional programs coordinated by the Secretariat. The Secretariat was to achieve a 5% coverage by 2012 for its own program, in addition to coverage by members, but this was changed by CMM 2008-01 to 20% in 2009 and 100% in 2010 (see below).

At the second session of the Commission, held in December 2005, CMM 2005-01 on the Conservation and Management Measures for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean was approved, and in December 2008 was replaced by CMM 2008-01. The objectives of CMM 2008-01 are to: 1) ensure that bigeye and yellowfin tuna stocks are maintained at levels capable of producing their maximum sustainable yield and to achieve, through the implementation of a package of measures, over a three-year period commencing in 2009, a minimum 30% reduction in bigeye tuna fishing mortality from the annual average during the 2001-2004 period or 2004; 2) ensure that there is no increase in fishing mortality for yellowfin tuna beyond the annual average during the 2001-2004 period or 2004. For the purse-seine fishery, the provisions of the CMM apply to the Convention Area bounded by 20°N and 20°S. CCM are called on to ensure that the effectiveness of these measures for the purse-seine fishery are not undermined by a transfer of effort in days fished into areas within the Convention Area north and south of 20°S. For the members of the FFA who are Parties to the Nauru Agreement, the measures are to be implemented through their domestic processes and legislation, including the vessel day scheme (VDS) which limits total days fished in the EEZs of such Parties to no greater than 2004 levels.

Additionally the purse-seine fishery in EEZs in the area bounded by 20°N and 20°S will be closed to fishing on FADs between 1 August and 30 September, during which time all purse-seine vessels without an observer from the Regional Observer Program on board are required to cease fishing and return to port. Similar measures are called for on the high seas.

As an alternative to the high seas FAD closure, Members are allowed to adopt measures to reduce their catch by weight of bigeye tuna in the purse-seine fishery by a minimum of 10 percent relative to 2001-2004 average levels.

CMM 08-01 calls on the Commission to consider in 2009 the development of a high-seas vessel day scheme (HS VDS) compatible with the PNA VDS, to provide a common currency for managing the purse-seine fishery, with adoption at its annual session in 2010, and to make efforts to ensure that reductions in fishing effort on the high seas and in adjacent EEZs are compatible. The portion of the high seas beyond the EEZs of the surrounding nations but within the area bounded by 10°N and 10°S, 135°E and 179°E (termed the ‘doughnut hole’) will be closed to fishing effective 1 January 2010 unless the Commission decides otherwise at its 6th annual meeting in December 2009. At this meeting the Commission will also consider the closure of all high seas ‘pockets’ in the Convention Area between 20°N and 20°S.

CMM 2008-01 also calls on CCMs fishing on the high seas to submit, by 1 July 2009, management plans for the use of FADs by their vessels on the high seas. These plans are to include strategies to limit the capture of small bigeye and yellowfin tuna associated with FADs. The Secretariat will prepare a report on additional FAD management options for consideration by the Scientific Committee, the Technical and Compliance Committee, and the Commission in 2009, including:

- a. Marking and identification of FADs;
- b. Electronic monitoring of FADs;
- c. Registration and reporting of position information from FAD-associated buoys; and
- d. Limits on the number of FADs deployed or the number of FAD sets made.

The CMM also calls on the Commission to work with industry and with other countries to de-

velop and implement a 3-year program to explore methods to reduce catches of juvenile bigeye and yellowfin tuna caught in association with FADs.

To create a disincentive to the capture of small fish and to encourage the development of technologies and fishing strategies designed to avoid the capture of small bigeye and yellowfin tuna, CCMs shall require their purse-seine vessels fishing in EEZs and on the high seas to retain on board and then land or transship at port all bigeye, skipjack and yellowfin tuna, excepting when in the final set of a trip, there is insufficient well space to accommodate all fish, the fish are unfit for human consumption for reasons other than size; or when serious malfunction of equipment occurs.

Purse-seine vessels fishing within the area bounded by 20°N and 20°S on the high seas and the EEZ of one or more coastal States are required, effective 1 January 2010, to carry an observer from the Commission's Regional Observer Program, and during 2009 observer coverage for such vessels should be 20 percent.

Developing purse-seine fisheries for skipjack between 20°N and 20°S that can provide verifiable evidence of minimal yellowfin and bigeye bycatch (cumulative <2%), with 100% observer coverage, and with a legitimate development plan, are exempted from these measures.

The total catch of bigeye tuna by longline fishing gear is subject to a phased reduction such that by 1 January 2012 the longline catch of bigeye tuna is 70% of the average annual catch in 2001-2004 or 2004, and the catch of yellowfin tuna is not to be increased from the 2001-2004 levels. This measure does not apply to members and participating territories that caught less than 2,000 tons in 2004. Each CCM that caught an average of more than 2,000 tons of bigeye shall be subject to a 10% reduction of the catch in 2009, a 20% reduction of the catch in 2010, and in 2011 a 30% reduction of the catch. Small island developing State members and participating territories in the Convention Area undertaking responsible development of their domestic fisheries are exempt from these limits, as are some fleets landing exclusively fresh fish.

The catch limit for China for 2009 and 2010 will remain at 2004 levels, pending agreement being reached to develop an arrangement for the attribution of Chinese catch taken as part of domestic fisheries in the EEZs of Pacific Island Countries.

With respect to monitoring and control a number of provisions are included in the CMM:

- More timely and detailed provision of data by CCMs.
- The Executive Director is mandated to present a report on measuring and monitoring fishing capacity in the WCPO for consideration at the Fifth Regular Session of the Technical and Compliance Committee.
- Each CCM shall prohibit landings, transshipment and commercial transactions in tuna and tuna products that are positively identified as originating from fishing activities that contravene any element of the Commission's CMMs, and routine monitoring is to be conducted at landing and transshipment ports to assess catch by species.

With respect to Vessel Monitoring Systems (VMS), the WCPFC will require, on 1 April 2009, all vessels greater than 24 meters in length fishing on the high seas in the Convention Area to have an activated automatic location communicator (ALC) and participate in a Commission VMS program. The Commission's Pacific VMS program will reside on the same shoreside platform at the MacQuarie Data Center in Sydney, Australia, as the FFA VMS program, but both will be independently operated and their data secure. By utilizing existing FFA infrastructure

and software, WCPFC will save significantly in infrastructure set-up costs. As with the other Commissions, a set of minimum standards for ALCs has been defined, and all ALCs must be tamper-proof and operating at all times. Whereas for most other RFMOs the flag state is responsible for the VMS systems and for sending data to the Commissions, for the WCPFC VMS, the MacQuarie Data Center sends reports on the activities of the vessels directly to the Commission. The program is essentially of the Commission and not of the member states. The Executive Director of WCPFC has indicated there could be about 600 vessels that will be required to report to its VMS, and that the Commission will be paying for transmission costs. Depending on the communication service provider selected (Argos, Iridium, Inmarsat, *etc.*) costs are estimated to be around US\$14.50/month, based on 4 hourly reporting, in addition to USD \$15/month charge for the FFA service. In total costs will be about \$30/month/vessel. Costs for the other Commissions should be similar if they able to tie into an already existing system. There will be a great deal of cooperation between the FFA and WCPFC programs. Vessels currently reporting their in-zone operations to FFA will be able to continue such reporting and their data for the high-seas operations will be transferred to the WCPFC data base. Any coastal state may elect to nominate its EEZ for inclusion in the WCPFC's program.

2.2.2. Bigeye

The discussions on conservation and management for yellowfin presented above also apply to bigeye. Scientists estimate that a reduction of about 30 percent in fishing mortality would be needed to maintain the biomass at the MSY level (F/F_{MSY} ratio of 1.0), and suggested that if fishing mortality stays at current levels, the biomass will decline to below the MSY level by 2013.

2.2.3. Skipjack

Skipjack tuna in the WCPO are not fully exploited and increased fishing effort would on the average result in a proportional increase in catch. Although there is no need for limiting fishing mortality on skipjack, there would likely be a reduction in catch as a result of the limits on fishing effort called for in the CMM.

The status of yellowfin, bigeye, and skipjack in the WCPO is summarized in Table D-2.

2.3. Limiting fishing capacity

Since the expansion of distant-water purse-seine tuna fishing vessels into the WCPO in the late 1970s and the extension of jurisdiction to 200 nautical miles, the states of the Pacific island region have been concerned about the management of fishing fleets in their region. This concern contributed to the formation of the FFA in 1979. The creation of a regional register of foreign fishing vessels within the FFA provided a mechanism to monitor and theoretically control, through the sale of licenses, the number of purse-seine vessels authorized to fish in the region. Though the register did not effectively limit the number of vessels operating there, it did provide a mechanism to monitor the numbers that could fish in the region. Because of growing concern

Species	$B_{current} < B_{MSY}$	$B_{current} \approx B_{MSY}$	$B_{current} > B_{MSY}$
Yellowfin		$B_c > B_{MSY}, F_c > F_{MSY}$	
Bigeye		$B_c > B_{MSY}, F_c > F_{MSY}$	
Skipjack			$B_c > B_{MSY}, F_c < F_{MSY}$

TABLE D-2. Status of yellowfin, bigeye and skipjack in the WCPO. $B_c = B_{current}$ the current biomass, $F_c = F_{current}$ the current fishing mortality rate, and F_{MSY} and B_{MSY} are the corresponding values for levels when the population is at a level corresponding to the MSY.

over the rapidly expanding number of purse-seine vessels operating in the region of the Pacific islands the PNA implemented the Palau Arrangement in 1992, which set a limit of 205 vessels that would be allowed to purchase licenses to fish within the EEZs of the PNA. About 80 percent of the purse-seine catch from the WCPO is taken within the waters of the PNA. The number of vessels fishing in the area between 20° north and south of the equator has not exceeded this limit of 205.

During the seven sessions of the Multilateral High-Level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (MHLC), and the six sessions of the Preparatory Conferences (PrepCon) a great deal of attention was paid to the issue of fishing capacity. At the 3rd PrepCon a resolution was adopted that urged all states and other entities to exercise reasonable restraint in respect of any expansion of fishing capacity in the area of the Convention establishing the WCPFC. The Convention, which was adopted on 4 September 2000 and signed on 5 September 2000, and which entered into force on 19 January 2004, is explicit in providing a mandate and authority to the new body to control fishing capacity in the Convention waters when necessary. Article 5(a) of the Convention notes that the new Commission shall “take measures to prevent or eliminate ... excess fishing capacity,” Article 10(g) states that the Commission shall develop “criteria for the allocation of the total allowable catch or the total level of fishing effort,” and Article 10, 2(c) states that the Commission may adopt measures for “limitations of fishing capacity.” It is clear that the convention establishing the WCPFC provides the legal authority for the organization to deal with the problem of excess fishing capacity. Since its inception, the WCPFC has taken various actions regarding the conservation and management of tunas under its mandate, including recommendations regarding fishing capacity.

During the 2nd session of the Commission a resolution on reduction of overcapacity was approved. This resolution requires CCMs whose nationals are beneficial owners of purse-seine vessels that entered the WCPFC convention area after the 1999 MHLC to exercise reasonable restraint in respect of any expansion of fishing capacity in the WCPFC convention area, and urges them to work together to ensure that the beneficial owners reduce by 31 December 2007, such overcapacity as created by those fishing vessels through reduction of equivalent fishing capacity of other fishing vessels operating in the Convention Area. The resolution applies only to capacity increases in the 1999-2005 period. At the December 2006 meeting of the WCPFC the CCM agreed to continued support of the provisions of the earlier resolutions and to take necessary measures to ensure that the total capacity of their respective other commercial tuna fisheries for bigeye and yellowfin tuna, including purse-seining that occurs between 20°N and 20°S does not exceed the average level for 2001-2004 or 2004.

In 2000 pursuant to the Palau Arrangement for the management of purse-seine fishing mortality in the WCPO the PNA developed the framework for a management scheme to enhance the management of purse-seine fishing vessel effort in the waters of the PNA by encouraging collaboration between all the parties, to promoting optimal utilization and conservation of the tuna resources of the region, to strive to maximize economic returns, to support the development of domestic locally-based purse-seine fishing industries, and to promote effective and efficient administration, management, and compliance pertaining to the tuna resources of the region. The management scheme establishes a vessel day scheme (VDS), which places limits on the total numbers of fishing days or total allowable effort (TAE) that is permitted in the waters under the jurisdiction of the PNA. The TAE is set by the PNA on the basis of the best scientific, economic and management information and advice. The TAE is partitioned among the PNA (party allow-

able effort, or PAE) based on the assessed relative 10-year average biomass of skipjack in the waters of the parties (50 percent) with the remaining 50 percent being based on the 7-year average annual distribution of the number of vessel days fished in the waters of the parties. Each party would then be free to use its PAE as it wished, either for its own vessels or for licensing foreign-flag vessels.

Prior to the allocation of the TAE among the parties, an amount of fishing days would be set aside for the vessels fishing under the FSM arrangement and an amount for the vessels fishing under the U.S. treaty. These two amounts would be calculated on the basis of the average number of days fished by each of the two fleets over a 7-year period, using the most recent data available.

The VDS does not directly limit fishing capacity or the number of vessels authorized to fish, but because the number of allowable fishing days is limited this could affect how many vessels might fish. Once the VDS is fully implemented the 205 vessel limit established by the Palau Agreement will be lifted. The VDS was, in fact, implemented on December 1, 2007.

The VDS attempts to control the amount of fishing mortality in the purse-seine fishery at sustainable levels, to maximize revenues from the sale of access permits, and to facilitate the opportunity for coastal states to acquire fishing vessels; it does not directly attempt to limit the number of vessels authorized to fish in the region, and since it applies only within the EEZs of the PNA, it leaves open the opportunity for increased capacity on the high seas. Additionally, not all coastal states in whose waters tuna occur are PNA. It seems that, because there are three enclaves for which licensing systems would need to be established, waters within the EEZs of the PNA, the high seas, and waters within the EEZs of the non-PNA states and territories bordering the area of the WCPO, there would be greater opportunity for vessels to circumvent monitoring and enforcement procedures carried out by the administrative entities of the three enclaves. One could imagine that a vessel purchasing a license for the high seas and for an EEZ, might be inclined to attribute more catch and effort to the high seas than was actually expended there in an attempt to actually spend more time in the more productive EEZ without using its allotted fishing days. Unless a foolproof Automatic Location Communicator (ALC) system is available to all three enclaves, the opportunity for misreporting would be great. Without very close cooperation among the three groups there will be a great deal of overlap and redundancy in the administration of the VDS, such as setting license fees, selling licenses, monitoring the vessels with licenses, policing IUU vessels, *etc.* No matter how the VDS is administered, the fisheries will have to be increasingly monitored and micromanaged as vessels owners develop means of circumventing controls placed on them in the three areas. The VDS could operate much more efficiently, with less minute controls, if the number of vessels permitted to fish in the region were limited, but the limit of 205 vessels imposed by the Palau Agreement is to be lifted upon full implementation of the VDS. Apparently one of the primary reasons for lifting the 205-vessel limit is the concern of coastal developing states that maintaining the limit would impede their opportunity to acquire vessels to fish under their flags. However, with a VDS and a limit on the number of vessels the coastal states could develop the opportunity to acquire vessels by working together to limit the number of access permits or licenses they sell to DWF to fish in their EEZs. By reducing the number of licenses, allowable effort quota would be available to them for any vessels they might wish to acquire.

There are several other points regarding the scheme that need to be addressed in the future if it is to be effective in achieving its objectives. 1) The data base used to calculate the TAE for the

first 3-year management period was for the years 2000-2002. During this 3-year period overfishing was taking place for yellowfin and bigeye, so that for each species current fishing mortality was greater than fishing mortality at AMSY; it is therefore probable that when the TAE is overfishing will continue to take place, leading possibly to stocks that are in an overfished state. 2) Utilizing only an ALC to monitor the fishing of vessels operating under the VDS may be inadequate for effective monitoring and control. To achieve more effective management it would be necessary to require that government observers be placed aboard each of the vessels to collect information on the species and quantities caught, including bycatch species, and to ensure that there is an effective means of monitoring landings. 3) It may prove difficult to ensure that the calculation of fishing days by each PNA is done in accordance with the definitions in the VDS and is uniform among parties. There should be no opportunity for corrupting the intent of the VDS respecting conservation of the resources being exploited. The establishment of a subcommittee within the VDS Committee, or within the office of the administrator, to monitor the calculation of fishing days by each PNA could serve this purpose. 4) There could be a tendency for excess capacity to build up because vessels operating under government subsidies could afford to purchase licenses even if the number of days authorized to fish under that license would not be enough to ensure a profitable operation if the vessel were not subsidized. This situation could also lead to IUU fishing. 5) Coupling a limit on the number of vessels with the VDS would be a more effective way to ensure both biological conservation and greater economic efficiency. Maintenance of reasonably high catch rates for vessels purchasing licenses under the VDS would make it possible to levy higher license fees. 6) Since the VDS applies only to the EEZ of the PNA, some licensing scheme would need to be implemented by the WCPFC for the high seas, and by the states that are not PNA, including the application of an effective ALC.

The most recent action taken by the Commission regarding capacity was included in the 2006 Agreement and beginning in 2007 requires all CCM to take the necessary measures to ensure that the total capacity of their respective other commercial tuna fisheries for bigeye and yellowfin do not exceed the average level for the period 2001-2004 or 2004.

2.4. Effectiveness of the conservation and management measures in reducing fishing mortality

The obligation for CCM to provide a list of their vessels that are authorized to fish in the convention area, along with specific vessel data, has resulted in the Secretariat being able to comply a list of 8,595 vessels, flagged in 21 CCM. Though many of the CCM have provided some of the required information on vessel characteristics, etc., many have not. This lack of cooperation makes it difficult for the Secretariat to monitor fleets fishing in the WCPO.

Notwithstanding the newly approved CCM 08-01 which become effective in 2009, the previous conservation and management measures implemented by the WCPFC, which deal directly with the conservation of the stocks, have been in force only since the beginning of 2006; therefore, it is not possible to evaluate their effectiveness with respect to the status of the stocks of yellowfin and bigeye, particularly the indicators based on the size of the biomass. This is particularly true for bigeye as the last assessment was done prior to the implementation of the management measures. Nevertheless, it is possible to examine specifically whether the management objective for each CCM to maintain fishing effort for purse seiners at 2001-2004 or 2004 levels, and not to allow each CCM longliners to exceed the average annual bigeye catch for the years 2001-2004 or 2004. The Secretariat of the WCPFC prepared a review of the Commission's conservation and management programs for the TCC, which has responsibility for providing to the Commis-

sion information, technical advice and recommendations relating to the implementation of, and compliance with Conservation and Management Measures (CMM). Progress with implementation of CMM is monitored through the reporting provisions within the CMM themselves or the Annual Reports by CCM to the Commission.

The review mentioned in the paragraph above compares the amount of fishing effort during the base years with the effort generated in 2005 and 2006, and the catch of bigeye in the base years by longliners with the catches in 2005 and 2006. Purse-seine fishing effort within waters under the jurisdiction of CCM which border the Convention area increased over the base years of 2001-2004 by 17 percent in 2005 and 19 percent in 2006. In international waters the effort increased by 4 percent in 2005, but decreased by 23 percent in 2006. About 5-6 times more effort is generated in the juridical waters than international waters. The catch of bigeye by longliners declined over the base years by 4 percent in 2005 and by 10 percent in 2006; however, the catch of bigeye by vessels other than longliners or purse seiners increased by 40 percent in each of the two years. These results imply that the intention to limit fishing effort has not been successful, whereas the catch limit on longliners has been successful.

With respect to the Commissions initiatives for CCM to not increase the fishing capacity of their fleets operating in Convention waters recent data for the purse seine fleets shows no increase in the number of vessels, but a slight increase in the total capacity of purse seiners in the area. The numbers of large scale longliners have not increased but the numbers of smaller coastal longliners ported in CCM have increased.

2.5. Compliance and enforcement

The convention establishing the WCPFC is very clear on the responsibilities of the CCM regarding compliance with the conservation and management measures implemented by the Commission. Article 5(j) instructs the Commission to implement and enforce conservation and management measures through effective monitoring, control and surveillance. Article 11(1) establishes a TCC to provide advice to the Commission regarding compliance. The primary responsibilities of the TCC are to monitor and review compliance with the conservation and management measures adopted by the Commission and to make recommendations relating to the implementation of, and compliance with, conservation and management measures.

Membership in the TCC is open to each member of the Commission. Article 25 of the Convention lays out the duties, responsibilities and rights of each CCM regarding compliance and enforcement. Each CCM has a duty to report any infractions to the conservation and management program to the flag state of the vessel committing the infraction. The flag state has a responsibility to undertake an investigation of the allegations and to take appropriate legal action, and if the allegations are sustained, to impose sanctions adequate in severity to be effective in deterring future violations. The CCM are also encouraged to take joint action against nations that continue to violate the conservation and management measures, including the imposition of joint non-discriminatory trade measures. In carry out its work the group is provided information by port states, flag states, observers, and any other relevant source on the activities of vessels suspected of contravening the conservation and management measures.

The FFA has a long history of maintaining a register of foreign fishing vessels that are eligible to apply for access licenses for fishing in the EEZs of the FFA members. To be on the list, vessels must meet a series of criteria set down by the FFA, including a willingness to participate in a vessel monitoring system (VMS), which involves the use of an electronic positioning device that

reports the location of the vessel, via satellite to the FFA. A vessel not on the list would not be permitted to fish in the area; a vessel can be on the register but not licensed to fish. Any vessel that has been found to be engaged in IUU fishing with respect to the EEZ of any FFA member country is blacklisted, and cannot obtain an access agreement. Although this system was in effect before the creation of the WCPFC it was helpful in ensuring that vessels from outside the region complied with national laws and regulations governing fishing for tunas.

One of the earlier actions taken by the WCPFC to deter IUU fishing was the establishment of a list of vessels authorized to fish in the Convention Area. The resolution lays out a detailed series of measures that CCM and their flag vessels must comply with in order to fish in the Convention Area. Each CCM is required to provide a list of their flag vessels that have been authorized to fish in the Area to the Secretariat. Any vessel not on the list that fishes in the Area would be considered to be engaged in IUU fishing. CCM are instructed to not authorize any vessel not on the list, or any IUU vessel, to fish in the region and are encouraged to only include vessels on their authorized list whose owners are citizens or residents within their jurisdiction so that controls and preventative actions can be applied to ensure compliance with conservation measures enacted by the Commission. Three other early actions dealing with compliance and enforcement were taken by the Commission: the first was to agree on a series of specifications for marking and identifying vessels authorized to fish in the area; the second was to implement a vessel monitoring system (VMS) by January 1, 2008, which would require that a reliable Automatic Location Communicator (ALC) be installed first on vessels greater than 24 meters in length and then all commercial fishing vessels under that length (the VMS was not activated on January 1, but has been delayed until a decision is made on which system will be used, that of the FFA, which appears to be most likely, or one newly established by the Commission); and; the third was to develop the framework for an observer program whose objective would be, among others, to collect information for use in enforcement and compliance.

More recently the Commission approved two CMM designed to improve surveillance, enforcement, and compliance. The first of these lays out a program in which members of the Commission are authorized to board vessels on the high seas that have been reported to be engaged in a fishery regulated pursuant to the Convention, and specifies actions they should take respecting these vessels and the reporting of their activities to the flag state. The second of these CMM requires the Secretariat of the Commission to maintain a list of IUU vessels operating in the Convention waters. The list is to be reviewed by the TCC, approved by the Commission and then given wide circulation among all the members. Vessels on the list cannot be authorized to fish in the area or in the waters under the jurisdiction of the CCM. There are currently about 6 vessels listed on the WCPFC IUU list, including two Venezuelan vessels from the EPO. The two EPO vessels on the IUU list raise an interesting issue. There is an agreement resulting from the Kobe meeting to exchange IUU lists among the tuna RFMO, and to include each others vessels in each list. This means that the IATTC should include in its IUU list the two vessels from Venezuela--that seems hardly likely to happen. Additionally the Kobe meeting emphasized the need for RFMO to provide information to each other on suspected IUU vessels. Again, it hardly seems likely that the IATTC would provide information to WCPFC to help them identified a vessel from the EPO that may be IUU fishing in the WCPO. If the IATTC did that it would jeopardize its ability to obtain catch-statistical data from the vessel in the future. Obviously and important issue for the future is to sort out how the different RFMOs will interchange information on IUU vessels, and whether the interchange of information can help to stem IUU fishing.

Several of the Resolutions and CMM authorize the CCM to under take joint non-discriminatory

action, including trade sanctions, against states whose fisheries act to diminish the effectiveness of the Commissions conservation and management measures.

Because the Commission has a short history many of these measures have not been implemented, but there are deadlines set for their implementation. Nevertheless, the suite of measures if and when implemented fully will deter IUU fishing.

3. ALBACORE TUNA IN THE PACIFIC OCEAN

Unlike the other species of tunas in the Pacific Ocean, albacore are divided into a northern and a southern stock; therefore, the IATTC and the WCPFC are jointly responsible for managing the Pacific albacore stocks, and the Pacific population of the species is treated separately in this report.

Albacore tuna, which are considered a temperate species because they generally frequent cooler waters than the tropical tunas, are distributed widely throughout the Pacific Ocean. The smaller individuals are commonly found in waters more pole-ward than the larger mature individuals, which tend to move to warmer waters nearer the equator for spawning purposes. A variety of fishing gear is used to harvest albacore. In the north a little more than one half the catch is taken by surface fishing gear and the rest by longline gear; in the south longline vessels account for about 92 percent of the catch and trolling gear the remainder. Since 1965 total Pacific catches of albacore have varied between 70 thousand tons in 1965 and 170 thousand tons in 2002; after 2002 the catch declined to a low of 99 thousand tons in 2005, increased in 2007 to 145 thousand tons (Figure D-3). Prior to 2002 about 65 percent of the total Pacific catch of albacore was taken from the northern stock, but after 2002 this share dropped to about 50 percent. In this sec-

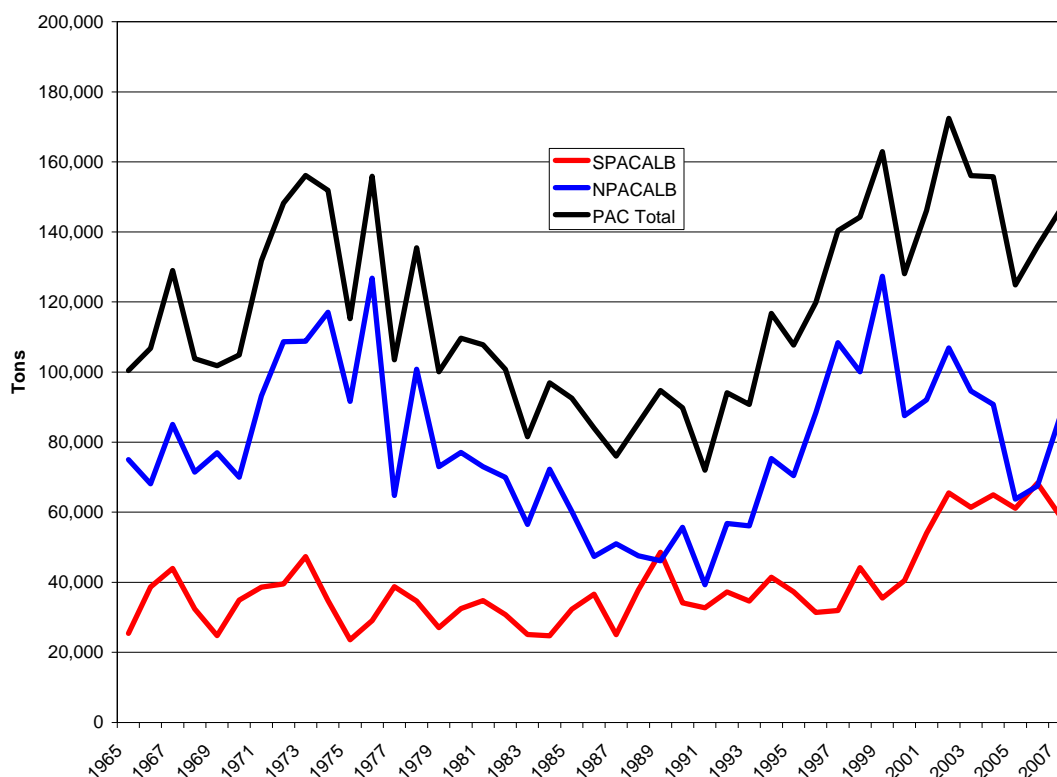


FIGURE D-3. Catches of north Pacific albacore (NPA), south Pacific albacore (SPA), and Pacific-wide albacore (Total), 1965-2006

tion albacore in the north and in the south will be discussed separately.

3.1. Institutional arrangements for science and management

There are a number of groups that are involved in studying, assessing, and managing albacore stocks. In the north the informal North Pacific Albacore Workshop was first conceived in 1974 with the purpose of promoting research on albacore. The original members of the Workshop were the NMFS and Japan's National Research Institute of Far Seas Fisheries. The Workshop meets annually and as more nations entered the albacore fishery, membership in it has expanded. Since the ISC was created in 1995, it has assumed responsibility for the albacore Workshop. The ISC workshop reports to the ISC plenary, which, since it has no management authority, reports to the Northern Committee of the WCPFC. The Northern Committee, which is primarily concerned with fisheries north of 20°N, makes management recommendations to the WCPFC. The Director of the IATTC receives a report from the ISC on the status of the albacore stock in the north Pacific and based on the report may make conservation and management recommendation to the High Contracting Parties. The High Contracting Parties may accept, reject, or accept with modifications the recommendations of the Director. The IATTC and the WCPFC are in turn, jointly responsible for implementing management measures in their geographical areas of competence.

With respect to the albacore stock of the south Pacific, the OFP of the SPC has for many years carried out assessments of the stock. About 20 years ago the OFP initiated the creation of the SCTB. Until the creation of the WCPFC, the SCTB was responsible for coordinating international research and assessment efforts for south Pacific albacore. Currently the SC of the WCPFC is responsible for assessing the status of the southern stock. This committee makes management recommendations to the WCPFC and the IATTC, who in turn have responsibility for managing this stock.

3.2. Conservation and management

3.2.1. North Pacific albacore

Based on the ISC report on the status of the albacore stock in the North Pacific, the Director of IATTC formulated recommendations designed to control fishing mortality on North Pacific albacore for consideration by member governments. The member governments of the IATTC, heeding the advice of its Director, approved a resolution in June 2005 designed to limit the total level of fishing effort for North Pacific albacore in the EPO. The resolution specifically calls on CPCs to not allow their vessels fishing for albacore in the EPO to increase their total level of fishing effort beyond current levels. The resolution requires all CPCs to report all catches of North Pacific albacore tuna taken in the EPO, by gear type, to the IATTC every six months. Also, the resolution calls on the Director to communicate with the WCPFC and request it to take similar measures.

3.2.2. South Pacific albacore

During the 2nd session of the WCPFC in 2005, a resolution for implementing management measures for the fishery for south Pacific albacore was approved. The resolution took note of the fact that the assessment indicated the albacore stock was in a substantially healthy condition, but because of uncertainty in the estimates derived from the stock assessments, and because increasing fishing effort might result in decreasing catch rates for little increase in catch, the economic consequences of any increases should be carefully assessed before such increases are encouraged or implemented. The resolution goes on to say that CCMs shall not increase the number of their

vessels that fish for albacore in the Convention Area south of 20°S above 2005 or 2000-2004 levels. Under certain criteria, small island developing states and territories and CCMs in the Convention Area for whom albacore is an important component of the domestic tuna fishery in waters under their jurisdiction, and who wish to pursue a responsible level of development of their albacore fisheries, would be allowed to do so without being subjected to the limits noted above.

The status of north and south Pacific albacore is summarized in Table D-3.

3.3. Limiting fishing capacity

There are no measures that have been taken by either the IATTC or WCPFC specifically addressing the issue of capacity in the North Pacific albacore fishery. However, resolutions ad-

Species	$B_{\text{current}} < B_{\text{MSY}}$	$B_{\text{current}} \approx B_{\text{MSY}}$	$B_{\text{current}} > B_{\text{MSY}}$
North Pacific albacore			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$
South Pacific albacore			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$

TABLE D-3. Status of north and south Pacific albacore. $B_c = B_{\text{current}}$ the current biomass, $F_c = F_{\text{current}}$ the current fishing mortality rate, and F_{MSY} and B_{MSY} are the corresponding values for levels when the population is at a level corresponding to the MSY.

ressing the capacity issue were agreed to during MHLIC and PrepCon. These 1) called for reasonable restraint in the expansion of fishing capacity in the Convention Area and continue to be applied by the Commission, and 2) calling on states whose nationals are beneficial owners of purse-seine vessels that entered the WCPFC Convention Area after the MHLIC and PrepCon resolutions regarding capacity, and other concerned CCM, to work together to ensure that the beneficial owners reduce by 31 December 2007, such over capacity as created by those vessels through reduction of equivalent capacity of other fishing vessels operating in the Convention Area.. In both the EPO and the WCPO there have been efforts to limit capacity in the purse-seine fisheries, but such fisheries catch very little albacore. Nearly all of the catch of albacore in the North Pacific is made by longline, pole-and-line, and trolling vessels. There have been no studies to determine whether there is excess fishing capacity in the pole-and-line and trolling fleets. There have been studies for longline fleets in the EPO and WCPO that have shown there is substantial excess capacity in these fleets. In fact, because of concern over too much capacity and declining profitability of longline vessels, the industry has undertaken to reduce the amount of longline capacity by 20 percent. Longline fleets from Japan, Chinese Taipei, Korea, China and Indonesia have participated in this reduction program, but most vessels removed from the fishery belonged to Japan. These measures apply to large-scale longline vessels, which are in excess of 24 meters in overall length, and theoretically should affect longline fishing effort in the Pacific albacore fishery... No such initiative has been taken for longline vessels under this size, even though their numbers are rapidly increasing in all oceans of the world.

The WCPFC resolution for management of the southern albacore fishery calls for no increases in the number of vessels over 2005 or 2000-2004 levels fishing in the Convention Area below 20°S.

3.4. Effectiveness of the conservation and management measures in reducing fishing mortality

There is not enough data with which to determine with any degree of certainty whether fishing

mortality has declined as a result of management efforts to curtail fishing effort.

3.5. Compliance and enforcement

For north Pacific albacore the IATTC reports that it has received some catch information on the 6 month schedule called for in the resolution from all countries with vessels fishing in the EPO for albacore, except China. Because the resolution is directed towards limiting fishing effort, and calls for timely reports on catch but not effort, the Commission is not able to evaluate on a short term basis compliance with the resolution, which calls for limiting effort. Additionally, the resolution mentions that effort should not exceed current levels, but does not define “current levels.” Because of these shortcomings and ambiguities in the details of the resolution, compliance is difficult to monitor. It would seem prudent to redraft the resolution to correct these shortcomings and ambiguities. The WCPFC resolution on northern albacore is written with the same shortcomings and ambiguities as the IATTC resolution, so monitoring compliance for the WCPFC suffers the same problems as the IATTC is suffering. Reports on catches were received from 10 countries with vessels fishing albacore in the north Pacific; however, no detailed reports as called for in the resolution were received.

The ISC North Pacific Albacore Working Group was directed to evaluate the effect of IUU fishing on the North Pacific albacore resource. They reported illegal fishing is likely occurring within the range of albacore, but the characteristics and magnitude of this IUU fishing is unknown. The Working Group cautioned that the IUU fishing could have the potential to increase total fishing mortality to unsustainable levels. The Working Group reported that it has insufficient data to analyze IUU impacts at this time.

The WCPFC has issued no reports on compliance with the conservation and management resolution for south Pacific albacore. It has been noted by scientists working on south Pacific albacore that the detailed logbook coverage for the Chinese Taipei fleet fishing south Pacific albacore (the largest producers of longline albacore in the south Pacific) is very limited and impacts adversely the stock assessment analysis.

4. ATLANTIC OCEAN

The tuna fisheries along the shores of eastern Atlantic and the adjacent Mediterranean Sea date back centuries, but significant catches made with modern types of fishing vessels did not really start until the expansion of Japanese longline and European pole-and-line fishing into the tropical Atlantic in the 1950s. Commercial catches increased slowly until the late 1960s when purse-seine vessels from the EPO moved to the Atlantic after the unrestricted fishing season for yellowfin closed in the EPO. After the influx of vessels from the EPO, augmented by fleets from France and Spain, catches rose steadily until they peaked in 1990 at nearly 600 thousand tons, after which they steadily declined to a low of about 400 thousand tons in 2007 (Figure D-4). Currently about nine percent of the world production of the principal market species of tuna is taken from the Atlantic Ocean. Prior to 1990 yellowfin tuna was the major species taken, but this species has been overtaken by skipjack in recent years. Currently skipjack accounts for 38 percent of the total catch of tunas from the Atlantic, followed by yellowfin with 25 percent, bigeye with 17 percent, albacore with 12 percent, and bluefin with about 8 percent. Longline vessels dominated the fishery until the early 1970s. Currently purse-seine vessels take about 40 percent of the catch, followed by pole-and-line with 27 percent, longline with 19 percent, trolling with 4 percent, trawl with 3 percent, and a myriad of other gear types taking the remaining 7 percent. Over the past decade Spain and France have dominated Atlantic tuna catches, and although

they still account for a significant share of the catch, fleets from other nations are moving up. During 2007 more than 35 nations reported catches of tuna from the Atlantic Ocean and among them the top five producers, in descending order, were Spain, Ghana, France, Brazil, and Panama (mostly Spanish owners).

4.1. The International Commission for the Conservation of Atlantic Tunas

ICCAT is the second oldest regional tuna management organization after the IATTC. The Convention establishing ICCAT was signed in 1966, and the Commission held its first meeting in 1969. The Convention waters are defined as the Atlantic Ocean and adjacent seas, and the species it has responsibility for are the tunas and tuna-like fishes (the Scombriformes, with the exception of families Trichiuridae and Gempylidae and the genus *Scomber*) and such other species of fishes exploited in tuna fishing in the Convention area which are not under investigation by another international fishery organization. The Convention is open to adherence by any government that is a member of the United Nations or any specialized agency of the United Nations. Each member government can be represented by up to three Commissioners. There are currently 45 Commission members and 2 cooperating non-contracting parties. The Commission is funded by contributions from its members. The responsibility of ICCAT is to make scientifically based recommendations designed to maintain the populations of tunas and tuna-like species under their jurisdiction at levels of abundance which will permit maximum sustainable yields. Four panels have been created by the Commission: Panel 1 is for tropical tunas (yellowfin, bigeye, and skipjack); Panel 2 for northern temperate species (northern albacore and Atlantic bluefin); Panel 3 for southern temperate species (southern albacore and southern bluefin); and, Panel 4 is for other species. Each of the 4 panels have responsibility for reviewing the fisheries for the species falling within their responsibility, recommending scientific studies, recommending management

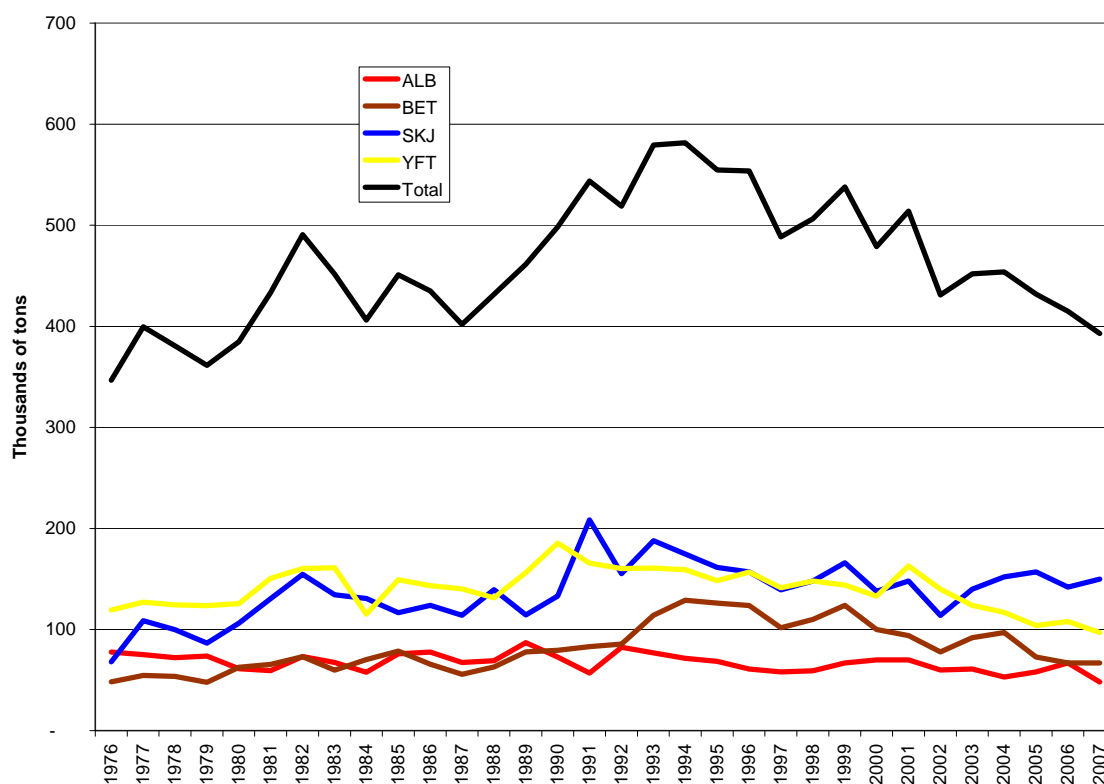


FIGURE D-4. Catches of tuna from the Atlantic Ocean, 1976-2007.

measures, and generally any other matters of importance concerning the object species. The panels may meet concurrently with the Commission and/or the Council. The Commission meets every year in November, and receives scientific advice, which it uses to make management recommendations, from the Standing Committee on Research and Statistics (SCRS). The SCRS is a subsidiary body of ICCAT, and its membership is comprised of scientific experts from the member governments. The SCRS meets at least once a year to review research on tunas and to prepare a report on the status of stocks for presentation to the Commission. Participants to the SCRS are funded by their respective governments.

The format for making management recommendations is the presentation of a report by the SCRS on the status of the stock of concern along with a series of options for achieving certain goals with respect to management. The appropriate panel, if it chooses may make a recommendation to the Commission for management measures. There must be two-thirds of the panel voting in favor of the recommendation for it to move to the Commission. The Commission can accept, reject, or modify the recommendation. The Commission may initiate recommendations without input from the panel. For a recommendation to be approved by the Commission there must be a majority vote of the members present, which must be a quorum (for there to be a quorum, two-thirds of the membership to the Commission must be present). Management decisions are binding on the members, unless they object. There is well defined system for nations to object to any management resolution approved, and any member that meets a particular schedule of objections is not bound by the resolution, *i.e.* there is an “opt out” clause for nations that do not want to be bound by the resolution.

Over the years ICCAT has implemented a number of management measures for a variety of tuna and billfish species under its jurisdiction.

4.2. Conservation and management

4.2.1. Yellowfin

One of the earliest management measures implemented by ICCAT was the establishment in 1973 of a minimum size limit of 3.2 kg for yellowfin. The rationale behind this measure was that by protecting small yellowfin the yield per recruit and the total yield could be increased. However, after many years of observing that a large share of the catch of purse-seine and pole-and-line vessels was comprised of fish under the 3.2 kg limit, the measure was repealed in 2005.

In 1993 the Commission implemented an additional management measure, stipulating that there be no increase in the level of effective fishing effort exerted on Atlantic yellowfin tuna over the level observed in 1992. Effective fishing effort is effort that is proportional to fishing mortality, as compared to nominal fishing effort, which does not take into account changes in efficiency. For example if a fleet spent 100 days at sea fishing in 1993, the nominal fishing effort would be 100 days. If that same fleet did not change its efficiency, and in 2003 spent 100 days at sea fishing, the effective fishing effort would not have changed, it would still be 100 days, the same as the nominal effort. If, however, the same fleet improved its efficiency 3 percent per year, and then spent 100 days fishing in 2003, its nominal effort would still be 100 days, but its effective effort would more than 130 days. This measure has been implemented each year since 1993.

In order to protect small bigeye, in 2004 ICCAT implemented a measure to close the area in the Gulf of Guinea between the equator and 5°N from 10°E to 20°E to fishing by purse-seine and pole-and-line vessels during November in the years 2005-2008. This measure was changed for 2009 and 2010 and applied to the area bound by 4°S to 5°N, and 20° to the African coast, and for

the period 1 November to 31 January. Although the intent was to protect small bigeye, the measure offers protection to small yellowfin as well, since they occur in that area during November.

4.2.2. Bigeye

Over the years the Commission has set a number of conservation and management measures for bigeye tuna in the Atlantic. One of the first bigeye was a minimum size limit of 3.2 kg, set in 1979 in order to enhance the enforcement of the yellowfin minimum size limit, because small yellowfin and bigeye are difficult to distinguish. A large portion of purse-seine caught bigeye is below this minimum size limit, and as was done for yellowfin, the size limit was repealed because it could not be enforced.

A number of bigeye measures were introduced between 1997 and 2003 to require CPCs to keep the number of vessels, the levels of effort, and the levels of catch, to no more than 1992-1993 averages.

In 2004 a series of controls on bigeye fishing were approved and implemented for the years 2005-2008: 1) limit the numbers of fishing vessels to less than the average number that fished during 1991 and 1992; 2) limit China to 45 longline vessels, Chinese Taipei to 98 longline vessels, Philippines to 8 longline vessels, and Panama to 3 purse-seine vessels; 3) bigeye catch limits were assigned for 2005-2008, with the current limits being 5.9 thousand tons for China, 24 thousand tons for European Union (EU) vessels, 5 thousand tons for Ghana, 25 thousand tons for Japan, 3.5 thousand tons for Panama, and 16.5 thousand tons for Chinese Taipei; 4) a total allowable annual catch of 90 thousand tons; and 5) a prohibition against fishing by purse-seine and pole-and-line vessels, as described in Section 4.2.1 above.

In 2005 the Commission, noting that Chinese Taipei vessel owners exhibited disregard for ICCAT conservation regulations in that they laundered illegally caught bigeye from the Atlantic and participated in IUU fishing, reduced Chinese Taipei's 2006 bigeye quota from 16.5 to 4.6 thousand tons. The Commission further stipulated that 60 Chinese Taipei albacore longliners would be restricted to taking no more than 1.3 thousand tons of bigeye as bycatch, and 15 Chinese Taipei longline vessels could engage in a directed bigeye fishery but could take no more than 3.3 thousand tons of bigeye, with no single vessel taking more than 220 tons. The Commission also ruled that there should be 100-percent observer coverage on these vessels to ensure compliance with the mandates. Because Chinese Taipei was found to have complied with the 2006 program as defined, it was authorized to have no more than 64 longline vessels participate in a directed bigeye fishery during 2007, and no more than 60 vessels during 2008; observer coverage would be reduced to 10 percent.

In 2008, the measure described in section 2.4.1 above was modified: it prohibited fishing on floating objects, including FADs, from 1 November to 31 January in the area between 5°N and 4°S east of 20°W. This measure has been extended through 2010.

4.2.3. Skipjack

There currently is no specific regulation in effect for the management of skipjack, nor has the SCRS recommended any management measures for this species. However the moratoria applied by the Spanish and French industry during 1997-1999, which closed a certain section of the fishery on floating objects during November-January, and the ICCAT recommendation to close a similar area during subsequent years, has had an effect on skipjack catches on FADs. The average annual catch of skipjack per vessel decreased by about 18 percent as a result of the morato-

ria; the average annual catches by purse-seine fleets that applied the moratoria decreased by 42 thousand tons (41 percent), but the overall decrease in effort as a result of less purse-seine vessels operating in the Atlantic probably contributed to this decline as well.

The status of yellowfin, bigeye, and skipjack is summarized in Table D-4.

4.2.4. Albacore

4.2.4.a North Atlantic albacore

Species	$B_{\text{current}} < B_{\text{MSY}}$	$B_{\text{current}} \approx B_{\text{MSY}}$	$B_{\text{current}} > B_{\text{MSY}}$
Yellowfin		$B_c < B_{\text{MSY}}, F_c < F_{\text{MSY}}$	
Bigeye		$B_c < B_{\text{MSY}}, F_c < F_{\text{MSY}}$	
Skipjack - East			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$
Skipjack - West			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$

TABLE D-4. Status of yellowfin, bigeye and skipjack in the Atlantic Ocean. $B_c = B_{\text{current}}$ the current biomass, $F_c = F_{\text{current}}$ the current fishing mortality rate, and F_{MSY} and B_{MSY} are the corresponding values for levels when the population is at a level corresponding to the MSY.

In 1998 ICCAT approved a recommendation calling on all CPCs with fleets fishing for northern albacore to limit, beginning in 1999, the numbers of vessels in their fleets to no more than the average number of their vessels fishing for albacore during 1993-1995. Each CPC was required to submit a list of the vessels it authorized to fish for albacore during 1999 and to resubmit such a list for each year thereafter. Japan was specifically requested to limit its catch of albacore to no more than 4 percent of its total longline catch of bigeye tuna. The provisions to limit fleets would not apply to nations whose fleets harvested less than 200 tons of northern albacore per year.

An additional resolution applying to northern albacore was approved by ICCAT in 2003 for application during 2004-2006, restricting catches to the then current levels of catch, or a total allowable catch (TAC) of 34.5 thousand tons. A series of catch allocations were included in the recommendations: EU: 28,712 tons; US: 607 tons; Venezuela: 270 tons; Japan: 4 percent by weight of its total longline catch of bigeye; other contracting parties: 200 tons; non-parties: 4,459 tons. The resolution also allowed for adjustments to be made for over-catches, under-catches, and transfers of under-catches to other parties. The resolution also sustained the measures for limitation of the number of vessels authorized to fish for northern albacore. A resolution was approved in 2006 extending all of these measures through 2007.

In 2007 the Commission, following the best scientific advice of the SCRS, established a TAC of 30,200 tons for 2008 and 2009; of this the EU was allocated 25,462 tons, the U.S. 538 tons, Venezuela 250 tons, and Chinese Taipei 3,950 tons; Japan was urged to limit its catch to 4 percent of its total bigeye catch in the Atlantic. If the TAC is followed the stock should increase to the MSY level of sustainability.

4.2.4.b South Atlantic albacore

In 2004 ICCAT approved a resolution designed to limit the catch of albacore south of 5°N to no more than 30,915 tons, a figure based on the then best estimate of MSY. The resolution stipulated that, if the catch in 2004 exceeded 29,200 tons, the TAC of 30,915 for 2006 would be reduced by the excess of the overage. Likewise, if the 2005 catch exceeded the 2006 TAC, the

2007 TAC would be reduced by the overage. Also, CPCs that caught no more than 100 tons during 1992-1996 would be allowed to increase their catch by 10 percent. The current TAC for south Atlantic albacore is 29,200 tons. For 2009-2011 the TAC was set for 29,200 tons; again, if the catch in 2008 exceeds this limit, the catch in 2009 shall be reduced by the full amount of the excess. If the catch in any year until 2011 exceeds the replacement yield of 28,800, the conservation measures for southern albacore should be reviewed. Those CPCs that caught less than 100 tons during 1992-1996 are subjected to an annual catch limit of 100 tons, and those catching more than 100 tons to a catch limit of 110 percent of their average catch during 1992-1996. In the case of Japan, it shall endeavor to limit its catch of southern albacore to 4 percent by weight of its total longline bigeye catch in the Atlantic south of 5°N.

The status of north and south Atlantic albacore is summarized in Table D-5.

4.3. Limiting fishing capacity

ICCAT established a working group on capacity that has met several times over the last few

Species	$B_{\text{current}} < B_{\text{MSY}}$	$B_{\text{current}} \approx B_{\text{MSY}}$
North Atlantic albacore	$B_c < B_{\text{MSY}}, F_c > F_{\text{MSY}}$	
South Atlantic albacore		$B_c < B_{\text{MSY}}, F_c < F_{\text{MSY}}$

TABLE D-5. Status of north and south Atlantic albacore. $B_c = B_{\text{current}}$ the current biomass, $F_c = F_{\text{current}}$ the current fishing mortality rate, and F_{MSY} and B_{MSY} are the corresponding values for levels when the population is at a level corresponding to the MSY.

years. During the most recent meeting held in the United States in July 2007 the group reviewed estimates of the number of vessels that are registered to participate in the Atlantic tuna fisheries. Of the 3,413 vessels greater than 24 meters in length, which represent a gross registered tonnage of 868 thousand tons, about 50 percent by weight were longliners, 20 percent purse seine, 5 percent trollers, and 3 percent pole-and-line vessels. These numbers are far in excess of the actual numbers that fish in the Atlantic at any time, since most of them are registered to fish in other oceans as well. Nevertheless, the working group expressed concern that there is overcapacity in some of the tuna fisheries, particularly those for northern albacore and possibly yellowfin. An FAO technical working group estimated that there was excess capacity in both the longline fleets and purse-seine fleets operating in the Atlantic Ocean. Over the last several years purse-seine capacity in the Atlantic has declined from about 70 thousand tons to less than 35 thousand tons; nominal fishing effort has also declined somewhat. It is probable that efficiency of the purse-seine fleet has increased progressively over the years so that fishing capacity is not proportional to the decline in carrying capacity.

ICCAT has taken a number of management measures designed to limit fishing capacity for some fisheries. Several different measures were recommended between 1997 and 2003 to require CPC to keep the number of vessels fishing for bigeye to no more than 1992-1993 averages. Additionally, ICCAT recommended in 2004 that the numbers of vessels fishing for bigeye be limited to less than the average number that fished during 1991 and 1992, China be limited to 45 longline vessels, Chinese Taipei to 98 longline vessels, Philippines to 8 longline vessels and Panama to 3 purse-seine vessels.

The Commission, in 2005 limited the number of Chinese Taipei vessels that could be engaged in a directed bigeye fishery to 15 and the number of albacore longliners that could take a bycatch of

bigeeye to 60. The number for the directed bigeye fishery was increased to 64 for 2007 and 60 for 2008.

In 1998 ICCAT approved a recommendation calling on all CPC with fleets fishing for northern albacore to limit beginning in 1999 the numbers of vessels in their fleets to no more than the average number of their vessels fishing for albacore during 1993-1995.

4.4. Effectiveness of the conservation and management measures in reducing fishing mortality

The earliest conservation measure for tropical tunas was a minimum size limit of 3.2 kg for yellowfin tuna established in 1973. Because of the difficulty in distinguishing small bigeye from yellowfin a similar limit was applied subsequently to bigeye. Because it was impossible to enforce this limit and more than half the catch of yellowfin and bigeye was comprised of fish under the limit, the Commission rescinded the measures in 2006.

The objective of the Gulf of Guinea closure for floating objects fishing was to reduce the catch of small bigeye tuna, but because yellowfin is taken with bigeye in mixed school sets on floating objects, the measure should also reduce the catch of small yellowfin. However, since the last assessment for yellowfin was in 2003, it was not possible for the SCRS to evaluate the effectiveness of the measure. In 1993 the Commission recommended no increase in effective fishing effort on yellowfin over the 1992 level. In 2003, the last assessment, effective effort was approaching or exceeding the 1992 level. Since 2003 catches have been declining as has nominal effort, but because it is likely that vessel efficiency has been increasing, effective effort may be increasing. It will not be possible to evaluate this until the next assessment in 2008.

A TAC of 90 thousand tons of bigeye was set in 2004. Catches of bigeye in 2005 and 2006 were 72 and 65 thousand tons respectively, well below the TAC of 90 thousand tons. However, the closure in the Gulf of Guinea, designed to reduce the catch of small bigeye, has not been effective; more than 70 percent of bigeye landings are comprised of small fish, and the percentage is increasing.

In 2001 a TAC of 34.5 thousand tons was set for northern albacore. In both 2005 and 2006 the catch of northern albacore was very near to the TAC, exceeding it by only about 3-4 percent. Based on the best scientific advice the Commission lowered the TAC to 30.2 thousand tons for 2008 and 2009, but the data to know whether catches in 2008 and 2009 exceeded the TAC are not available. The measure to limit the total number of vessels fishing for northern albacore to 1993-1995 levels has not been evaluated; therefore it is not possible to know whether CPC have complied with the measure. The TAC of 29.2 thousand tons for southern albacore has not been exceeded since 2002.

4.5. Compliance and enforcement

ICCAT has been one of the most active of the tuna RFMO with respect to implementing measures to ensure compliance with certain of their conservation initiatives. Much of this action, which has been directed towards IUU fishing, is attributable to the aggressive stance that Japan took with respect to IUU fishing for Atlantic bluefin. Japan submitted evidence to ICCAT of vessels fishing bluefin in contravention of the conservation regulations, and insisted that something be done about forcing compliance. This was the initial motivation for the introduction of trade sanctions against IUU fishing states. It effectively brought Panama into compliance and resulted in it joining ICCAT. There has been several multilateral non-discriminatory trade sanctions applied against nations whose fleets have fished in contravention to ICCAT regulations, for

example Bolivia, Georgia, and St. Vincent and the Grenadines. In most cases these sanctions have resulted in the offenders coming into compliance.

To coordinate its enforcement and compliance interests ICCAT formed a Conservation and Management Measures Compliance Committee (Compliance Committee). This Committee has taken the initiative to recommend to the plenary a series of measures designed to improve compliance. The Commission established a register of vessels that are authorized by their governments to fish in the Atlantic tuna fisheries. Any vessel not on the list is considered to be IUU fishing and subject to a series of sanctions applied by ICCAT, including trade sanctions and port state controls. There are currently 17 vessels on the ICCAT IUU list. Two of these vessels fly the Sierra Leone flag, the other 15 are of unknown nationality. The type of fishing gear used is not given on the ICCAT IUU list. There are other vessels suspected of IUU fishing that are not on the list as they have not been properly identified. ICCAT also includes on its IUU list any vessels listed as IUU by other tuna RFMO, which helps to ensure compliance on a global scale. IUU fishing continues to be a problem in the Atlantic and Mediterranean tuna fisheries.

In an attempt to enforce ICCAT management and conservation measures a number of actions have been taken: 1) With the exception of some large-scale tuna longline vessels, and some small-scale albacore longline vessels, transshipping at sea is prohibited. 2) Carrier vessels that work with the excepted longline vessels must carry an ICCAT approved observer. 3) Coastal CPC are encouraged to assign a port inspector to monitor all tuna unloadings within their ports and report this information to ICCAT. 4) Vessel masters are encouraged report to ICCAT any vessels they observe that may be engaged in IUU fishing. 5) Port states are encouraged to prohibit all unloadings and transshipments of any vessels entering the ports that have been identified as IUU or otherwise guilty of infringement of ICCAT regulations.

Resolution 08-09 approved by ICCAT during 2008 calls on all CPCs and NGOs to submit to the Compliance Committee, at least 120 days before the annual meeting, any documented information indicating non-compliance with ICCAT conservation and management measures.

Although ICCAT has many measures they have recommended regarding compliance and enforcement, information with which to evaluate their effectiveness is very limited. Similarly, it is difficult to determine whether states have complied with measures limiting capacity or fishing effort to previous average levels as called for in a number of the Atlantic tuna fisheries. Although ICCAT is supposed to monitor how many vessels are fishing and how much effort they are generating, the monitoring depends on the flag states providing information to compare with the earlier guidelines, and in many cases this information has not been forthcoming.

5. INDIAN OCEAN

There is a long tradition of tuna fishing in the Indian Ocean, but it was not until the expansion of the Japanese longline fleet in the 1950s that large-scale commercial fishing for tunas in the Indian Ocean began. Catches increased only slowly until the early 1980s when the French and Spanish purse-seine fleets fishing in the Atlantic Ocean transferred operations to the Indian Ocean. Catches increased rapidly, from about 150 thousand tons in 1982 to about 800 thousand tons in 1994 (Figure D-5). They have continued to increase since 1994, but at a slower pace, reaching a peak of about 1,150 thousand tons in 2005; in 2007 they declined to 910 thousand tons. During the last few years the Indian Ocean was responsible for about 25 percent of the world production of the principal market species of tuna.

Skipjack has generally made up more than 50 percent of the total catch, and during the last five

years averaged about 500 thousand tons per year. Yellowfin catches average about 425 thousand tons during the same period, bigeye about 118 thousand tons, and albacore about 25 thousand tons.

Purse-seine vessels account for about 40 percent of the catch, gill net and longline 20 percent each, pole-and-line about 12 percent, trolling and hand-lines about 4 percent, with the remaining 4 percent being taken by a variety of gears. Purse-seine vessels make sets on FADs and on free-swimming schools. The number of sets on each type is nearly equal. On the average the catch on FADs is made up of 65 percent skipjack, 27 percent yellowfin, and 8 percent bigeye, whereas the corresponding figures for school sets are 24 percent skipjack, 70 percent yellowfin, 5 percent bigeye, and slightly more than 1 percent albacore. Purse seine fishing capacity has been increasing each year since 1984; between 1984 and 1997 it increased very rapidly, from 1997 to 2003 it increased very slowly, and thereafter shot upward. Some purse-seine fleets use tender or supply vessels to assist in their fishing operations, particularly when FAD fishing. These vessels generally deploy and monitor FADs and provide supplies to the purse-seine fleet they are associated with.

More than 50 nations participate in the catch of tunas in the Indian Ocean, and 8 of them account for 80 percent of the catch. Vessels fish throughout the Indian Ocean, but most of the yellowfin, skipjack, and bigeye are taken in the western part.

5.1. The Indian Ocean Tuna Commission

In 1948 the Indo-Pacific Fisheries Council (IPFC) was created under the auspices of the FAO. Its function was to promote scientific studies of the resources of the Indo-Pacific region and to provide advice to governments concerning these resources. A second organization, created within the framework of the United Nations Development Programme (UNDP), was the Indo-Pacific Tuna Management and Development Programme (IPTP), which focused the attention of many of the coastal states of the region on the tuna resources of the Indian Ocean. Much of the early research on tunas was done under the umbrella of the IPFC and the IPTP, and it in many ways these organizations were the catalyst for creating a regional tuna organization. An agreement for the establishment of an Indian Ocean Tuna Commission was signed by governments in 1993 and entered into force in 1996. Unlike the other tuna RFMOs, the IOTC was created within the framework of Article XIV of the FAO Constitution, and as such has several shortcomings. Most of its funding is handled through the FAO, although they are not FAO funds, so therefore its functioning is not totally independent of that body. FAO makes decisions on some things concerning the Commission, such as staffing. Since it falls within the FAO Constitution, no state can become a member of the IOTC unless it is a member or associate member of FAO, and is a coastal state, a state whose vessels engage in fishing in the area, or a regional economic integration organization at least one of whose members fits the aforementioned criteria. These limitations were recognized when the IOTC was created, but the coastal states of the region were concerned about undue influence that could come from developed states with an interest in Indian Ocean tuna, so they attached it to FAO. A case in point is Chinese Taipei, because it is not a member of any UN organization, it cannot become a member or cooperating member of IOTC, which could result in problems for IOTC regarding the acquisition of catch statistical data from Chinese Taipei, one of the most important harvesters of tuna from the region. After 10 years of operation, the IOTC is considering abandoning its FAO format and becoming an independent Article 64 RFMO. If and when the process of “independence” is completed, the duties and responsibilities will not change much. One of its current objectives is to promote cooperation

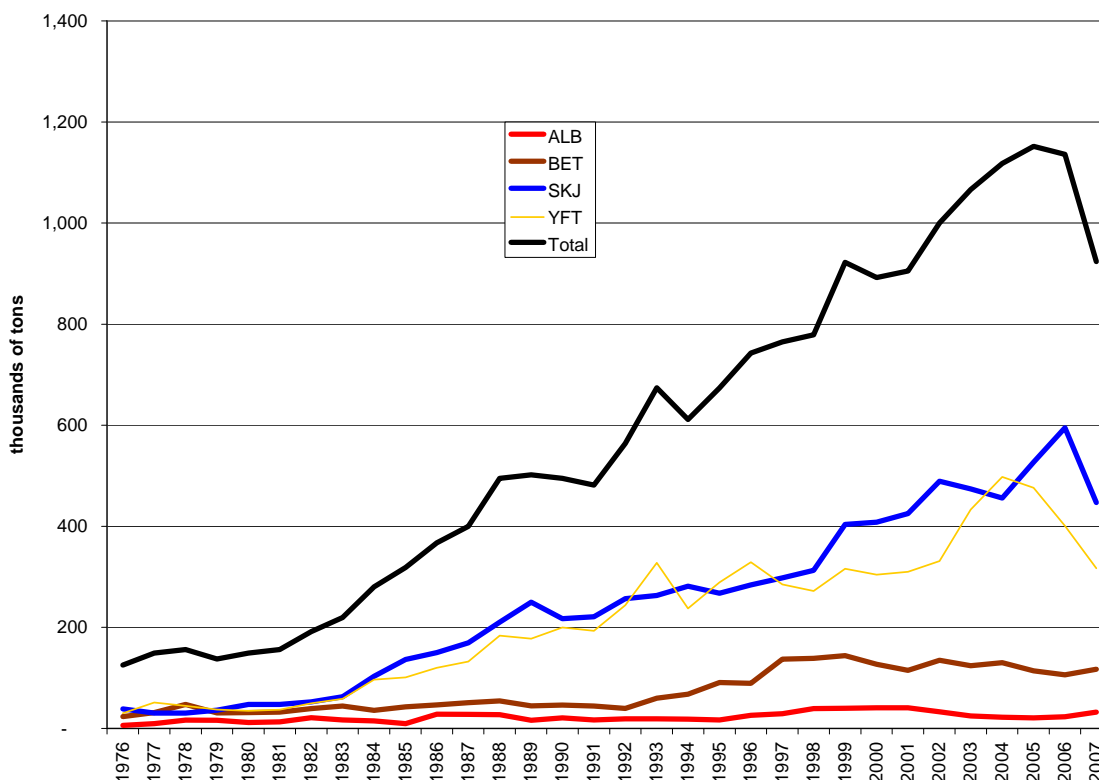


FIGURE D-5. Catches of tuna in the Indian Ocean, 1950-2007.

among its members to ensure the conservation and optimum utilization of stocks covered by the Convention. To achieve this objective the Commission is responsible for 1) keeping under review the conditions and trends of the stocks of tuna and tuna-like fishes of the Indian Ocean; 2) encouraging, recommending, and coordinating research and development activities, including the transfer of technology and training, with due regard to the equitable participation of members, particularly the special needs of developing coastal states; 3) adopting conservation and management measures to ensure the conservation of the stocks; and 4) keeping under review the economic and social aspects of the fisheries covered by the Convention, bearing in mind the interests of developing coastal states.

Currently there are 28 members of IOTC and 3 cooperating non-contracting parties. The area of competence of the IOTC is the Indian Ocean (FAO statistical areas 51 and 57), and the 16 species of tuna and tuna-like fishes for which it is responsible are listed in an Annex to the Convention.

The Commission employs an Executive Secretary and support staff hired by FAO; it does not employ an independent scientific staff, but works through a Scientific Committee, which in turn establishes working parties for carrying out research and assessment of the tuna stocks. These committees and working parties are comprised of representatives of the member states, working in their individual capacity as scientists, and they work in a similar format to that of ICCAT. The Committee presents the results of the assessments and recommendations for conservation to the Plenary for action. The plenary can choose to take such recommendations, ignore them, or modify them.

Conservation and management measures are agreed to by two-thirds majority vote, and are binding on all members. However, there is an 'opt-out' clause, any member can file an objection to

the measure, and by doing so is not bound by it.

5.2. Conservation and management

5.2.1. Yellowfin

Until the recent assessment there was apparently no overfishing of yellowfin tuna, with the possible exception of reduced yield per recruit resulting from the FAD fishery; therefore there has been very limited action taken by IOTC with respect to the implementation of conservation and management measures for yellowfin in the Indian Ocean. Because of concern over the increasing catches of small yellowfin in the FAD fishery, and overall increases in fishing mortality, in 2002 the Plenary requested that the Scientific Committee provide it with technical advice regarding options for managing yellowfin, particularly the possibility of time and area closures. Although there was some discussion of this in 2003 meetings, no action was taken at that meeting or at subsequent ones.

In 2003 the Commission approved a resolution recommending limitations on fishing capacity. Although this was not a directed measure towards yellowfin, it theoretically would impact that stock as well as others. The resolution also called on CPCs with more than 50 vessels in the fishery greater than 24 meters in length to limit the number of their vessels to the number they had in 2003. Exceptions were made for coastal developing states that submitted development plans to IOTC. These measures were updated in 2006 and are to apply through 2009.

Once again, in 2003 the Commission established a working group to examine options for managing yellowfin tuna that could be considered in 2005. No action was taken on these management options. In essence, there has been no directed management of yellowfin tuna in the Indian Ocean.

The Scientific Committee has recommended in its 2008 report to the Commission that the catch of yellowfin tuna not exceed the average catch in 1998-2002, when catches were stable prior to the exceptional years of 2003-2006, when the stock might have been overexploited. They also recommended that the fishing effort should not exceed the level exerted in 2007, when the catch of yellowfin tuna returned to the pre-2003 levels

5.2.2. Bigeye

In 2001 the Commission called on non-members to limit their fishing effort on bigeye tuna to 1999 levels and to report to the Commission on the measures they have taken to comply with this request.

In order to improve the monitoring of catches of bigeye, the Commission approved a measure, effective July 2002, requiring that all bigeye tuna imported into the territory of a Contracting Party be accompanied by an IOTC Bigeye Tuna Statistical Document.

The 2003 and 2006 measures to limit fishing capacity applied to all vessels, whether fishing for bigeye or other species.

In 2005 the Commission agreed that CPCs would limit their catch of bigeye tuna to recent levels of catch, and asked Chinese Taipei to limit its annual bigeye catch in the Indian Ocean to 35,000 tons.

Based on the most current assessments of bigeye, in 2006 the Scientific Committee recommended that bigeye catches should not exceed the MSY, and fishing effort should not increase beyond the levels exerted in 2004, but the Commission did not implement the recommendation.

5.2.3. Skipjack

Because the IOTC considers that skipjack are not fully exploited, it has made no recommendations for conservation and management. Theoretically, the measures for limiting fishing effort and capacity mentioned earlier would affect the catches of skipjack, since most is taken in association with FADs and in schools mixed with yellowfin and bigeye.

5.2.4. Albacore

There has been only one measure taken by IOTC that directly addresses the management of albacore. A resolution was approved during the 2007 meeting of the Commission which places a limit on the number of longline vessels targeting albacore (and swordfish). Specifically, all CPCs are requested to limit the number of their vessels greater than 24 meters, and less than 24 meters if they fish outside their EEZ for albacore in the IOTC area of competence, to the number of their vessels recorded by IOTC for 2007. The number of vessels is to be commensurate with the corresponding overall gross tonnage, and for any replaced vessel the overall tonnage is not to be exceeded. The measure also provides for any CPC with less than 10 vessels to submit a fleet development plan to the Compliance Committee of IOTC for review in 2008; the plans will be reviewed by the Commission and recommendations made regarding development, taking under consideration the advice of the Scientific Committee.

The status of the stocks of yellowfin, bigeye, and skipjack in the Indian Ocean is summarized in Table D-6.

5.3. Limiting fishing capacity

One of the first management concerns taken up within the IOTC had to do with fishing capacity.

Species	$B_{\text{current}} < B_{\text{MSY}}$	$B_{\text{current}} \approx B_{\text{MSY}}$	$B_{\text{current}} > B_{\text{MSY}}$
Yellowfin	$B_c < B_{\text{MSY}}$		
Bigeye			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$
Skipjack			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$
Albacore			$B_c > B_{\text{MSY}}, F_c < F_{\text{MSY}}$

TABLE D-6. Status of yellowfin, bigeye and skipjack in the Indian Ocean, where $B_c = B_{\text{current}}$ the current biomass and $F_c = F_{\text{current}}$ the current fishing mortality rate, and F_{MSY} and B_{MSY} are the corresponding values for levels when the population is at a level corresponding to the MSY.

During 1999 the Commission expressed concern that the level of fishing capacity of fleets operating in the tuna fisheries of the Indian Ocean may exceed sustainable levels. The Commission therefore expressed its desire to undertake action to limit the fishing capacity of large-scale fishing vessels, and requested that the Scientific Committee determine the optimum levels of fleet capacity for large-scale tuna fishing vessels and precise information on possible areas and times to prohibit unrestricted fishing with FADs. The recommendations of the Scientific Committee would be considered at the 2000 meeting of the Commission and appropriate action taken to limit fishing capacity. Unfortunately, the Scientific Committee reported back that it did not have all of the information necessary to make recommendations for optimum fleet capacity; therefore, no action to limit capacity was taken by the Commission.

The first directed action to limit fishing capacity was undertaken by IOTC during 2003. A resolution was approved directing CPC with more than 50 large-scale tuna fishing vessels on the

IOTC register of vessels to limit the number of their vessels to the number registered in 2003. The resolution also stipulated that the numbers shall be commensurate with the corresponding overall tonnage capacity of the fleets, and where vessels are replaced the overall corresponding tonnage is not to be exceeded.

In 2006, the 2003 resolution mentioned in the preceding paragraph was updated and was to apply to 2007-2009: CPC were requested to limit the number of their vessels greater than 24 meters, and less than 24 meters if they fished beyond the EEZ, to the number notified in 2006 to IOTC for inclusion in its vessel registry. Special provisions and exemptions were made for CPC with small fleets and which have plans for development, for example any CPC with less than 10 vessels may submit a fleet development plan to the Compliance Committee of IOTC for review in 2008; the plans will be reviewed by the Commission and recommendations made regarding development taking under consideration the advice of the Scientific Committee.

In 2007 the Commission approved a resolution requiring all CPC to limit the number of their vessels fishing in the IOTC area of competence for albacore and/or swordfish in 2007-2010 to the number listed in the 2007 IOTC register of vessels.

The purse-seine fleet operating in the Indian Ocean has continued to grow since first entering the fishery in the mid-1980s. In 1980 no large purse-seine vessels were fishing in the region, by 1985 capacity had increased to 25 thousand tons, by 1990 to 35 thousand, by 1995 to 55 thousand, and currently capacity is at about 65 thousand tons. Although no quantitative studies of whether excess capacity exists in the fleets fishing tuna in the Indian Ocean have been completed by the Commission, or its subsidiaries, outside sources have addressed the issue. The FAO Technical Advisory Committee on Fishing Capacity in 2005 undertook studies of fishing capacity which indicated that excess capacity existed in the purse-seine fleet fishing for tuna in the Indian Ocean. Additionally the Organization for the Promotion of Responsible Tuna Fishing (OPRT) concluded that the capacity of large-scale longline fleets needed to be reduced by at least 20 percent. This reduction applied to all oceans, and has nearly been completed.

Based on all of the foregoing information it would appear that there may be more capacity fishing in the Indian Ocean than needed to take the available catch and overall increases in fishing capacity may need to be restricted.

5.4. Effectiveness of the conservation and management measures in reducing fishing mortality

The IOTC has implemented a limited number of measures directed toward conservation of the species that fall within its mandate. What measures have been implemented are difficult to evaluate in terms of effectiveness. Additionally, the stock assessment analyses do not provide enough detail to know if the stocks being assessed are declining as a result of fishing and failure to enforce conservation measures, or to other causes, if indeed they are declining. In the case of bigeye, and the measure to limit catches to recent levels, it does appear that the CPC have complied with this measure, although this might have been a serendipitous effect of the excellent yellowfin fishing during 2003-2006. Total catches of bigeye during 2004-2007 are less than catches for 2000-2003 (117 and 126 thousand tons respectively), and the catch of Chinese Taipei in 2006 was 38.8 thousand tons, only slightly greater than the assigned limit of 35 thousand tons.

One factor contributing to the limited usefulness of stock assessment information to evaluate the effectiveness of the conservation measures is the shortcomings in the availability of data for the fresh fish longline fishery, the artisanal fisheries, the fisheries of Chinese Taipei, Yemen, and

Iran.

In essence, it is not possible to evaluate with any degree of accuracy the effectiveness of the conservation measures put into place by IOTC, although it is worth noting that, at the 2007 Meeting of the Commission, the outgoing Chairman stated that he thought that the IOTC was failing, and had failed since its inception, to fulfill its mandate of ensuring the sustainability of the tuna resources of the Indian Ocean.

5.5. Compliance and enforcement

Early in its history the IOTC recognized that for any conservation and management measures to be effective there would need to be developed a system of effective enforcement schemes to ensure compliance. The first actions along these lines taken by the Commission were at the 3rd Annual Meeting held in 1998 when it approved a resolution defining guidelines for the collection and submission of statistical data to IOTC for vessels fishing tunas in the Indian Ocean. Such information would be used to monitor fishing activities, form the basis for stock assessments, and evaluate compliance with conservation and management measures. Since the passage of that first resolution, the Commission has addressed the issue of compliance in each of its subsequent meetings. This issue of mandatory statistical requirements has been revisited at many of the Annual Meetings and resolutions approved to enhance the acquisition of essential data. At its 4th Annual Meeting the Commission elaborated the details of a control and inspection scheme for ensuring compliance; the scheme was further elaborated during a special meeting in 2001. The meeting resulted in guidelines, and in some cases the approval at subsequent annual meetings, of a number of measures such as control of at sea transshipments, at sea inspections by CPC, port controls, placing observers on fishing and carrier vessels, and requirements for VMS to improve compliance and enforcement. In 2008 the Commission approved a resolution to prohibit transshipments at sea except for large-scale tuna vessels that participate in the Commission's Regional Observer Program. CPC are requested by ICCAT to monitor unloading activities of tuna vessels in their ports, and to report to IOTC the results of that monitoring, particularly any suspected infractions of IOTC conservation and management measures. These aforementioned measures were enacted in part to control the "laundering" of tuna, particularly the reporting of Atlantic caught bigeye as being caught in the Indian Ocean (as much as 18 thousand tons of tuna was reported to be laundered by Chinese Taipei). Additionally, in an attempt to improve compliance, a bigeye statistical document is required by IOTC for any exported bigeye taken in the Indian Ocean. A resolution was also approved requesting CPC to place observers aboard 10 percent of their vessels to collect information regarding compliance with conservation and management measures. In an effort to improve compliance, provision has also been made by IOTC to implement if necessary non-discriminatory trade measures against states whose actions impair the effectiveness of the Commissions conservation and management measures.

In 2002 the Commission established a Compliance Committee whose functions are to review compliance with the conservation and management measures adopted by the Commission and to make recommendations to ensure their effectiveness, to review the implementation of measures for monitoring, control, surveillance, and enforcement, to develop and enhance the implementation of the IOTC control and inspection scheme, to review and recommend actions to control IUU fishing, and to consider the effectiveness of the IOTC statistical document program. The Compliance Committee reported to the Plenary on its first meeting held in 2003; it has held additional meetings since then and during each meeting it reviews the compliance of states with the Commission's conservation and management measures. At its most recent meeting the Compli-

ance Committee noted that not all CPC have approved national laws and regulations to enforce the recommendations of the Commission. The Commission has urged those CPC that have not instituted such laws to do so as quickly as possible. The Compliance Committee also recommended that all CPC require that a logbook or fishing record be kept on each vessel fishing in the Indian Ocean, and that such records be made available to the Commission. A resolution was approved regarding the logbooks, and a sample logbook was included in the resolution.

The Commission maintains a register of vessels authorized by their governments to fish in the IOTC area, which is termed the “positive list.” Any vessel that is not on the positive list that fishes in the area, or any vessel of a non-CPC that fishes in the area, or any vessel on the positive list that fishes in contravention to the conservation and management measures of IOTC, would be termed an IUU vessel and the intention would be to include it on the Commission’s “negative list.” In practice, it has proven much more difficult for the Commission to add a vessel to the IUU list. The Compliance Committee reviews information on suspected IUU vessels and provides advice to the Commission on which vessels should be considered IUU and included in the IUU list. The list of IUU vessels that the Commission maintains has varied between 6 and 15 vessels over recent years. The names and specifications of the IUU vessels are distributed to all CPC as well as other RFMO, and the flag state of the IUU vessels are allowed the opportunity to comment on their inclusion in the list and are encouraged to take remedial action that would allow removing their vessels from the list.

The IOTC has implemented a number of measures, which if followed, would ensure more effective compliance with the conservation measures. However, in their reviews, the Compliance Committee has indicated that many of the nations, both CPC and non-CPC, do not provide the types of information needed to monitor compliance. Only one CPC has report to the Commission on Port State Controls, hardly any have implemented the 10 percent observer coverage, and there have been few at sea inspections reported. Furthermore the Committee has noted that certain essential data on catch, effort and size composition, that is required under the mandatory data provision measures of IOTC, is lacking that it hinders the Scientific Committee in its stock assessments. Though the IOTC has implemented a number of measures regarding enforcement and compliance, which if followed by all CPC would ensure effective management, the CPC have been slow to enact them. In a recently completed performance review it was pointed out that the Commission has failed to implement effective means for monitoring, control and surveillance. With the exception of observers aboard transshipment vessels, few have been placed on fishing vessels, the VMS program has not been implemented, there have been few boarding and inspections reported, and catch documentation and tracking has been limited. It was also pointed out in the review that there are no procedures in any resolutions to address non-compliance by CPCs, and that the work of the Compliance Committee is hampered by poor communication among the CPCs regarding infractions against measure mandated in IOTC resolutions, and actions taken respecting sanctions, if any.