1. Development of world tuna fisheries

It is important to understand the general trends and any large changes in the history of world tuna fisheries before reviewing the catch trends of each species of tunas by gear and country. Therefore, a brief review of major historical developments is provided here. Trends in fishing and catches, by oceans, species, stocks, gears and countries, are reviewed in detail in later sections.

In this report, the term "catch" does not necessarily include all discards, while "landing" means reported landings, not including discards. Basically, only the five major species of tunas (albacore, bigeye, bluefin, skipjack and yellowfin) are included in the analysis of aggregated tuna catches in this study. Therefore, "major tunas" refer to these five species, unless otherwise noted.

At a recent meeting of the Coordinating Working Party on Fishery Statistics (CWP), it was decided that Atlantic and Pacific bluefin tuna are different species (*Thunnus thynnus* and *T. orientalis*, respectively). However, the statistics in the past have treated them as one species, and since their appearance is the same and treated as one species in the market, they are not separated in this analysis.

Southern bluefin tuna is dealt with in a separate section, as there is only one stock common to all three oceans; therefore, the species is not described in the sections for individual oceans.

Swordfish is not included in the aggregated catches, but is discussed as an individual species owing to its importance in the tuna fishery, as by-catch or as a target species. However, as information on swordfish in the Pacific is not complete, the species is not discussed for that ocean nor for the world.

As to the fleet, the distinction between "NEI" and "Others" should be clearly understood. "NEI" catches are those not reported, and hence are mostly estimates made by scientists using trade data and port sampling, while "Others" means reported catches by unknown or mixed countries. Since the NEI catches are by vessels of various flags but mostly of the same owners, and have a very specific meaning in relation to the conservation of tunas, they are treated as a country.

The longline fishery can be categorized into large-scale (pelagic) and small-scale (coastal) fleets. In this report, "large-scale" refers to longliners over 24 metres in total length, over 200 GT, and equipped with freezers. "Longline" generally refers to large-scale longline, unless specified as coastal, artisanal, etc., for which statistics are generally available only in aggregated form.

In the analysis and figures by gear, "major fishing gears" refers to longline, purse seine and baitboat. Other gears are included in "others", which also includes unclassified gears.

The "main fishing fleets" for the various species and oceans, referred to in the text and illustrated in the figures, are classified by their accumulative catches during the 1950–2000 period.

1.1 BRIEF REVIEW OF DEVELOPMENT OF TUNA FISHERIES OF THE WORLD

1.1.1 Pre-1950

Since the nineteenth century, and indeed since ancient times, tuna fishing has been carried out in many places in the world. These fisheries were local, and generally near

coasts. As most species of tunas are highly migratory, these fisheries caught tunas only at certain points in their life cycle, and thus had to be seasonal. They included, in the Atlantic, purse seining for bluefin off Norway, trolling for albacore in the Bay of Biscay, trap fishing in the Straits of Gibraltar and along the North African coast, fishing for bigeye and skipjack near islands and artisanal fishing along the coasts of Africa. Also, fisheries for swordfish have existed for a long time in the northwestern Atlantic and in the Mediterranean.

In the Pacific, there were various artisanal fisheries near islands in tropical waters, troll fisheries for albacore and baitboat fisheries for yellowfin and skipjack off the west coast of the United States of America, baitboat fisheries for skipjack near Japan, and many other fisheries for various tunas along the coasts of Japan. Coastal fisheries using baitboats and small seine nets existed off South America. In the Indian Ocean, fisheries for skipjack existed off Sri Lanka, India and the Maldives, and southern bluefin tuna were the target of longline fishing off Australia.

Besides the above, many artisanal fisheries for tuna-like fishes[1] existed in tropical or subtropical areas all over the world.

1.1.2 1950s

As a result of increasing demand for tuna for canning, industrial fisheries started during the 1940s and 1950s. In the 1950s, the major fisheries consisted of Japanese longliners and baitboats in the Pacific and United States baitboats off California and along the coasts of Mexico, while other traditional fisheries continued. After the Second World War the Japanese tuna fishery was limited to areas near its coast until 1952, but thereafter the fishery, particularly the longline fishery, expanded its fishing area very rapidly, and in the late 1950s reached the Atlantic Ocean.

Also, in the late 1950s, some European baitboats, based in local ports, started fishing off the African coast.

1.1.3 1960s

Spanish and French baitboats and purse seiners started fishing for tunas off tropical West Africa, and were joined by Japanese baitboats. Also, Japanese longliners expanded their fishing area all over the world, still targeting mostly albacore and yellowfin for canning. In the middle of this decade, the Republic of Korea and Taiwan Province of China started large-scale longline fisheries, learning the techniques from Japan, for exporting tuna to the canning industry. At the end of the decade, the Japanese longline industry developed extremely cold storage systems, which established new frozen products for the *sashimi* market, and consequently started to change their target species from yellowfin and albacore to bluefin and bigeye tunas.

In the Pacific, the US baitboat fishery off Central and South America was almost completely replaced by purse seiners, which developed a new fishing method, called dolphin fishing. Schools of yellowfin tuna associated with dolphins, a phenomenon observed only in the eastern Pacific, were their major target, and speedboats were used to chase the tuna into the net, together with the dolphins.

1.1.4 1970s

The purse-seine fishery by European nations in the tropical eastern Atlantic developed quickly, targeting yellowfin and skipjack.

Although the purse-seine fishery in the tropical eastern Pacific also continued to develop, strict regulations aimed at reducing the incidental mortality of dolphins in the fishery in this area led to US vessels changing flags to Central and South American

[1] Includes all the species in FAO category 6 (tunas, bonitos and billfishes) except the major species analysed here (e.g. marlins, king mackerels, wahoo).

countries, and also some of their effort shifted the central western Pacific, where there is no dolphin fishing.

After the development of super-cold storage, the longline fishery gradually changed its target from yellowfin and albacore for canning to bigeye for *sashimi*. This shift was first seen among Japanese longliners only, but gradually expanded to the Korean and Taiwanese fleets. In order to catch adult bigeye, which live at much greater depths than yellowfin and albacore tunas, the hooks were set deeper and deeper (so-called "deep longlines"). This change in fishing strategy greatly affected the fishing areas and seasons, and the species compositions of catches, including by-catch species.

1.1.5 1980s

A new purse-seine fishery started in the western Indian Ocean, and an important portion of the fishing effort in the eastern Atlantic, particularly French purse seiners, moved to the Indian Ocean. In the Pacific Ocean, the purse-seine fishery expanded its fishing area, particularly in the central western Pacific. The efficiency of purse-seine fishing increased with the use of new equipment such as bird radar and helicopters.

During this decade, many new countries entered the large-scale industrial fisheries, mostly with purse seiners (e.g. Brazil, Mexico and Venezuela). Small-scale longline fishing operations also started in coastal countries in various areas (e.g. Mediterranean countries, Indonesia and the Philippines).

For the large-scale longliners, the Japanese and Korean fleets started to decrease in size, whereas the Taiwanese and "flag of convenience" (FOC) fleets increased rapidly. During this period, regional fishery management organizations introduced many management and regulatory measures for tuna fisheries, which affected fishing patterns and the distribution of catches among countries.

1.1.6 1990 to present

More and more management measures have been introduced, and illegal, unreported and unregulated (IUU) fishing practices have increased. IUU fishing became a major problem for the proper management of fisheries resources. In general, tuna-fishing capacity, including IUU vessels, increased extensively during this decade. Recent increases in catches have sometimes caused over-supply to the market, particularly for skipjack.

Small-scale longline fishing increased extensively, while the legal longline fishing industry started to limit its capacity.

Purse seiners started fishing with fish-aggregating devices (FADs) in the Atlantic in the early 1990s, and this method expanded to the Indian and Pacific Oceans. The FAD fishery is less selective than other fishing modes with regard to the species and size of the fish caught. Fishing efficiency, the size of the fish taken, the species compositions of the catch, and the by-catch of species caught incidentally have all changed drastically with the adoption of this fishing method.

Starting in the 1980s, and increasingly in the 1990s, many coastal states, in all oceans, started new tuna fisheries by chartering FOC boats. Some of these vessels changed flag to the coastal state that chartered them, and possibly this tendency will be intensified in the near future. Partially due to the development of these new coastal fisheries, the fishing effort by traditional longline countries started to decline.

In this decade, tuna farming (keeping tuna in captivity for a short time for fattening purposes) started as a new industry. This business resulted in increasing price and demand for specific sizes and species of tunas, and hence affected fisheries to a great extent: the relatively small tunas taken by purse seiners that used to be sold only to the canning industry can be now converted to products for the sashimi market. Currently, the main species used in farming is bluefin tuna, but the practice is spreading to bigeye and yellowfin tuna.

1.2 DATA SOURCES AND PREPARATION

The data sources used for this study vary among oceans. As far as possible, data prepared by regional agencies, such as the International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), Inter-American Tropical Tuna Commission (IATTC), Secretariat of the Pacific Community (SPC), Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and Interim Scientific Committee on Tunas and Tuna-like Species in the North Pacific (ISC), as of October, 2002 were used. The FAO database (FISHSTAT PLUS) and national statistics were used to provide missing data. The individual data source for each region is discussed in the corresponding chapter. In principle, the 1950–2000 period is covered by these data.

In this report, the borders between oceans follow the decision by the CWP. Each ocean includes all adjacent seas (e.g. the Atlantic Ocean includes the Mediterranean Sea).

The data are analysed by species, gear and country. Often, particularly for the Pacific, data are not available by gear, region and/or country, but only in aggregated form, and hence the sum of each category may not match to the total catches by species.

1.3 GENERAL TRENDS

Figures 1.1 and 1.2 show the combined reported catches of the major tuna species in three oceans, cumulatively and separately, from 1950 to 2000. The data for 1950 and 1951 might be incomplete, and those for 1999 and 2000 are still incomplete and tentative.

The total catch increased steadily from about 400 000 metric tons (tonnes) in 1950 to almost 4 million tonnes in 1999. Figure 1.2 shows that the catches in the Pacific have been predominant throughout the period. Both the Pacific and Indian Ocean catches have shown rapid increases in recent years, except for the last one or two years. However, the data for 2000, and possibly 1999 as well, are still incomplete. The rate of increase for the Atlantic catch is much slower than those of other oceans, and in fact the catches from the Indian Ocean have exceeded those from the Atlantic since 1989. Currently, the Atlantic, Indian and Pacific Oceans produce about 15, 20 and 65 percent, respectively of the total catch. It should be noted that catches of Atlantic bluefin, bigeye and albacore and eastern Pacific yellowfin and bigeye have been under some restrictions, while such regulations do not exist in other oceans, except for southern bluefin tuna.

FIGURE 1.1
World catches of major tuna species, cumulative, by oceans

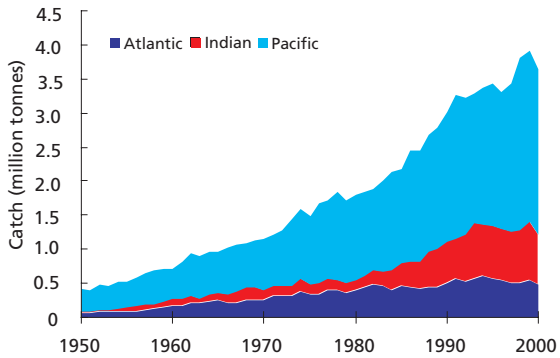
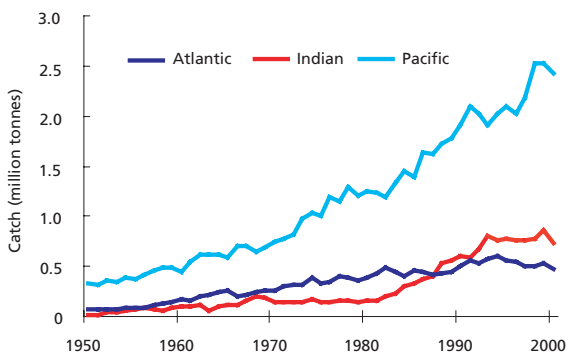


FIGURE 1.2
World catches of major tuna species in three oceans



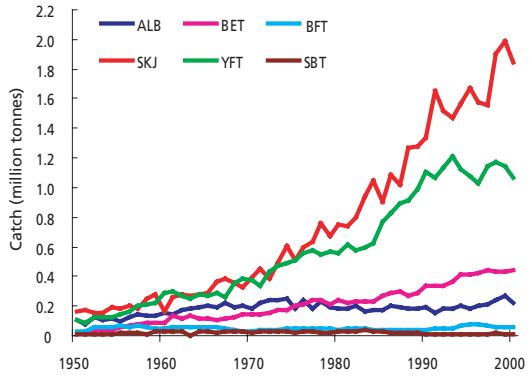
1.4 CATCH BY SPECIES

Figures 1.3 and 1.4 show the combined world catches of the major species of tunas and their composition by species, respectively. Since the late 1960s, the largest component by far has been skipjack, followed by yellowfin.

Catches of both species have shown rapid increases throughout, but those of yellowfin seem to have levelled off in the 1990s at 1 to 1.2 million tonnes (over 25 percent of

the total), while catches of skipjack are still growing, reached a record of 2 million tonnes in 1999 (almost 50 percent of the total). Bigeye catches also showed a constant increase, although at a much lower level than those of yellowfin and skipjack. The catches of albacore, bluefin and southern bluefin have been stable or decreasing, at much lower levels in the case of southern bluefin.

FIGURE 1.3
World catches of major tuna species, by species



1.5 CATCH BY FISHING GEAR

Figure 1.5 shows the combined world catches of major tuna species by the three main fishing gears (purse seines, baitboats, and longlines). The purse-seine catches show the largest increase, from almost nil in 1950 to 2.2 million tonnes in 2000. They became significant only in the late 1950s, and increased at an accelerating rate until 1990, after which the rate of increase showed some slowing down. Purse seines fish mostly in the tropical waters of the three oceans, targeting yellowfin and skipjack, but bigeye catches have become significant in recent years.

Baitboat catches used to be the greatest during the 1950s, but were overtaken by longline catches in the 1960s. In the 1970s they increased sharply, exceeding longline catches again, and have stabilized at about 500 000 tonnes since then.

Longline catches started picking up in the late 1950s, increased gradually until 1990, then rose relatively sharply until 1993, and thereafter have been declining. The earlier catches were almost exclusively by industrial offshore (pelagic) longliners of Asian countries, while the recent increase came from the development of coastal small-scale longliners. Longliners used to target yellowfin and albacore, but now most of the pelagic longliners target bluefin, southern bluefin and, more importantly in terms of quantity, bigeye.

FIGURE 1.4
Composition of world tuna catches, by species

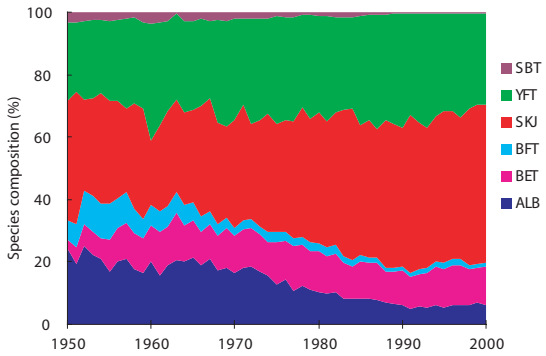
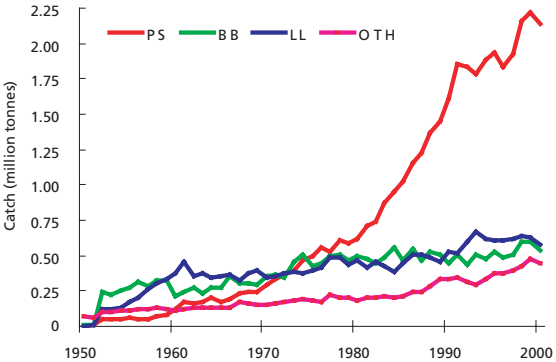


FIGURE 1.5
Combined world catches of major tuna species, by fishing gear

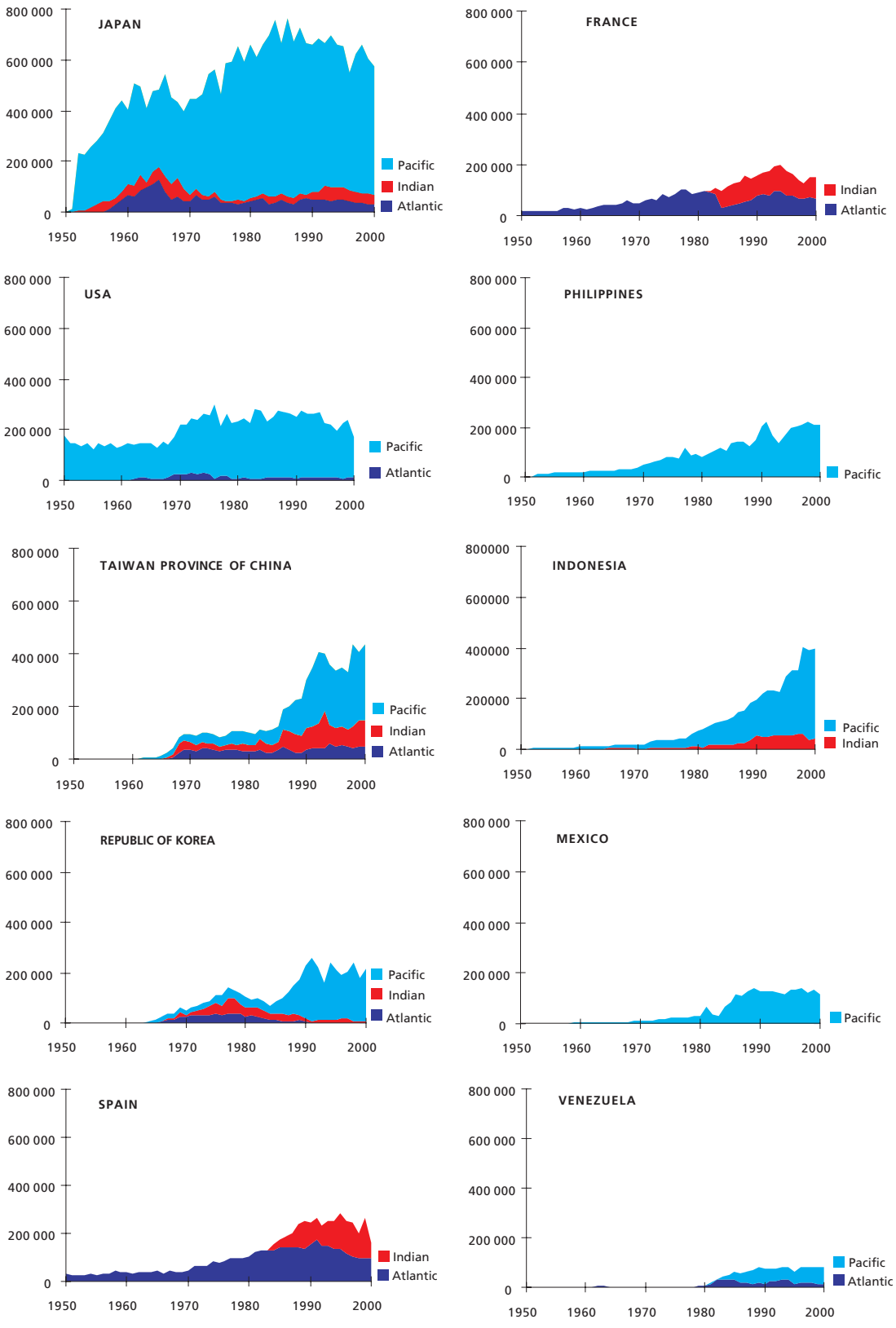


Recent increases in the catches of "other" fisheries are due to the increase in catches by artisanal fisheries (e.g. trolling, gillnet, handlines and miscellaneous unclassified gears) developed in coastal and island areas.

1.6 CATCHES BY COUNTRY

The combined catches of the five main tuna species (albacore, bigeye, bluefin, skipjack and yellowfin) from the world oceans during 1950–2000 by the ten main fishing fleets are shown in Figure 1.6.

FIGURE 1.6
Combined catches of major tuna species, cumulative, by oceans, by the ten main fishing fleets, 1950–2000 (tonnes)



Japanese catches are by far the largest, and the great majority of these are from the Pacific. They show a sharp increase from the 1950s to the mid-1960s, reaching a first peak of about 550 000 tonnes in 1965, resulting from the increased catch in the Atlantic Ocean by longliners and baitboats. The Atlantic catch then declined, particularly after the baitboats based in Tema, Ghana, retired from the fishery, and the total catch declined until 1970. It then started increasing again until the mid-1980s to a second peak of about 750 000 tonnes, mostly due to the increase in the catches in the Pacific by purse seiners and baitboats. Since the mid-1980s the catch has declined. Overall, the Japanese share of the catch has been declining, as the total world catch has been increasing at a higher rate than the Japanese fishery.

United States catches were quite stable until the late 1960s. They started increasing in the early 1970s as the purse-seine fishery developed in the eastern tropical Pacific, and then stabilized again at a level of about 200 000 tonnes, in part because many US-built boats were sold to other countries during this period.

Taiwan Province of China started longline fishing only in the late 1960s, and increased its catch rapidly in all three oceans. During the 1970s and 1980s, its catch stabilized at a level of less than 100 000 tonnes. In the late 1980s it increased sharply to over 300 000 tonnes, due to the initiation of a purse-seine fishery and the expansion of its longline fleet. In the 1990s the level remained slightly below 400 000 tonnes. The fleet has been operating in all three oceans, but the share of the catch from the Pacific has increased in recent years.

The **Republic of Korea** also started fishing in the 1960s with longliners, and its catch increased rapidly until the mid-1970s, fishing in three oceans. As the longline activity was reduced, the catch declined as well until 1985, when the purse-seine fishery started in the Pacific. Consequently the catch jumped up to the level of 100 000 tonnes, and has been maintained at that level.

Spain and **France** show very similar trends. Until the early 1980s, their catches were limited to the Atlantic; then their purse seiners established fisheries for tropical tunas in the western Indian Ocean, and their catches almost doubled.

The **Philippines** and **Indonesia** show very similar patterns of the growth of catches. Since 1970 their catches have increased steadily, and recently were near 200 000 tonnes and 400 000 tonnes, respectively. The Philippine catch comes mostly from the Pacific, while Indonesian catches come from the Pacific and Indian Oceans.

Mexico and **Venezuela** also had traditional (artisanal and some industrial) fisheries, mostly in the Atlantic, but with very low catch levels. Since the early 1980s their catches have increased rapidly in the eastern Pacific.