

4. Development of the Pacific tuna fisheries

4.1 DATA SOURCES AND PREPARATION

Various data sources for the Pacific were used in this study. The reason is that there are various regional fisheries bodies covering tuna statistics: IATTC for the eastern Pacific (east of 150°E), SPC for the central western Pacific (west of 150°E, but excluding northern albacore and Pacific bluefin tuna and southern bluefin tuna), and ISC (Pacific bluefin and northern albacore).

IATTC Annual Reports and the SPC Tuna Fisheries Yearbook 2000 were used for the eastern and central western Pacific tuna data. Data are available for 1952–2000 for most of the major species. However, catches by country are not available for all countries until 1980. Therefore, for the 1952–79 period, the FAO FISHSTAT-PLUS database was used for those countries for which data are missing. As FAO data have no breakdown by fishing gears, some assumptions have had to be made in some cases.

Japanese bigeye catch data before 1962 are also not available. The data for 1952–61 were taken from the FAO database, and hence the breakdown between eastern and western Pacific was not available. Also, those data were assigned to longline catches, though the gear breakdown was not available. For northern albacore and Pacific bluefin, the major source was the data presented at the ISC.

As many of the data were taken from different sources and the data aggregations (by fishing gear, country and area) are different between data sources, the annual sum of catches by country, fishing gear and area do not match exactly the total catches reported by species. However, for most of the cases, the discrepancies are minor.

Most of the figures are landings data, including minor amounts of discards that were reported. The data for recreational fishing that were reported are included. Swordfish data for the Pacific are not very complete and accurate, and hence no swordfish section was prepared for the Pacific.

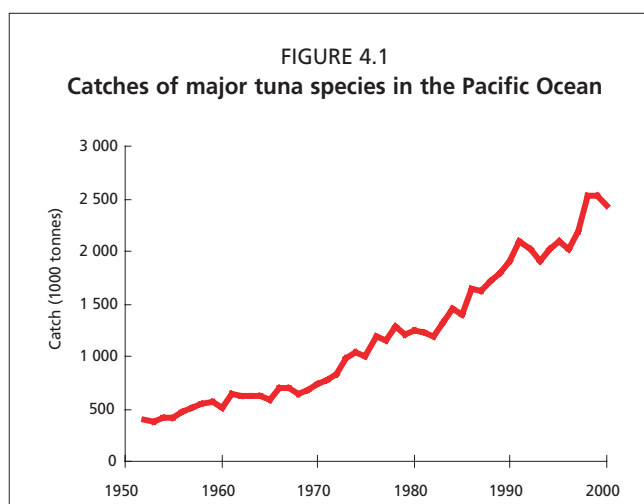
4.2 GENERAL TRENDS

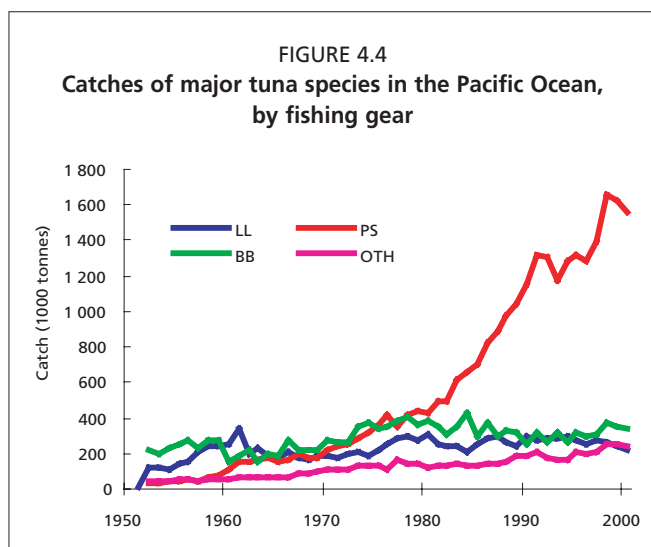
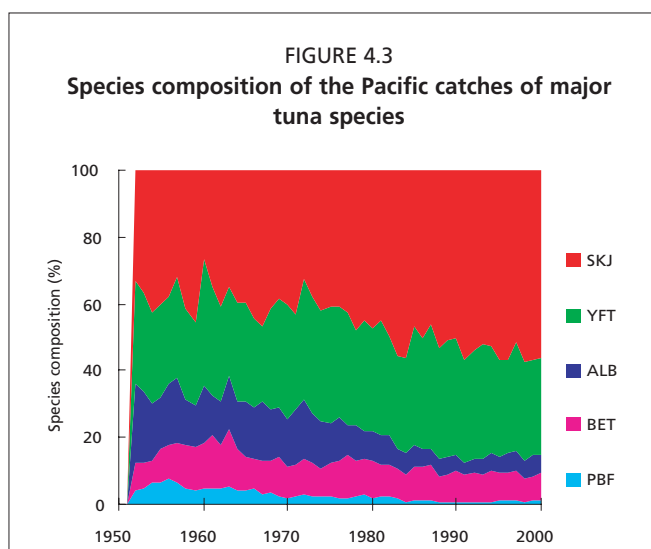
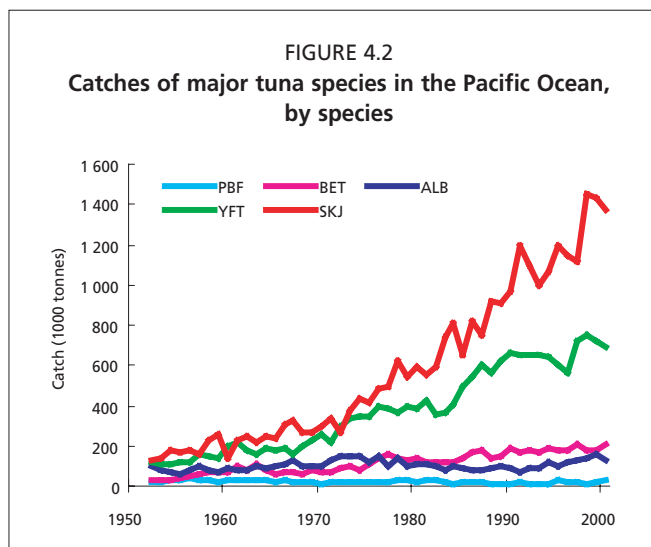
4.2.1 Total catch

Figure 4.1 shows the combined reported total catches of the major tunas for 1952–2000. The catch increased steadily from about 400 000 tonnes to a peak over 2 500 000 tonnes in 1998.

4.2.2 Catch by species

Figure 4.2 shows the catches in the Pacific by species, and Figure 4.3 the percentage species composition of the catch. The skipjack catch has been the largest almost throughout the period, and its share of the catches has increased from 35 to 50 percent. The next biggest catch is of yellowfin; it has been





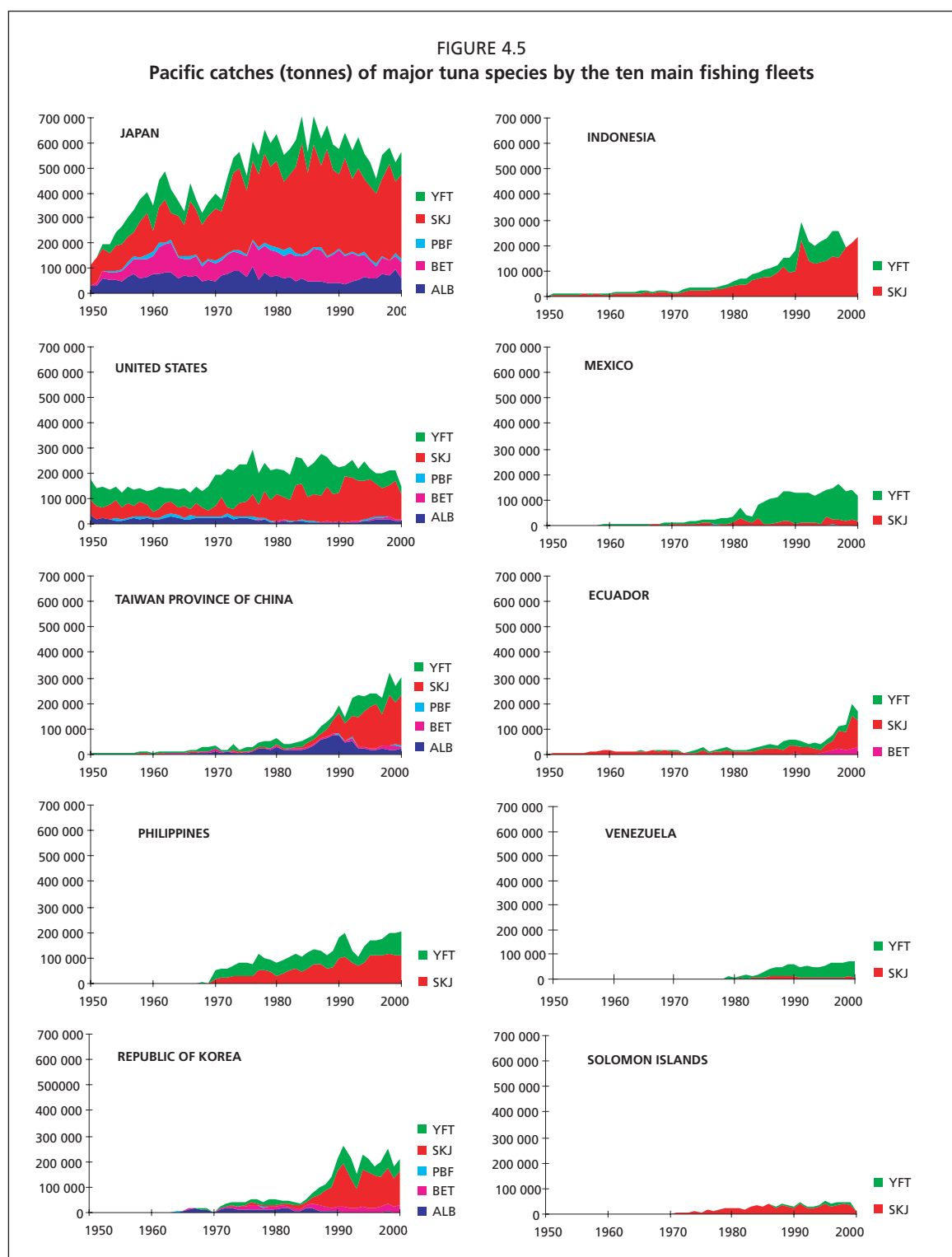
increasing, and its share has remained stable at about 30 percent. The albacore catch has been stable, and hence its share has decreased. The bigeye catch has increased steadily, and its share has been stable at about 10 percent or slightly more. The bluefin catch has fluctuated very widely, while its share has declined steadily through the period.

4.2.3 Catch by fishing gears

The catches of the main tunas in the Pacific during 1952-2000 are given in Figure 4.4. Until the early 1960s, baitboats caught the largest quantities of tunas, particularly skipjack and, to a lesser extent, yellowfin. In the eastern tropical Pacific, purse-seiners replaced baitboats during the 1960s, while in the central-western Pacific this did not happen until much later, and then only partially. Consequently the purse-seine catch increased very rapidly, from almost nil in 1950 to 1 700 000 tonnes in 1998, and since the 1980s has dominated the catches by all other gears; it now accounts for 60 to 70 percent of the total, both in the central-western and eastern Pacific. Most of the purse-seine catch consists of skipjack and yellowfin. However, baitboats are still important in the Pacific, unlike in other oceans: they are mostly traditional Japanese baitboats fishing for skipjack in the central-western Pacific.

The longline catch increased during the 1950s, and stabilized during the 1960s and early 1970s at around 150 000 tonnes. During this period there was a major change in the operational pattern of longline fishing, from targeting fish for the canning industry to targeting fish for the *sashimi* market. This became possible because of the development of super-cold temperature storage (below -40°C) for fishing vessels. The hooks were also set at much greater depths after the change. This change caused some decrease in catch, since the catch

rate for high-value tuna for *sashimi* is lower than that of low-value tuna for canning, but this decrease was compensated by the increasing trend in fleet size. Between the mid-1970s and early 1980s, the longline catch started increasing again due to the rapid development of new fleets such as those of Taiwan Province of China and the Republic



of Korea, as well as coastal longliners, and thereafter it has been stable at about 200 000 tonnes. Other fishing gears include traps, trolling, handlines and gillnets; also, many artisanal fisheries with unclassified gears have been conducted in the island states and in Southeast Asia.

4.2.4 Catch by country

The combined catches of the main tuna species from the Pacific Ocean during 1950–2000 by the ten main fishing fleets are shown in Figure 4.5. **Japan** has been the leading

nation in the tuna fisheries in the Pacific throughout the period. Its catches increased from 1952 to 1960, then stabilized at the level of about 300 000 to 400 000 tonnes. In the 1970s they started increasing again until the mid-1980s, to a maximum of nearly 700 000 tonnes. Since the late 1980s they have been declining. The catches include yellowfin, albacore, bluefin and bigeye by longliners, yellowfin, skipjack and bluefin by purse seiners, and skipjack and albacore by baitboats. In terms of quantity, skipjack constitutes more than 50 percent of the total catch.

The **United States** catch, mostly yellowfin and skipjack by baitboats in the eastern tropical Pacific, was stable at 100 000 to 150 000 tonnes during the 1950–60 period. However, when purse seiners replaced baitboats in the late 1960s and early 1970s, the catch started to increase, until the dolphin mortality associated with the fishery was restricted in the mid-1970s. Thereafter the catch has levelled off. Due to the problems of dolphin mortality and of the lower catch rates experienced during the El Niño in the early 1980s, an increasing part of the purse-seine fleet fishing in the eastern Pacific moved to the central-western Pacific, and now almost all the United States catch comes from the central-western Pacific.

The **Philippines**, **Indonesia** and the **Solomon Islands** started artisanal fisheries, mostly coastal longline fishing, in the 1970s, and those catches have been continuously increasing. **Taiwan Province of China** and the **Republic of Korea** started longline fisheries for yellowfin and albacore in the 1970s and 1980s, and the catch gradually increased, but since they started purse-seine fishing for skipjack and yellowfin in the 1990s the catch has increased rapidly.

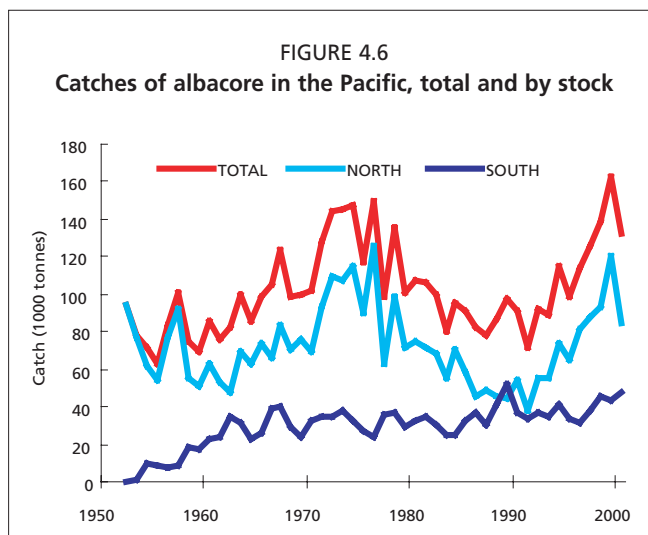
In the eastern tropical Pacific, **Mexico**, **Ecuador**, **Venezuela** and **Vanuatu** started purse-seine fishing in the 1980s, using former United States and/or Spanish vessels. Their catch has been increasing rapidly in recent years.

4.3 ALBACORE

4.3.1 General overview

It is considered that there are two stocks of albacore in the Pacific, one each in the southern and northern hemisphere; the species is not found in equatorial waters. The size of fish caught depends on the area of fishing, as the distribution of this species changes with age. Large adults inhabit tropical and subtropical waters between 25 °N and 25 °S, and small to medium fish are found at higher latitudes. Tagging data indicate that juvenile fish make extensive long-distance east-west migrations, and that they return to the spawning grounds in tropical and subtropical waters when they reach maturity. Spawning takes place where the sea-surface temperature is 24 °C or higher. Albacore are mainly caught by longlines, baitboats, trolling and gillnets. Medium- to large-sized fish are caught by longline; baitboat, troll and gillnet fisheries, operating mostly in temperate waters, catch small to medium fish.

The longline fishing grounds for albacore are widely distributed in the vast area of the ocean between 40 °N and 40 °S, except the area between 10 °N and 5 °S. There are two types of longline fleet, large-scale and small-scale. The Japanese baitboat fleet has been actively catching albacore in the temperate waters from south of Japan to north of the Midway Islands. Trollers from the United States and Canada operate in similar latitudes



from north of the Midway Islands all the way to the west coast of North America. New Zealand and United States trollers have fished in temperate waters near the subtropical convergence zone in the southern hemisphere east of New Zealand. These surface fisheries operate during summer in each hemisphere, while longline fishing grounds in temperate waters are active during the winter season.

The total catch of albacore from the whole Pacific Ocean (Figure 4.6) was high, at about 140 000 tonnes, during the mid-1970s and during the most recent few years (1998–99), and lower during the 1950s and 1980s. Since the catch in the southern Pacific has been relatively stable around 30 000 to 40 000 tonnes and less than that for the northern Pacific, the trend in the total Pacific catch is a reflection of the northern Pacific catch, having fluctuated from 40 000 tonnes to over 180 000 tonnes.

Northern stock

The catch from the northern stock has been always higher than that from the southern stock, with the exception of 1990. The northern catch has relatively wide fluctuations: it varied between 50 000 and 100 000 tonnes in the 1950s and 1960s, then went up to almost 130 000 tonnes in 1977, but thereafter showed a sharp decline until the early 1990s. After hitting the bottom of 30 000 tonnes in 1992, it started to increase sharply, and recorded the highest catch in 1999.

Southern stock

The southern catch went from almost nil to around 30 000 tonnes by the early 1960s, and was stable at that level until the late 1980s. The highest catch of 50 000 tonnes was recorded in 1990, but has declined again to the level of a little less than 40 000 tonnes since then.

4.3.2 Catch by fishing gears

For the northern stock of albacore, the baitboat catch was the largest component until 1987 (Figure 4.7). The large increase in catch during the mid-1970s was due to the increase of the catch by this fishery. However, the baitboat share declined, and the longline catch has exceeded the baitboat catch since the late 1980s. The troll catch has also shown some decline since the mid-1970s. The catch by all gears except drift gillnets has shown concurrent increases since the early 1990s.

For the southern stock (Figure 4.8), more than 90 percent of the total catch has been taken by the longline fishery, except from the mid-1980s to early 1990s, when the drift gillnet catch dominated. The troll catch has increased during recent years, but has never exceeded 10 000 tonnes.

FIGURE 4.7
Catches of albacore in the North Pacific,
by fishing gear

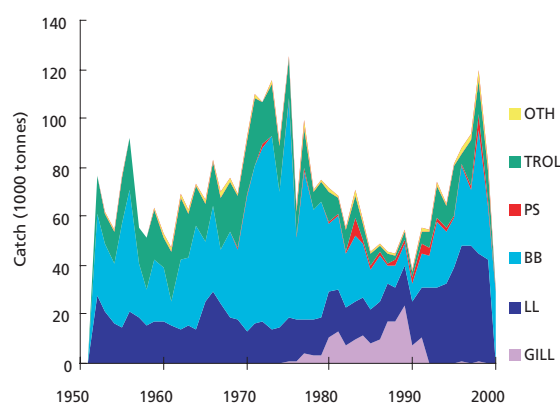
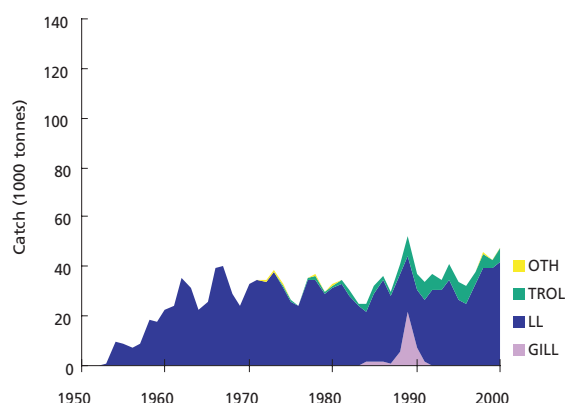


FIGURE 4.8
Catches of albacore in the South Pacific,
by fishing gear



Longline fishing

The largest longline fleet has been operated by Japan. Its area of fishing has expanded since 1952. Initially, its target species were albacore and yellowfin for the canning industry.

Since the early 1970s, the fleet has shifted to targeting bigeye. The major reason for this was the increased demand for raw fish (sashimi) and the development of super-cold freezers for longliners, with which it became possible to freeze fish for sashimi-quality products. This tendency was more prevalent among the larger vessels, and they have operated in the eastern Pacific Ocean east of 160°W, while the small- to medium-sized boats have remained in the central-western Pacific.

The Korean longline fleet has been fishing in the tropical area of the central-western Pacific, while the Taiwanese longline fleet fished in the tropical to temperate waters of the southern hemisphere, where it targeted albacore.

Small-scale longline fisheries have been developed in various island states, using small boats that operate in the vicinity of their home countries. Such fisheries are found in Fiji, French Polynesia, American Samoa and Hawaii. China and the Federated States of Micronesia also operate such fisheries in the tropical western Pacific, but their albacore catch is very minor.

Troll fishery

The United States and Canadian troll fisheries in the North Pacific have a long history. Fishing takes place during the summer in the area that extends from north of the Midway Islands to off Canada. In the South Pacific, New Zealand and US boats have operated during the past 10 to 20 years. The fishing ground is generally located in the subtropical convergence zone between New Zealand and 140°W. The fishery catches pre-adult fish that are consumed canned.

Baitboat fishery

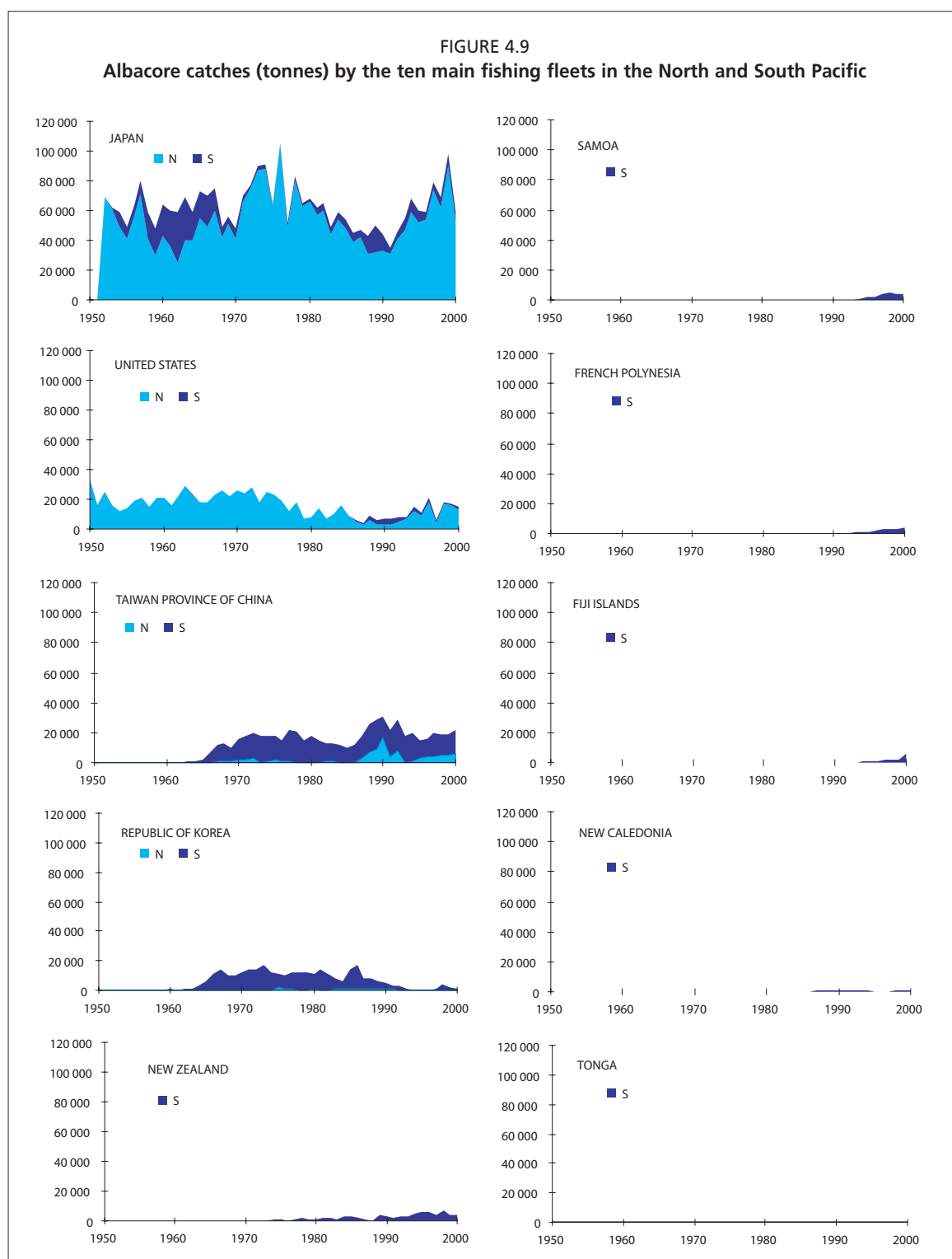
Japan has operated a baitboat fishery in the western North Pacific for a long time. The fishing season is between May and October. Fishing starts to the south of Japan and gradually moves northeast. These boats also target skipjack, and switch target species from time to time, depending on the fishing and market conditions. The fish caught are mostly medium-sized (60–90 cm).

Other fisheries

Until the United Nations ban on high-seas drift gillnets became effective in 1992, a large-mesh drift gillnet fishery had existed in the temperate waters of the North Pacific since 1970s to 1991. In the South Pacific, a similar fishery had operated since the late 1980s, mostly in the Tasman Sea. Both these fisheries were operated by Japan, the Republic of Korea and Taiwan Province of China.

4.3.3 Catch by country

The albacore catches from the Pacific Ocean during 1952–2000 by the ten main fishing fleets are shown in Figure 4.9. The **Japanese** catches of albacore came mostly from the northern stock, and have two peaks at about 100 000 tonnes, one around the mid-1970s and the other around 2000, and two troughs at about 40 000 to 50 000 tonnes, one around 1970 and the other around 1990. The **United States** catch came mostly from the northern stock, and has been stable at around 20 000 tonnes except for a decline during the 1980s. The **Taiwanese** catch is minor in the north but relatively high in the south. It started in the mid-1960s, and is stable around 20 000 tonnes with some peaks around 1990 reflecting increases in the northern catch during that time. The **Korean** catch is almost exclusively from the south, and occurred mainly during 1965–90 at the level of about 10 000 tonnes. **New Zealand** has been catching albacore at a level of a few



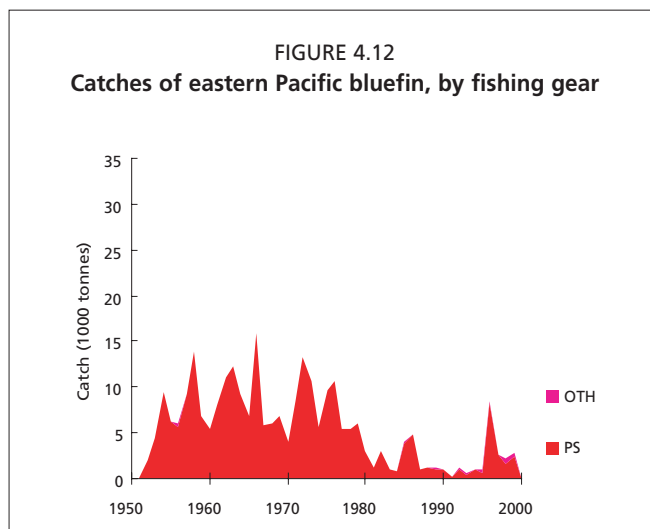
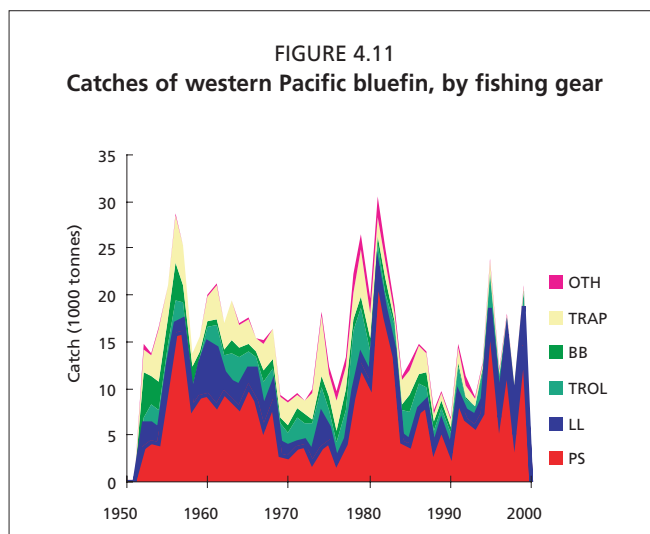
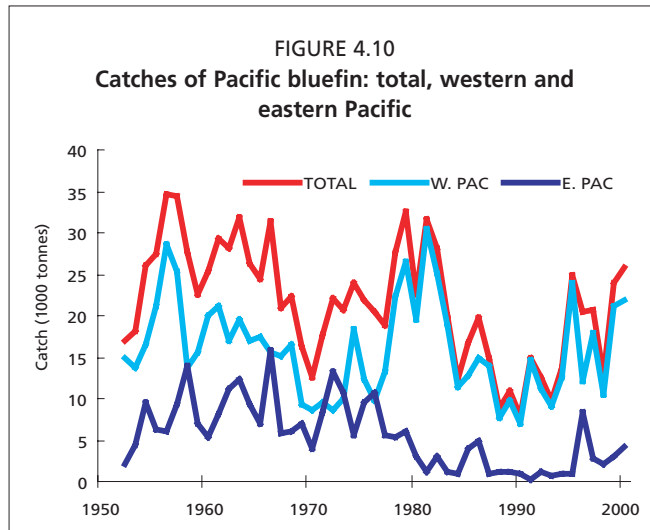
thousand tonnes since the mid-1970s. Starting in the mid-1990s, South Pacific island countries such as **Samoa**, **French Polynesia**, **Fiji**, **New Caledonia** and **Tonga** have been increasing their catches, though the level is still minor.

4.4 PACIFIC BLUEFIN TUNA

4.4.1 General overview

The spawning grounds of Pacific bluefin are assumed to be between the Philippines and southern Japan as well as in the Sea of Japan. No larvae have been reported in any

other areas of the Pacific. Juveniles move northward from the spawning grounds and become available for the coastal troll fishery in the southern Japan at a size of about 20 cm. They make north-south migrations as they grow. Some fish undertake trans-Pacific migrations to the eastern Pacific when they reach about one or two years of age. These fish are thought to return to the western Pacific after one or two years.



Adults appear to be distributed mainly in the north-western Pacific, but some are known to occur in other waters, since sporadic catches are recorded by the longline fishery in the far offshore area east of Japan and north of Hawaii, as well as off southern Australia and around New Zealand. Therefore, it is considered that there is only one stock in the entire Pacific Ocean.

The major fishing grounds for Pacific bluefin are located at the middle latitudes of the North Pacific between 20°N and 45°N in the west and between 23°N and 33°N in the east. In the northwestern Pacific, catches have been made by various gears in the waters from eastern Taiwan to northeastern Japan, including the East China Sea between Japan and the Republic of Korea and the Sea of Japan. In the eastern Pacific, bluefin are caught off Baja California and southern California, by purse-seine and sport fisheries.

The total catch for the whole Pacific Ocean since 1952 (Figure 4.10) has shown large fluctuations between 10 000 tonnes and 35 000 tonnes with lower catches during early 1950s, late 1960s to mid-1970s, and after the mid-1980s. The declines of catch seen before the 1980s were due to the decreased catches in the western Pacific but the decline after the mid-1980s was attributed to the very low catch in the eastern Pacific. The catch in the western Pacific generally exceeded that in the eastern Pacific. This is especially true for the years since 1980, as the eastern catch declined to a low level.

4.4.2 Catch by fishing gear

Both in the eastern and western Pacific, the largest catch has been made by the purse-seine fishery, followed by the longline, baitboat, troll and trap fisheries (Figures 4.11 and 4.12).

Longline fishery

Longline fishing targeting Pacific bluefin takes place only in the western Pacific. The Japanese longline fishery has the longest history, dating back nearly a hundred years. In general, the fishing season for small-scale longliners near Japan is summer in northern Japan and winter-spring in southern Japan. Until the 1970s, the catch by this fishing sector was significant. The catches by Taiwanese longliners were not significant (less than 700 tonnes) until 1996, but have gone up since then, reaching a record high of nearly 3 000 tonnes in 1999. These are large spawning-size fish, caught by coastal longliners in the waters around Taiwan Province of China and the Philippines between 122°E and 124°E. The fishing season starts in April and ends in June. The majority of the catch is exported to Japan.

In addition to these fisheries, there are some catches made by local longliners in Hawaii, Australia, New Zealand and other islands. The catches by these fleets have been very minor. Also, many Japanese large-scale longliners have fished in almost the entire Pacific except for the high latitudes of the central to the eastern Pacific in the southern hemisphere, targeting other species such as bigeye and yellowfin. Some sporadic catches of Pacific bluefin have been reported by these vessels fishing in these vast areas. Among those, relatively significant catches have been recorded in the North Pacific between 25°N and 35°N, as well as off Australia and New Zealand between 25°S and 40°S.

Purse-seine fishery

The largest Pacific bluefin catches are made by purse seiners in both the western and eastern Pacific. The largest purse-seine fishery is in Japan; it targets skipjack, yellowfin and Pacific bluefin around Japan, and a fishing unit is normally formed by a seiner plus scouting and transport boats. On the Pacific side of Japan, the season starts in June off central Japan and moves northeast as the season progresses, ending in early November in the waters between 35°N and 40°N. Generally, Pacific bluefin are not the most important species in terms of weight, but are probably most important in terms of value because of the high price paid for Pacific bluefin. Since 1981, a purse-seine fishery has operated in the Sea of Japan between 127°E and 136°E during the summer, as well as in the Tsushima Strait and East China Sea, mostly during fall to winter. The fish caught in the summer are generally adults, and those caught in winter are mostly juveniles (ages 0 to 2). The Korean purse-seine fleet has also been fishing since the mid-1980s in the waters between the Republic of Korea and Japan, as well as in the Yellow Sea, catching juveniles less than 100 cm long. The fishing season lasts from January to July, with the peak in March and April.

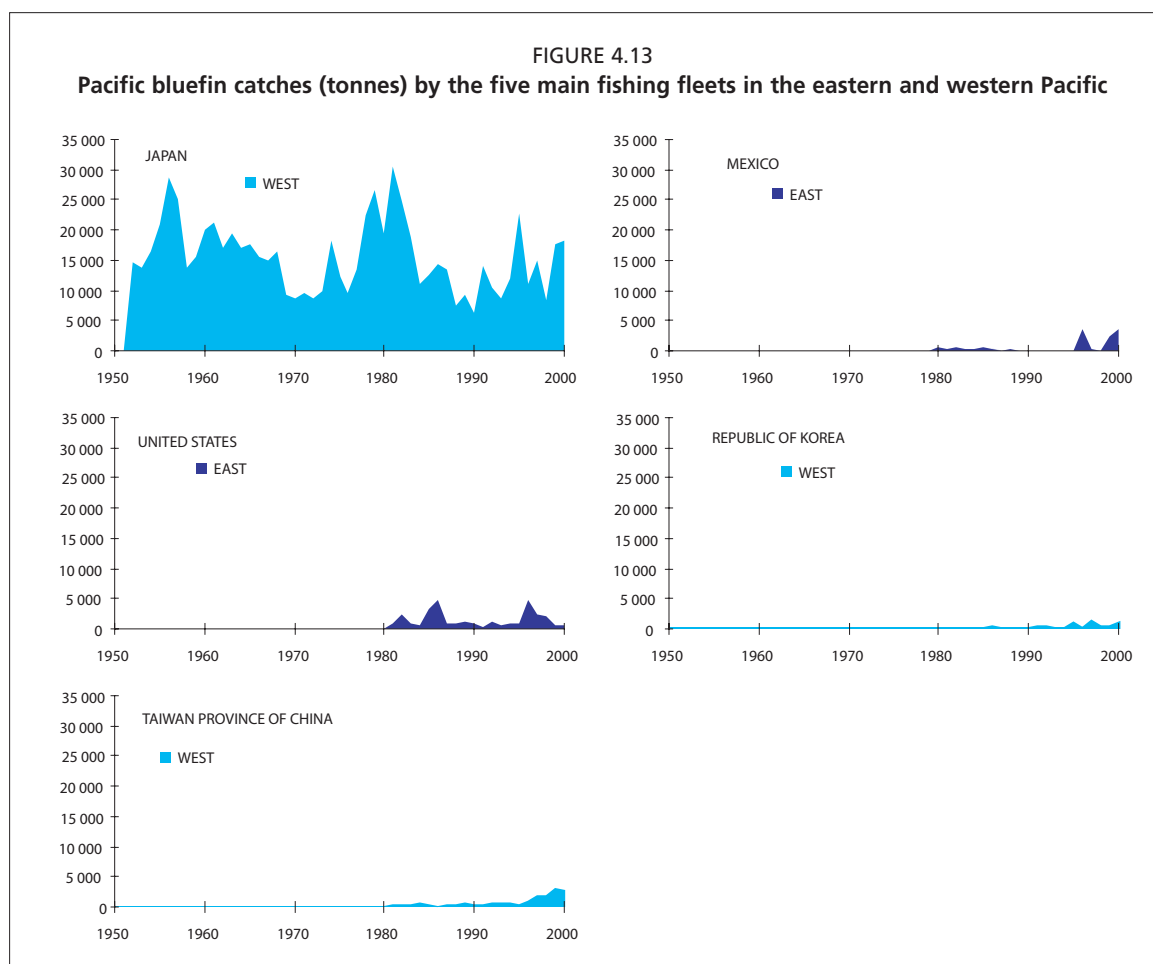
In the eastern Pacific, relatively small purse seiners fish for this species in the waters off Baja California and southern California. The majority of the catch is made between May and October.

Baitboat fishery

Only Japan operates a baitboat fishery for Pacific bluefin. The boats range from less than 5 GRT to nearly 200 GRT offshore, and those boats generally target skipjack.

Trap fishery

A trap fishery has existed for a long time in Japan, on both the coasts of the Sea of Japan and the Pacific. These traps are set not only for Pacific bluefin but for other species as well. The catch of Pacific bluefin is apparently influenced by the coastal oceanographic conditions. Consequently the catch showed large fluctuations between 2 000 and 6 500 tonnes until the beginning of the 1980s, and since then has decreased to less than 1 000 tonnes in recent years.



Other fisheries

The other types of fisheries known include trolling and gillnet fisheries in Japan. The fish caught are small, between 20 and 70 cm. Trolling is carried out by small boats in coastal waters in southern Japan, as well as in the East China Sea and Tsushima Strait. The gillnet fishery has operated in the Pacific Ocean off northeastern Japan.

4.4.3 Catch by country

Figure 4.13 shows the Pacific bluefin catches by five main fleets targeting this species in the eastern and western Pacific. The **Japanese** catch dominates, and usually accounts for more than 80 percent of the total. Since 1995, the catches by other fleets have increased.

4.5 BIGEYE TUNA

4.5.1 General overview

Data on bigeye catches in the Pacific by gear and area prior to 1962 are very incomplete, and hence the analyses of catches by gears and by areas are done only for the period of 1962–2000.

Bigeye tuna are caught by various gears, such as longline, purse seine and baitboat. Medium to large fish are targeted by longline, but this species is not of primary importance for the purse seine and baitboat fisheries, but is by-catch.

The longline fishing grounds for bigeye are widely distributed in the Pacific Ocean between 40°N and 40°S, while the purse-seine fleets operate in equatorial waters, roughly between 140°E–170°W and 130°W–80°W in the western and eastern Pacific, respectively.

Surface fisheries catch mostly juveniles, which form schools with other tunas (skipjack and/or yellowfin) in association with objects such as floating logs, sea mounts and large animals. As they grow older, bigeye tend to inhabit deeper waters and become less vulnerable to the surface fisheries. Spawning takes place in warm waters where the sea-surface temperature is 24 °C or higher. The stock structure is not yet very well understood; most likely there are two separate stocks in the east and west of the Pacific.

The total bigeye catch for the whole Pacific Ocean (Figure 4.14) shows a rapid increase in the 1950s from 25 000 to 100 000 tonnes in the early 1960s. From the mid-1960s to 1975 it was stable at about 75 000 tonnes, but with an increasing trend. The increase accelerated after the mid-1970s up to almost 200 000 tonnes in recent years. Interestingly, catch tendencies and levels in the western and eastern Pacific are very similar, although the eastern catch has wider fluctuations than the western catch.

4.5.2 Catch by fishing gears

Figures 4.15 and 4.16 show the catches of bigeye, by fishing gears, in the eastern and western Pacific, respectively. As mentioned earlier, data by fishing gear are only available from 1962 to 2000. In both areas, longline catches were predominant by far until the late 1980s, but in recent years purse-seine catches have increased very rapidly, particularly in the eastern Pacific, and are now greater than the longline catches in the east. In the Pacific as a whole, the longline catch share went down to about 60 percent of the total in 2000; in that same year, purse seines and other gears accounted for nearly 25 percent and 15 percent, respectively, of the total.

In the eastern Pacific (Figure 4.15), there have been essentially two gears, longlines and purse seines. The longline catch dominated until 1992, and then declined. This decline has been replaced by the purse-seine catch, as stated previously, and the total catch was maintained at a relatively similar level.

FIGURE 4.14
Catches of bigeye: total, western and eastern Pacific

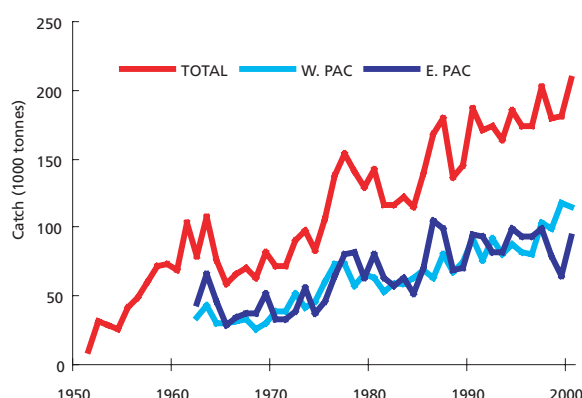


FIGURE 4.15
Catches of bigeye in the eastern Pacific, by fishing gear

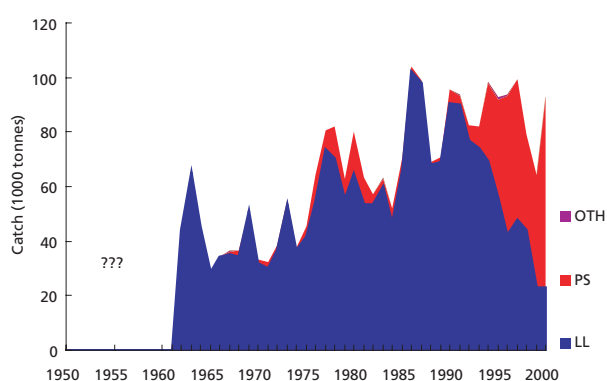
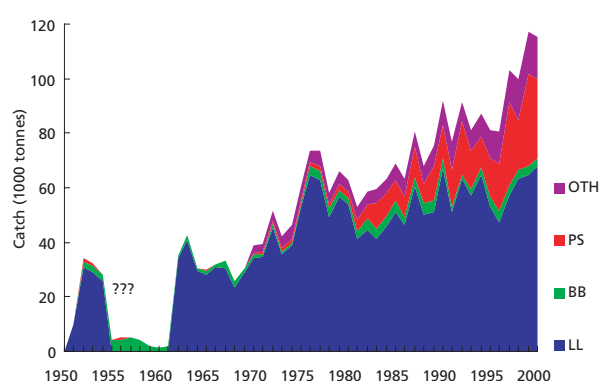


FIGURE 4.16
Catches of bigeye in the western Pacific, by fishing gear



Longline fishery

The catch by the small-scale longline fishery is air-freighted to fresh fish markets abroad. The large-scale longline fleet has been operated mostly by Japan.

Eastern Pacific: The longline catch, made almost exclusively by the Japanese fleet, with some minor catches by Taiwan Province of China, increased until 1987 to a peak of 100 000 tonnes, with fluctuations. However, it has declined, particularly in the 1990s, to the level of almost one-fifth of the peak, due to the reduction in fishing effort caused by the shift of boats to other areas and to a decline in the catch per unit of effort.

Western Pacific: Japanese large-scale longliners operated in the eastern Pacific east of 160°W, while the small to medium-sized boats fished in the western Pacific. The major fishing grounds are located in two bands of tropical waters running east-west, one north of the equator and the other in the south. Winter season fishing grounds are also found in the middle latitudes (centering on 30°) of both northern and southern hemispheres.

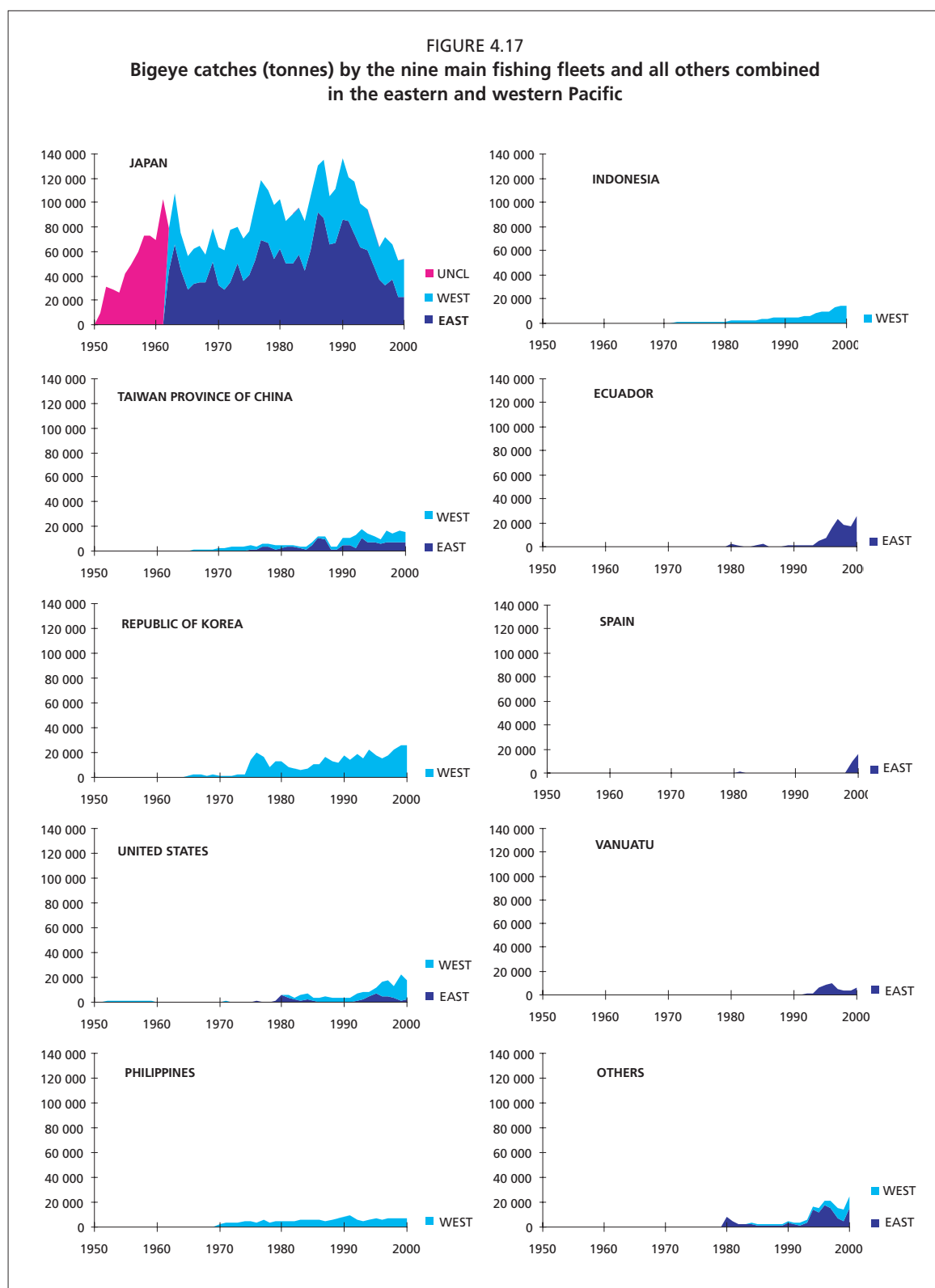
The Republic of Korea and Taiwan Province of China also maintained longline fleets. The Korean fleet fished in the tropical area of the central-eastern Pacific, while the Taiwanese fleet fished in the tropical to temperate waters of the southern hemisphere, targeting albacore. China also started longline fishing in the tropical central-western Pacific in the late 1980s.

More recently, longline fisheries have been developing in various island countries. The boats are small and operate in the vicinity of their home countries. Such fleets are found in Micronesia, Fiji, French Polynesia, American Samoa and Hawaii. High-quality fish are being air-freighted for the fresh fish market, and others are either consumed locally or deep-frozen and then exported.

Purse-seine fishery

Eastern Pacific: In the eastern Pacific, purse-seine boats replaced baitboats, the traditional tropical tuna fishing method, in the late 1950s to early 1960s. Starting around 1970, this fleet expanded further, and reached peak capacity in the late 1970s. Thereafter, it declined, with some fluctuations, but increased again in the late 1990s. These purse seiners set mostly on dolphin-associated tuna schools, and the catch of bigeye in this area had been small, less than 16 000 tonnes. However, when some boats started fishing on schools associated with FADs in 1993, the catch of bigeye immediately increased, to more than 50 000 tonnes by 1996, and has remained above 35 000 tonnes. The catch is made in a wide area between 10°N and 20°S, *inter alia*, between 5°N and 10°S from 80°W to 125°W.

Western Pacific: Japan initiated and developed a purse-seine fishery in the tropical waters of the central-western Pacific in the 1970s. The number of boats increased to the current level in the early 1980s. The United States, the Republic of Korea and Taiwan Province of China also developed their fisheries in the central-western Pacific during the early to mid-1980s. Fishing by US boats in this region began with the shift of part of the US fleet fishing in the eastern Pacific, due to the poor catch rates during the strong El Niño conditions in 1982–83. Since the mid-1980s, this fishery has expanded to include the waters of some Pacific island nations. Sets have traditionally been made on schools associated with naturally-occurring floating objects, as pioneered by the Japanese seiners, while other distant-water nations set mostly on free-swimming schools. In 1998 FADs were introduced, and have been used extensively since then. The amount of bigeye catch by seiners has not been well estimated in the past, because this species and yellowfin were landed together in most places and were sold at the same price. For this reason, the reported catch of bigeye is considered to be an underestimate. The area of operations for the Japanese fleet has been limited by the lack of access agreements with the coastal states, since most of the fishing areas are inside national EEZs, while the US fleet has free access to most waters under a multilateral



agreement with island nations. The geographical extent of the catches are tropical waters between 10°N and 10°S from 135°E to 170°W.

Baitboat and other fisheries

Eastern Pacific: There are locally-based fleets in Hawaii, the continental United States and Mexico, but they are small, and hence the catches are minor.

Western Pacific: Japan has operated a large-scale baitboat fishery in the central-western Pacific, and a small-scale baitboat fishery around Japan during the summer-fall season. The bigeye catch is minor, as by-catch to skipjack. Catches from schools associated with floating objects contain more bigeye.

Other fisheries

In Indonesia and the Philippines, there are miscellaneous fisheries (small purse seine, jigging, hand-lining, etc) that catch bigeye. Most of them operate near FADs. Due to their artisanal nature and the non-existence of a data collection system, information on catches is limited.

4.5.3 Catches by country

The bigeye catches from the eastern and western Pacific Ocean during 1952–2000 by the ten main fishing fleets are shown in Figure 4.17. In general, the **Japanese** catch dominated all other countries, but its share has declined in recent years, due to the reduction of Japanese catch and the increase in catches by other fleets.

In the western Pacific in the last several years, Japan accounted for 27 percent of the total, followed by the **Republic of Korea** (22 percent), the **United States** (14 percent), **Indonesia** (13 percent), **Taiwan Province of China** (8 percent) and the **Philippines** (6 percent). In the eastern Pacific, Japan's share was more than 90 percent until 1992. However, it then started declining, and fell to about one-third of its 1992 level.

4.6 SKIPJACK TUNA

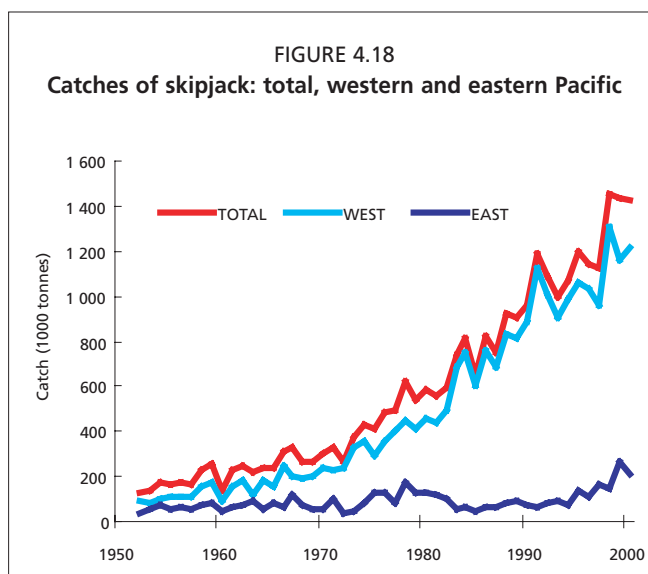
4.6.1 General overview

Skipjack are caught almost entirely by surface gears such as purse seine and baitboat. The fishing is conducted in both the eastern and central-western Pacific, but the catches in the west are much greater than in the east. Fishing was initiated by baitboats in both areas, but in the eastern Pacific this fishery was soon replaced by the purse-seine fishery, while baitboats continued operating in the central-western Pacific. Skipjack form schools associated with objects such as floating logs and large animals. Spawning takes place in vast areas of the Pacific where the surface temperature is 24°C or higher. It is considered that there are at least two stocks in the Pacific, eastern and western, and possibly others in the southeast and other areas.

Baitboat fisheries operate in the central-western Pacific, including off Japan. There are similar fisheries in the Pacific island countries, but they are conducted on

a smaller scale. The purse-seine fleets operate in equatorial waters on both sides of the Pacific, roughly between 140°E and 170°W and 130°W and 80°W, respectively. Miscellaneous gears are used in the Philippines and Indonesia, including handlines, trolling and small seine nets.

Figure 4.18 shows the total, western, and eastern Pacific skipjack catch during 1952–2000. It shows a general continuous increasing trend throughout the period, slower at the beginning and faster in more recent years. At the beginning of this period catches were about 100 000 tonnes; they passed 500 000 tonnes during the mid-1970s and reached more than 1 000 000 tonnes in the early 1990s.



The catch in the central-western Pacific has been much larger than that of the eastern Pacific, and represented about 80 percent of the total catch in recent years. The catch in the eastern Pacific has fluctuated, and showed little increase except for some gradual increase since the mid-1990s.

4.6.2 Catch by fishing gears

Figures 4.19 and 4.20 show skipjack catches during 1952–2000 in the central-western and eastern Pacific, respectively, by fishing gears. Until the early 1980s, the catch in the central-western Pacific was made exclusively by the baitboat fishery. Thereafter, the purse-seine catch has increased greatly, and is now about three times larger than the baitboat catch. The catch by other gears is mostly made by various fisheries in many countries, including the Philippines and Indonesia often without gear specification.

In the eastern Pacific, the baitboat catch has been negligible since the early 1970s, and purse seines make nearly all the catches. The annual catch has been more than 200 000 tonnes since 1999, the highest level.

Baitboat fishery

Western Pacific: Japan has operated a fishery by large-scale boats in the central-western Pacific targeting skipjack, and a similar fishery around Japan during the summer-fall seasons with small to medium-sized boats. There are locally-based fleets in the Pacific island countries such as Fiji and the Solomon Islands. Fisheries were developed in Palau and Papua New Guinea, but have diminished their fishing since the mid-1980s.

Eastern Pacific: Until the 1960s the United States had a baitboat fishery for tropical tunas in the eastern Pacific, but this was replaced by purse seiners during the 1960s.

Purse-seine fishery

Western Pacific: Japan initiated and developed the purse-seine fishery in the tropical waters of the western Pacific. The number of boats increased to the current level in the early 1980s. The United States, the Republic of Korea and Taiwan Province of China also developed their fisheries during the early to mid-1980s. The US fishery was initiated by seiners moving from the eastern Pacific because of poor catch conditions during the El Niño of 1982–1983. Since the mid-1980s, the fishery has expanded to include some Pacific island nations such as Micronesia, Papua New Guinea and Kiribati. Japan made sets traditionally on schools associated with natural floating objects, while other distant-water nations set mostly on free-swimming schools. FADs were introduced in 1998, and have been used extensively since then. Skipjack accounts

FIGURE 4.19
Catches of skipjack in the western Pacific,
by fishing gear

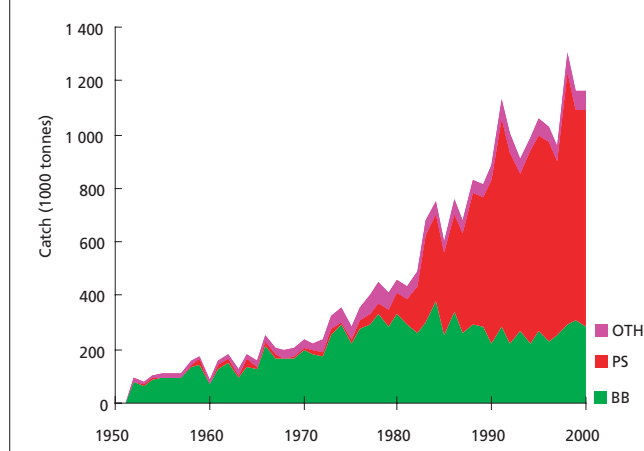
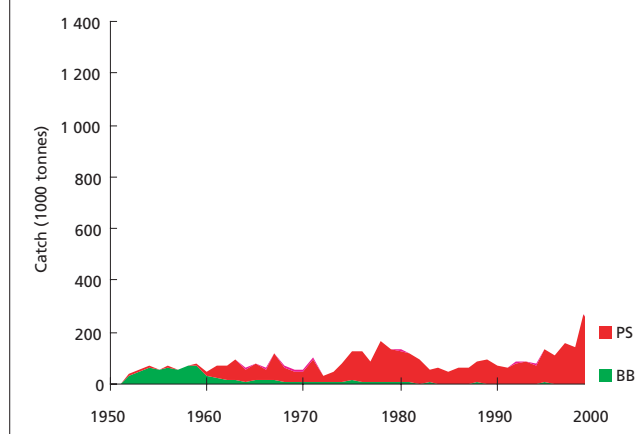
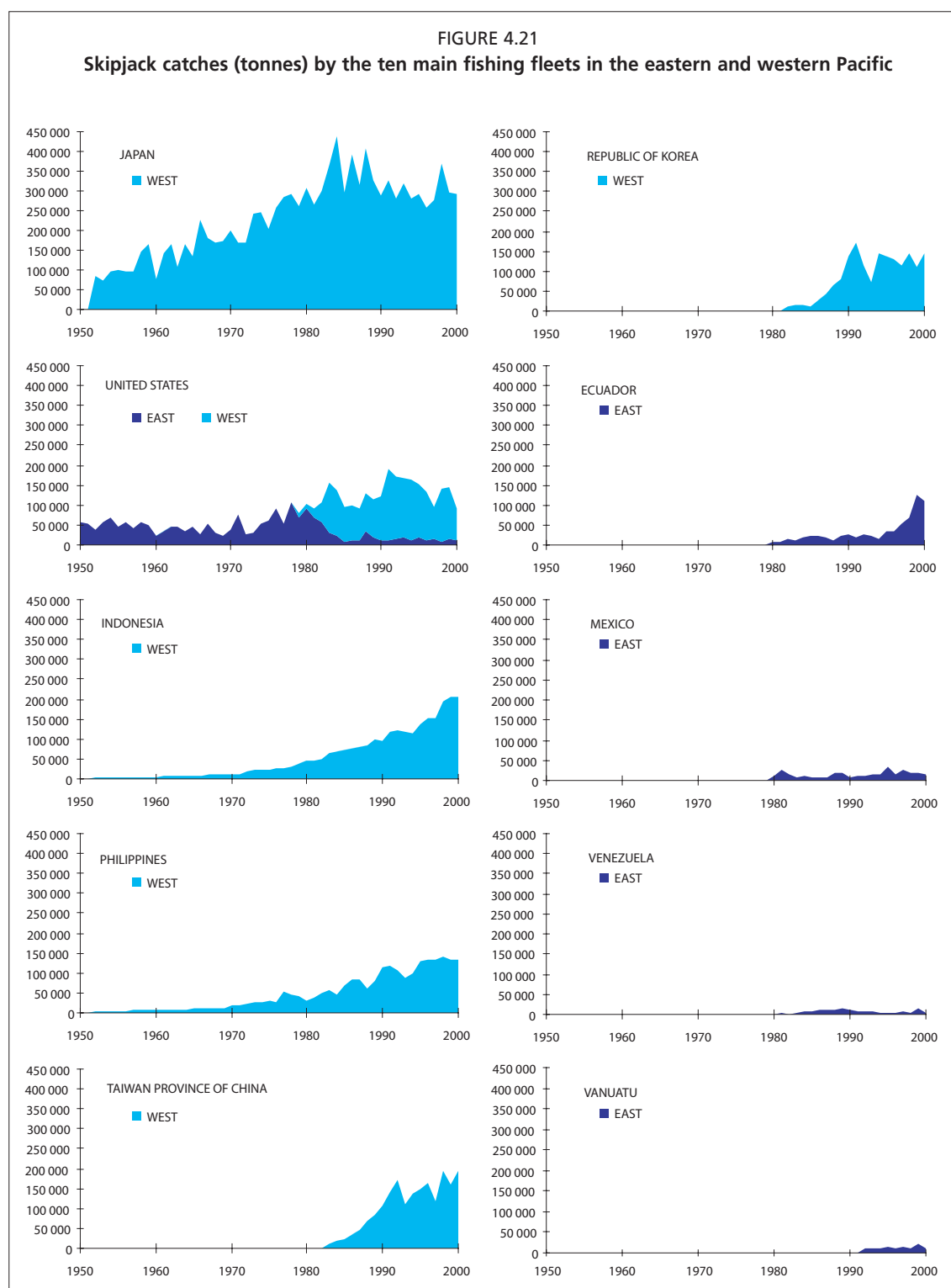


FIGURE 4.20
Catches of skipjack in the eastern Pacific,
by fishing gear





for more than 70 percent of the total catch of the purse-seine fishery. As with bigeye, the area of operations for the Japanese fleet has been limited by the lack of access agreements with the coastal states, since most of the fishing areas are inside national EEZs, while the US fleet has free access to most waters under a multilateral agreement with island nations. The geographical extent of the catches are tropical waters between 10°N and 10°S from 135°E to 170°W.

Eastern Pacific: In the eastern Pacific, purse-seine boats, mostly from the United States, replaced baitboats during the late 1950s and early 1960s. Starting around 1970,

the carrying capacity of the fleet expanded until it reached a peak in the late 1970s. Thereafter it declined somewhat, with some fluctuations, but increased again in the late 1990s, but with seiners of other countries. The catch of skipjack is much smaller than that of yellowfin, partly because they target yellowfin as the first priority and many purse seiners set their nets on schools associated with dolphins, which are mostly composed of large yellowfin. The skipjack catch in this area has been increasing in recent years due to the increase in the use of FADs. The catch is obtained in a wide area of the eastern Pacific Ocean between 10°N and 20°S, inter alia, between 5°N and 10°S, 80°-125°W.

Other fisheries

In Indonesia and the Philippines, there are miscellaneous fisheries (small purse seines, trolling, handlining, etc) that catch skipjack. Most of them operate around FADs. Due to their artisanal nature and the lack of a data collection system, precise information on catches has not been available.

4.6.3 Catch by country

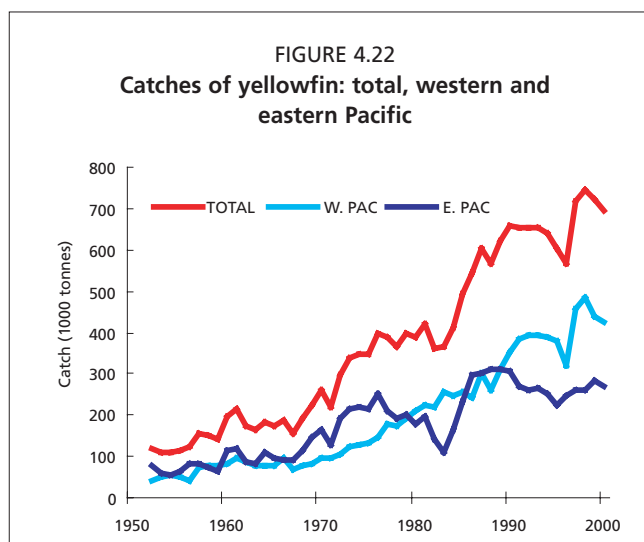
The skipjack catches from the Pacific Ocean during 1950-2000 by the 10 main fishing fleets are shown in Figure 4.21, by east and central-western area. **Japan's** catch, all from the central-western Pacific, dominated throughout the period, but its share has been decreasing since the early 1980s, as the Japanese catch has been decreasing slightly while those by other nations have been increasing. Those include purse-seine catches, by the **United States**, the **Republic of Korea** and **Taiwan Province of China** in the central-western Pacific and **Ecuador**, **Mexico**, **Venezuela** and **Vanuatu** in the eastern Pacific, and artisanal fisheries by **Indonesia** and **Philippines**.

4.7 YELLOWFIN TUNA

4.7.1 General overview

Yellowfin tuna are caught by various gears, such as purse seines, longlines and baitboats. Until the development of the purse-seine fishery, most of the catches were made by longlines, which take medium to large-sized fish, as one of the main target species. Although in the western Pacific the purse-seine catch has been less than that of skipjack, yellowfin is very important for the fishery both in terms of quantity and economic value. On the other hand, in the eastern Pacific yellowfin have been the primary component of the catch in the purse-seine fishery. After the purse-seine fishery had developed fully, its catch has been far greater than those of other fisheries. Juveniles form schools in association with other tunas or objects such as floating logs and large animals. Adults are also found in schools, either free-swimming or associated with other tunas. However, it is only in the eastern Pacific that schools of large yellowfin are frequently found associated with herds of dolphins. Spawning takes place in the vast areas of the Pacific where the sea surface temperature is 24 °C or higher. There are most likely two stocks in the Pacific, one in the east and one in the west.

Figure 4.22 shows the catches of yellowfin in the entire Pacific and in the eastern and central-western Pacific. The total catch for the whole Pacific Ocean has shown a general increasing trend



throughout the 1952–2000 period. Two important increases occurred, in the late 1960s and the mid- to late 1980s.

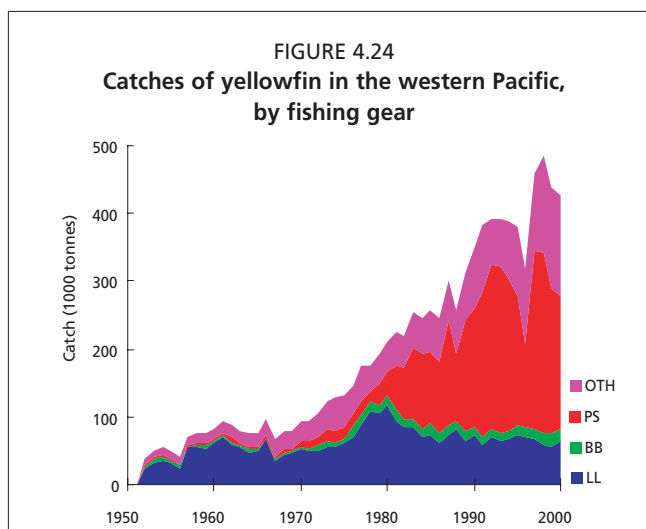
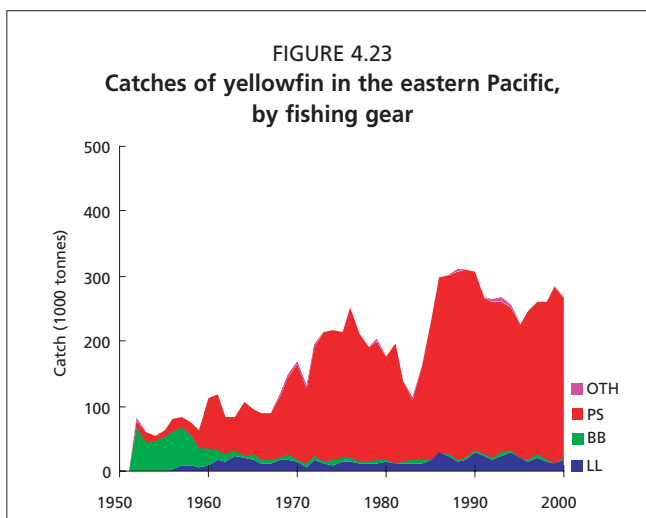
Until the late 1960s the catches in the east and west were at almost the same level. In the 1970s the catch in the east was much higher than in the west, but since the late 1970s the western catch has been larger than the eastern catch, and has continued to increase to 450 000 tonnes, while the eastern catch has been stable around 200 000 tonnes.

Eastern Pacific: In the eastern Pacific, most of the catch was by surface gears, originally baitboats and, since the mid-1970s, purse seines. The current catch of 270 000 tonnes is close to the highest historical level.

Central-western Pacific: In the western Pacific, most of the catch was made by longliners until the mid-1970s. In the early 1980s, the catch by the purse-seine fishery expanded sharply, and exceeded the longline catch in the mid-1980s. It has continued to increase and has been at the level of about 200 000 tonnes since the early 1990s. The longline catch has been stable between 50 000 and 110 000 tonnes since the 1950s. The catches by other gears, which are mostly made by various fisheries in the Philippines and Indonesia, also show increasing trends, and the recent catches of this category are larger than the longline catch.

4.7.2 Catch by gear

Figures 4.23 and 4.24 show the catches of yellowfin, by fishing gears, in the eastern and western Pacific, respectively.



Longline fishery

The longline fishing grounds are widely spread in vast areas of the Pacific Ocean between 40°N and 40°S, with the catch rates being higher in the central-western Pacific. For the longliners operating in the western tropical Pacific, yellowfin has been the primary species, while it has been of secondary importance for those operating in other areas.

The largest fleet has been operated by Japan. At the initial stage of this fishery, the target species were albacore and yellowfin for canning. Since the early 1970s the fleet has shifted to targeting bigeye for the sashimi market, with the development of super-cold freezer. This shift of target species was more obvious with the larger boats which operated in the eastern Pacific east of 160°W. Small to medium sized boats have operated in the central-western Pacific. The major fishing grounds are located in two bands of tropical waters running east-west, one north of the equator and the other in the south. Winter fishing grounds are also found in the middle latitudes (centering on 30°) of both northern and southern hemispheres.

The Republic of Korea and Taiwan Province of China also maintained

large-scale longline fleets. The Korean fleet has fished in the tropical area of the central-eastern Pacific, while the Taiwanese fleet fished in the tropical to temperate waters of the southern hemisphere, targeting albacore.

Recently longline fisheries are developing in the island countries. The boats are small, and operate in the vicinity of their home countries. Such fleets are found in Micronesia, Fiji, French Polynesia, American Samoa and Hawaii. China also has been fishing in the tropical western Pacific since the late 1980s. High-grade fish in the catches of these small longliners are air-freighted to fresh fish markets, while others are either consumed locally or deep-frozen on land and then exported.

Purse-seine fishery

The purse-seine fleets operate in the equatorial waters of both the western and eastern Pacific, roughly between 140°E and 170°W and 130°W and 80°W, respectively.

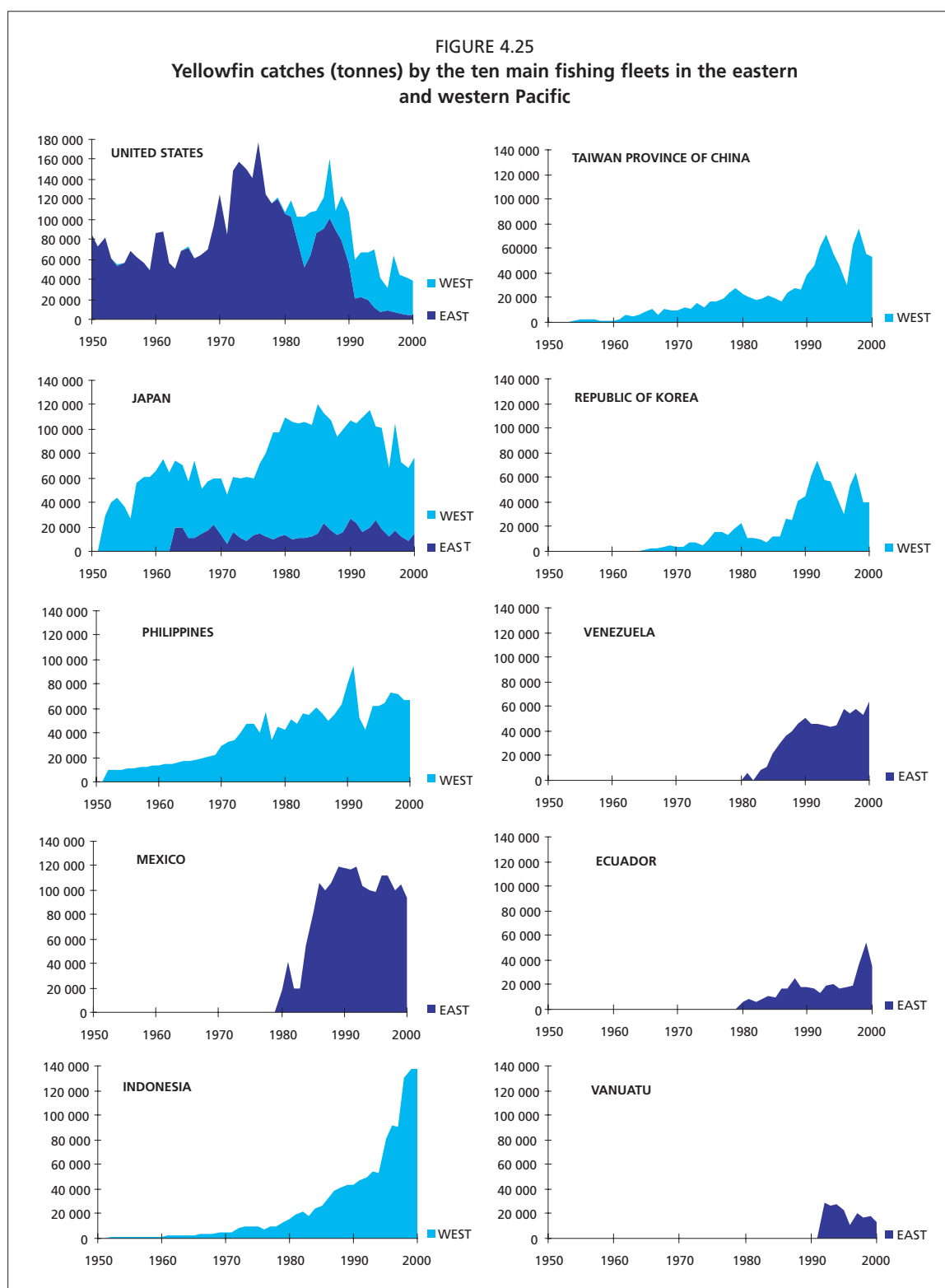
In the **eastern Pacific**, purse-seine boats replaced baitboats in the late 1950s and early 1960s. Starting around 1970, this fleet expanded further, reaching a peak in the late 1970s. The catch also reached a peak of more than 200 000 tonnes in 1976, most of it made on dolphin-associated schools. Thereafter it started declining, due mostly to restrictions on the mortality of dolphins associated with tuna schools, although poor catch rates caused by severe El Niño conditions also contributed. At this time many US seiners moved to the central-western Pacific. The catch increased sharply in the mid-1980s to a new high level of 300 000 tonnes, and stayed high until recently. The catches are made in a wide area of the eastern Pacific between 10°N and 20°S, inter alia, between 5°N and 10°S, 80°-125°W.

Japan initiated and developed the purse-seine fishery in the tropical waters of the **central-western Pacific**. The number of boats increased to the current level in early 1980s. The United States, the Republic of Korea and Taiwan Province of China also developed their purse-seine fisheries during early to mid-1980s. Fishing by US boats in this region began with the shift of part of the US fleet fishing in the eastern Pacific, due to the poor catch rates during the strong El Niño conditions in 1982-1983. Since the mid-1980s, this fishery has expanded to include the waters of some Pacific island nations. Sets have traditionally been made on schools associated with naturally-occurring floating objects, as pioneered by the Japanese boats, while other distant-water nations set mostly on free-swimming schools. In 1998 FADs were introduced and have been used extensively since then.

Yellowfin and bigeye in purse-seine catches were often not separated at the time of landing, and were sold at the same price, mostly as yellowfin. For this reason, the reported catch of yellowfin is considered to have been over-estimated. The area of operations for the Japanese fleet has been limited by the lack of access agreements with the coastal states, since the majority of the fishing areas are inside national EEZs, while the US fleet has free access to most waters under a multilateral agreement with island nations. The geographical extent of the catches are tropical waters between 10°N and 10°S, 135°E and 170°W.

Baitboat fishery

Japan has operated a baitboat fishery in the central-western Pacific with large boats. As their target is skipjack, the catch of yellowfin has been minor. Japan also operates a baitboat fishery around Japan during the summer-fall season with small to medium-sized boats. In the eastern Pacific, baitboats were one of the major gears for yellowfin until having been replaced by purse seines in the early 1960s. There are locally-based fleets in Hawaii, the continental United States and Mexico, but they are small, and hence the catch has been minor in recent years.



Other fisheries

In Indonesia and the Philippines there are miscellaneous fisheries (small purse seine, jigging, handlining, etc.) that catch yellowfin. Most of them operate around FADs. Due to their artisanal nature and the absence of a data collection system, precise information on catch has not been available.

4.7.3 Catches by country

The yellowfin catches from the eastern and western Pacific Ocean during 1950-2000 by the ten main fishing fleets are shown in Figure 4.25. The **United States** catch dominated in the eastern Pacific until the early 1980s, but then the catch in the central-western Pacific started increasing while the eastern Pacific catch fell to almost nil in 2000. In its place, the **Mexican** catch started increasing very rapidly in the eastern Pacific in 1981, and has been over 100 000 tonnes since 1985. **Japan** had been the largest producer of yellowfin in the central-western Pacific, but the **Indonesian** catch increased very rapidly after 1980 and since 1997 has been the largest producer of yellowfin, reaching more than 130 000 tonnes. The **Philippines** catch increased continuously from 1952 to about 100 000 tonnes in 1990; it dropped once in 1992 and 1993, but since 1994 has been at a high level of about 60 000 tonnes. The **Republic of Korea** and **Taiwan Province of China** in the central-western Pacific, and **Venezuela**, **Ecuador** and **Vanuatu** in the eastern Pacific, have all increased their catches very rapidly in the last 10 to 20 years.