

## 2. Development of the Atlantic tuna fisheries

### 2.1 DATA SOURCES AND PREPARATION

The data source used in this study is ICCAT FISHSTAT Plus, 2002 version (updated in October 2002), which includes data for 2000. Although the term “catch” is used in the text, most of the data are landings, but sometimes include partially reported discards. Reported data for recreational fishing are included.

### 2.2 GENERAL OVERVIEW

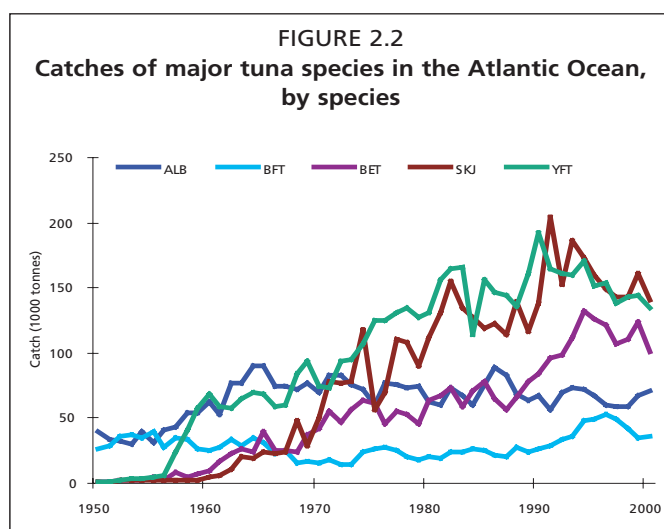
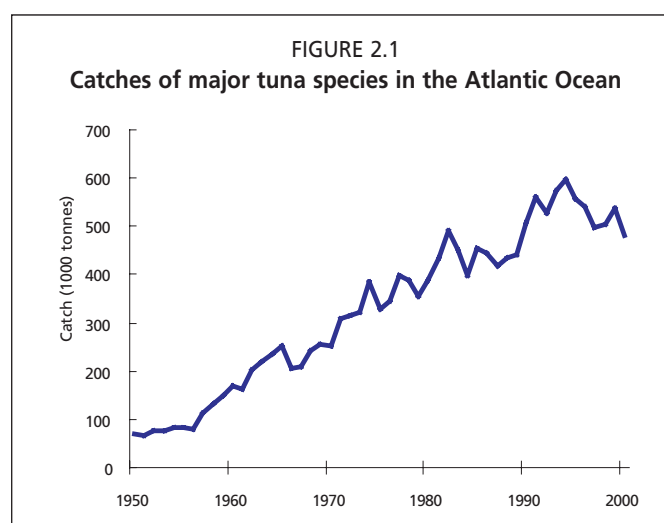
#### 2.2.1 Total catch

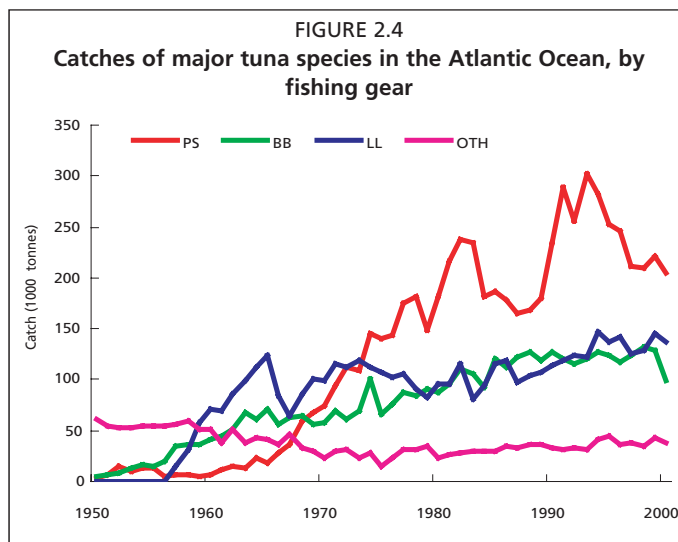
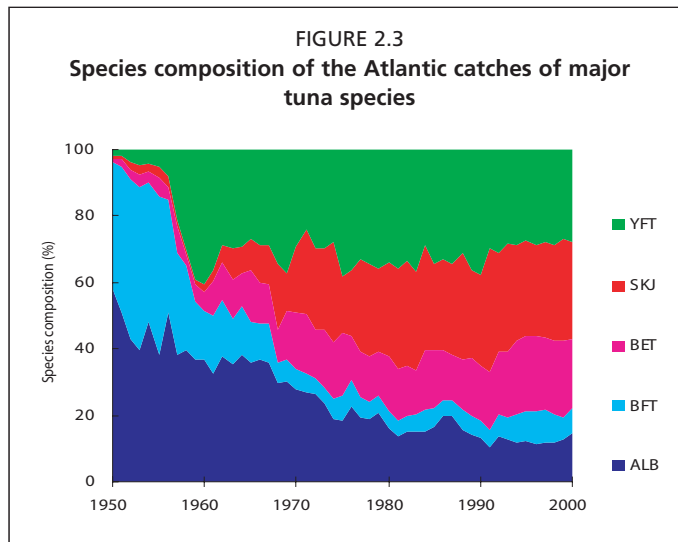
Figure 2.1 shows the combined reported catches of the major tunas, 1950–2000. The catches increased almost steadily from 1950 until 1994, when they peaked at nearly 600 000 tonnes, and thereafter declined. At least a part of the recent decline is due to ICCAT management measures.

#### 2.2.2 Catch by species

Figure 2.2 shows the Atlantic catches, by species, and Figure 2.3 the species compositions of these catches. The catch trends for each species are discussed in the following sections; only their relative importance is described in this section.

Until the late 1950s, only bluefin and albacore were intensively exploited in the Atlantic, and the catches of the two species were about even. However, in the late 1950s, when a large-scale longline fishery (mostly by Asian boats) developed in the Atlantic, the catches of the initial target species, yellowfin and albacore, started increasing very rapidly (Figure 2.4). The albacore catch increased until 1970, and it was for a period the most important species, as it was taken by both longlines and surface gears. However, since 1972, with the development of the surface fishery (baitboats and purse seines), the yellowfin catch has continued to increase, while the albacore catch has stabilized. The yellowfin catch was the greatest until 1991, when it was exceeded by the skipjack catch.





It should be noted that bluefin has been under ICCAT catch restrictions since 1981. All other species except skipjack have also been under some kind of regulation (size, effort, or catch level), which has in all probability affected the catch trends.

### 2.2.3 Catch by fishing gear

Figure 2.4 shows the combined Atlantic catch of major species, by fishing gears. The large-scale longline fishery was started in 1957 by a Japanese experimental fishing boat off Venezuela. Japanese longliners followed the experimental boat that same year, and in 1958 found a good fishing ground for bluefin off Brazil.

When the bluefin distribution patterns changed in the mid-1960s, the fleet expanded the fishing ground to the west and northwest, targeting yellowfin and albacore, and was followed by fleets from the Republic of Korea and Taiwan Province of China. The catch reached its first peak in 1965. The boats at that period were equipped with freezers of about  $-25^{\circ}\text{C}$ , and the catches were exported for canning. In the early 1970s, the longliners started changing their strategy: equipped with super-cold freezers ( $-40$  to  $-55^{\circ}\text{C}$ ), they started

fishing for the Japanese *sashimi* market. As bluefin and bigeye tunas are the most valuable species for this market, the target shifted from yellowfin and albacore to these species, and the longlines were set in the deeper layer of the water where large bigeye live. Such changes were seen first in the Japanese longliners, and much later in Korean and Taiwanese boats.

The longline catch declined in the late 1970s, but later rose again and stabilized until the early 1990s. Besides these Asian longline fleets, swordfish longline fishing also has developed since the 1970s (see Sections 2.8 and 3.7). In the 1990s many longliners operating under “flags of convenience” (FOC) and/or engaging in illegal, unreported and unregulated (IUU) fishing started fishing in the Atlantic, and are partially responsible for the increases in longline catches and in bigeye catches.

The baitboat fishery initially fished mostly for bigeye, and some bluefin and albacore, in areas near islands, such as the Canaries, Madeira and the Azores. In the late 1960s, this fishery started to expand into the eastern tropical Atlantic, targeting yellowfin and skipjack, and since then the catch has increased gradually but steadily. In particular, the fishery in the Gulf of Guinea, based in Ghana, has been very important.

A purse-seine fishery for bluefin existed in the 1950s to 1960s in the northeastern Atlantic, but this disappeared when bluefin no longer migrated in the northeastern Atlantic, probably because this area was on the margins of the distribution of the species. On the other hand, the purse-seine fishery that started in the eastern tropical

Atlantic in the late 1960s developed very rapidly. In the early- to mid-1980s the catch rate dropped in this area, and many of the seiners moved to the new fishing grounds being developed in the western Indian Ocean. However, at the beginning of the 1990s the catch rate recovered very quickly and increased further. At about the same time, fish-aggregating devices (FADs) were introduced in the Atlantic. As the efficiency of this fishing method is very high, this fishery developed very fast. Purse seiners started catching juvenile tunas in mixed-species aggregations around FADs, which resulted in a further increase in bigeye catches. Also, in the 1970s a purse-seine fishery for bluefin started in the Mediterranean area, and the catches by this fishery increased very rapidly (Figure 2.2).

Other gears used to catch tunas in the Atlantic include traps, harpoons, trolls, pelagic trawls, handlines, gillnets and other, unclassified gears. In the early years, these other catches consisted mostly of bluefin caught with traps. Also, improvements in data collection reduced the catches assigned to the "other" gears' catches in more recent years.

#### 2.2.4 Catches by country

The combined catches of the major tunas from the Atlantic Ocean during 1950–2000 by the ten main fishing fleets are shown in Figure 2.5. **Spanish** catches have been made by traditional fishing methods (e.g. trap fishery for bluefin, troll fishery for albacore, and baitboat fishery for bigeye), as well as by the more recently developed industrial purse-seine fishery for skipjack and yellowfin and the longline fishery for swordfish. The Spanish catch peaked at the beginning of the 1990s and then declined, mostly due to various ICCAT regulations.

**France** had a traditional troll fishery for albacore, but recently its major catches have been made by purse seiners fishing for yellowfin and skipjack in tropical waters and, to a lesser extent, for bluefin in the Mediterranean. Therefore its catch trend is very similar to that of its purse seiners. The drop in catch in 1984 is due to the shift of the seiners to the Indian Ocean. The **Japanese** catch is almost exclusively longline, except for some tropical baitboat fishing in the 1970s. The peak in the 1960s reflects the catches of yellowfin, skipjack and albacore for canning. **Taiwanese** and **Korean** fisheries are exclusively longline, except for a couple of years by Taiwanese drift gillnets. The **Ghanaian** catch is almost all by baitboats, and in the latter half of the 1990s also by purse seine.

### 2.3 ALBACORE

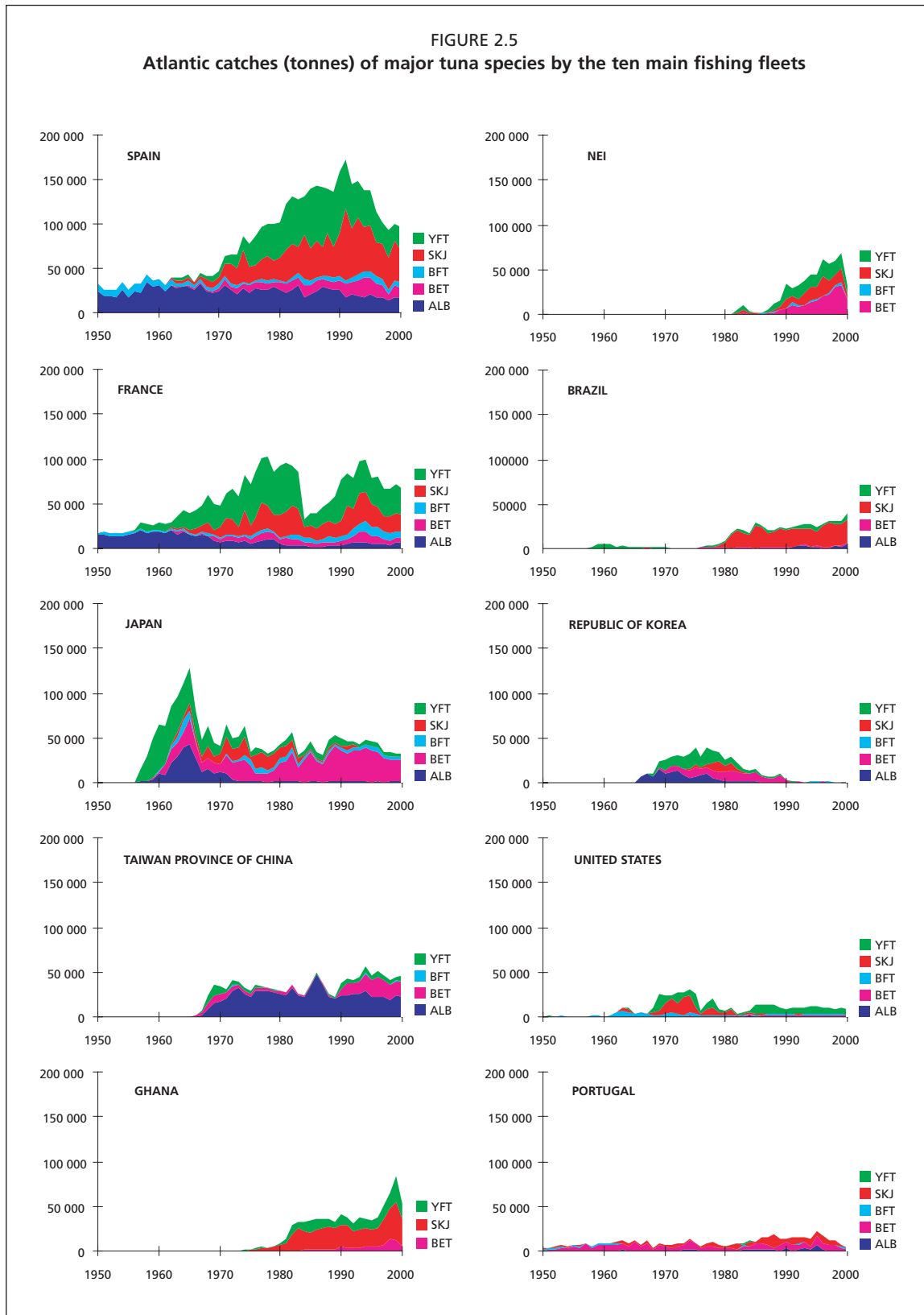
#### 2.3.1 General overview

The fisheries for albacore are distributed throughout the Atlantic between 55°N and 45°S and in the Mediterranean Sea. The spawning areas are in the western subtropical areas of both hemispheres in the Atlantic and throughout the Mediterranean. The distribution in the Atlantic is split between the northern and southern hemispheres, and albacore is thus considered as two separate stocks, with Mediterranean albacore as another independent stock.

Figure 2.6 shows the catches of Atlantic albacore, total and by stock, and Figure 2.7 the catches of the northern and southern stocks, by fishing gear. Figure 2.8 shows the albacore catches, by stock, by the ten main fishing fleets during 1950–2000.

#### *Northern stock*

The northern stock has been exploited historically for a long period, mostly by trolling in the Bay of Biscay. The catches consist of young fish. The catch level was about 30 000 to 40 000 tonnes (Figure 2.7). In the late 1950s, when Asian longliners, initially from Japan and, from the mid-1960s, the Republic of Korea and Taiwan Province of China, started fishing for adult albacore on the high seas, the catches rose to 50–60 000 tonnes. However, as the longline fishery gradually shifted towards bluefin and bigeye tuna



over the last 20 years, the catch has been in a declining trend. Surface fisheries have maintained their catch levels, but the troll fishery has been gradually replaced by baitboats and, later, by drift gillnet<sup>2</sup> fisheries.

<sup>2</sup> The European Commission has prohibited all fishing with drift gillnets since 2002.

### Southern stock

Exploitation of the southern stock started with longliners in the late 1950s. From the mid-1960s to the 1980s catches were at least about 20 000 tonnes (Figure 2.7). Since the surface fishery started in the mid-1980s, there was a general increase in the total catch of southern albacore. Recently, due to ICCAT regulations, the increasing trend has been halted.

### Mediterranean stock

In general, the catch statistics have shown an upward trend since the early 1980s with much fluctuation (maximum about 5 000 tonnes). However, the statistics are not reliable, and the apparent fluctuations in the catch may simply reflect changes in the reporting rate.

## 2.3.2 Catch by fishing gears

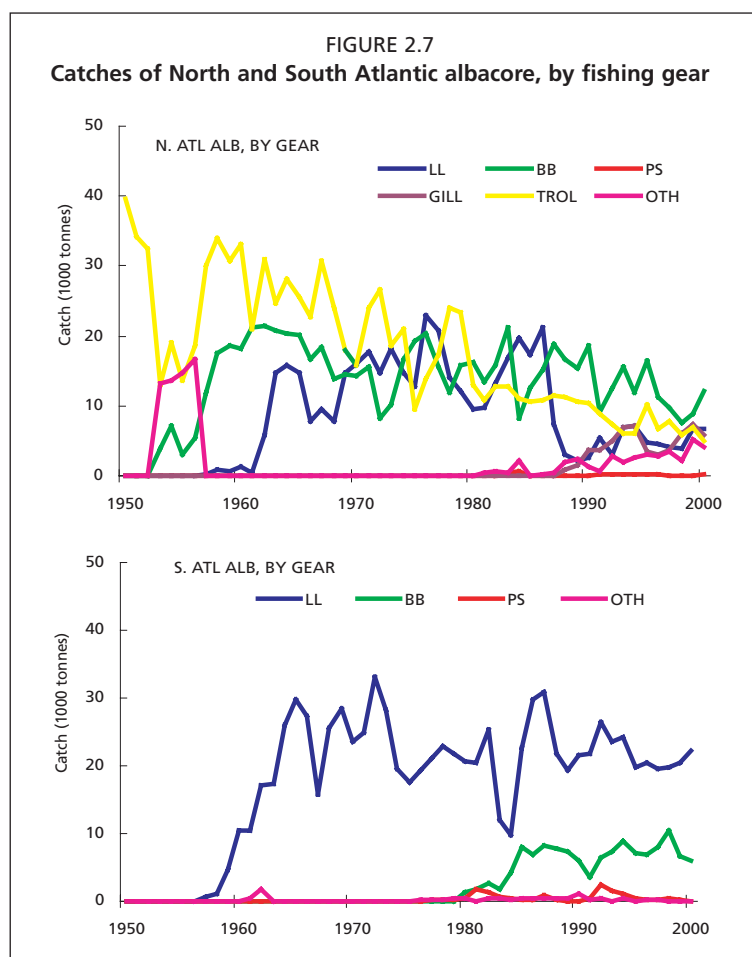
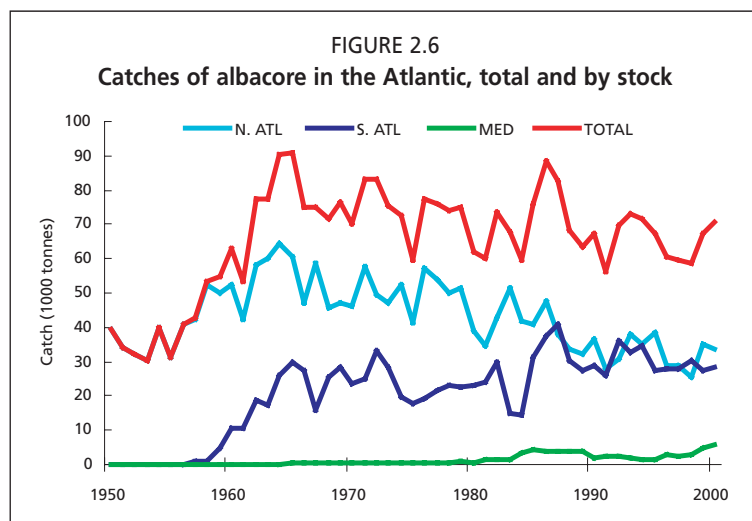
### Troll fishery

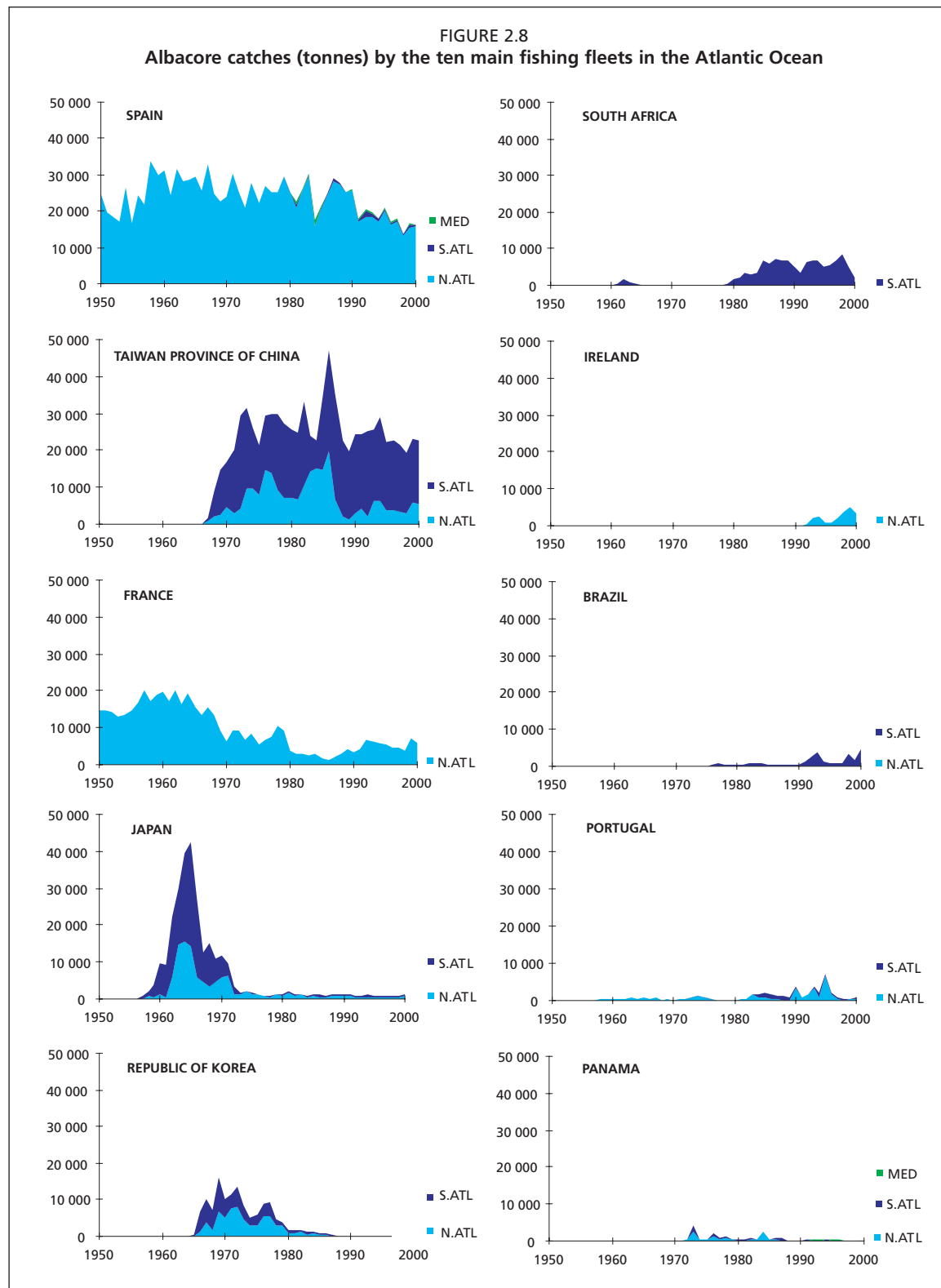
**North:** The troll fishery for albacore by French and Spanish fishers in the Bay of Biscay has existed since the early nineteenth century. Prior to the 1950s, the troll catch in the north Atlantic was quite high (30 to 40 000 tonnes) and stable. This high level was maintained until the early 1960s. The catch attributed to “other” gears for 1952–55 should have been attributed to trolling. Since the late 1950s, it has declined steadily, due to the conversion of Spanish troll vessels to bait fishing since the mid-1950s and of French troll vessels to mid-water trawling and drift gillnet fishing since the late 1980s.

**South:** There has been no troll fishing in the South Atlantic.

### Baitboat fishery

**North:** Baitboat fishing started in 1950s, and catches increased very rapidly to the 20 000 tonnes level by the beginning of the 1960s. Since then, the baitboat catch has maintained this level, with annual fluctuations. The major component has been the Spanish fishery in the Bay of Biscay, which changes target species seasonally between





albacore and bluefin tuna. There is also a Portuguese baitboat fishery around its island areas (Azores and Madeira). These fisheries undergo very large annual fluctuations, due to the variability in the availability of fish in the waters near the islands.

**South:** Baitboat fishing in the south was started in the early 1980s by the Portuguese fleet off Namibia and South Africa. This fishery developed quickly, and catches by Namibian and South African baitboats reached the level of 10 000 tonnes in recent years.

### Longline fishery

Japan started a longline fishery in the Atlantic in the late 1950s. During its initial stage, Japanese longliners targeted bluefin off Brazil and later albacore, together with yellowfin tuna. Those fish were exported for canning. However, toward the end of the 1960s, the Japanese longliners equipped with super freezers changed the target species to bigeye tuna, deploying deep longline gears. The catches were mostly brought back to the Japanese *sashimi* market. For this reason, the albacore catches became only by-catches of bigeye or bluefin fishing. Korean and Taiwanese longliners started in the Atlantic several years after the Japanese longliners, targeting albacore in both the North and South Atlantic. Their catches increased in the late 1960s in the North Atlantic and in the early 1970s in the South, and the latter eventually exceeded the catches by these countries in the North Atlantic. Korean catches decreased rapidly in the late 1970s as their fleet started withdrawing from the Atlantic. However, the Taiwanese fleet has continued targeting albacore until now. Since early 1990s, a part of the Taiwanese fleet shifted its effort to bigeye for the Japanese *sashimi* market. Therefore, the total longline catches in the North Atlantic were high between the early 1960s and the mid-1980s, at a level of 10 000 to 20 000 tonnes, while those in the South Atlantic have been high from the late 1960s to the present, between 20 000 and 30 000 tonnes, with some annual fluctuations.

ICCAT started management measures for southern albacore in 1998, when it established the TAC. Up to now, this has had some effect on the total albacore catches in the south, and has possibly limited a further increase in the catches.

Longlining is also the major fishing method in the Mediterranean Sea; the major longlining countries are Italy, Spain and Greece. However, the statistics from that area have not been reliable.

### Other fisheries

Among the other fisheries, the most important was the drift gillnet fishery, developed by France in the Bay of Biscay as a replacement for trolling. This fishery started, together with the paired pelagic trawling, in 1987, and developed further in the 1990s, with Ireland and England also participating, while trawling was not very successful. However, due to the EU regulations, the fishery has been banned since 2002.

### 2.3.3 Catches by country

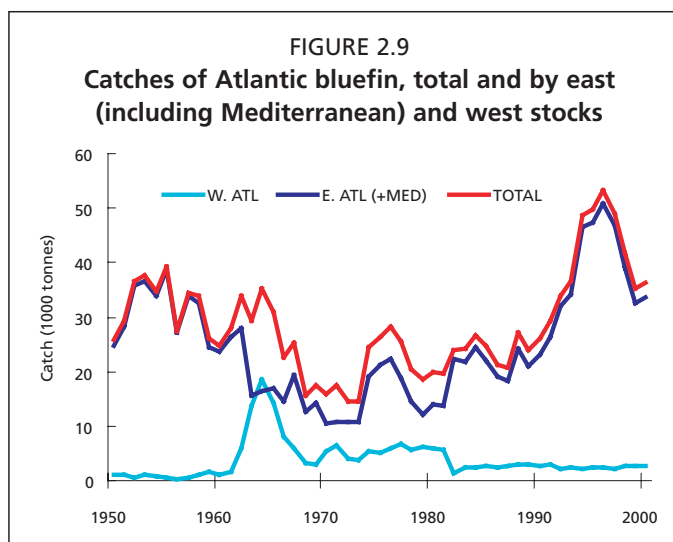
**Spain** has been the largest producer of albacore throughout the whole period; catches are mostly made by trolling in the northeastern Atlantic. The **Taiwanese** catch has been high since the late 1960s, and is all by longline from both North and South Atlantic.

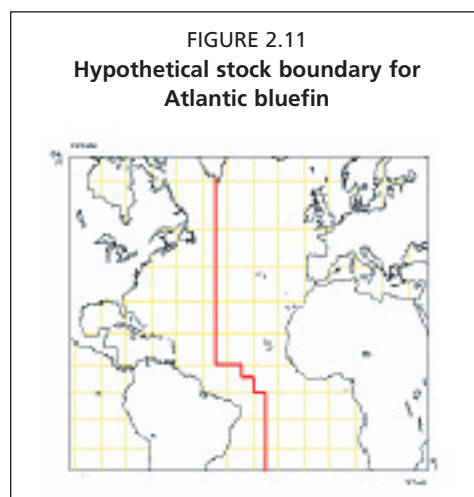
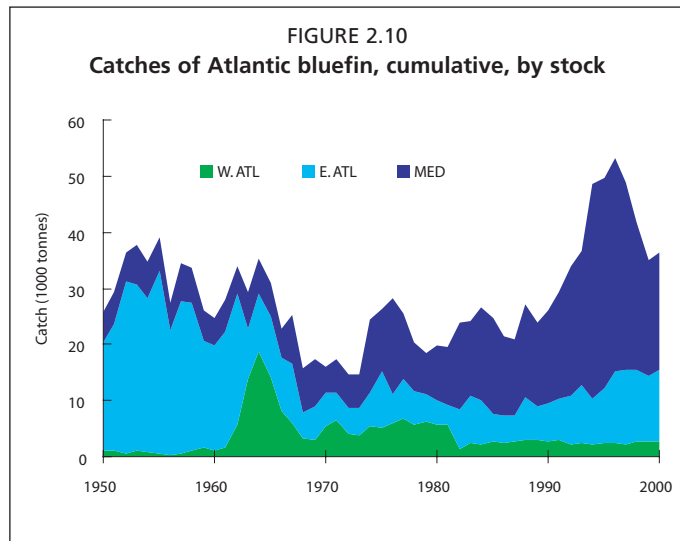
**France** used to be important producer of albacore, but recent catch levels have been low. **Japan** had a high level of albacore catch in its initial longline fishing stage.

## 2.4 ATLANTIC BLUEFIN TUNA

### 2.4.1 General overview

The fisheries for Atlantic bluefin tuna are currently distributed from the Gulf of Mexico to Newfoundland in the West Atlantic, from roughly the Canary Islands to south of Iceland in the East Atlantic, and throughout the Mediterranean Sea. Figure 2.9 shows the annual catches from the





West and East Atlantic (including the Mediterranean), and Figure 2.10 the cumulative catches of the East Atlantic, Mediterranean and West Atlantic. There are two spawning grounds known in the Atlantic, one in the Gulf of Mexico and one in the Mediterranean Sea. Assuming that bluefin tuna have homing fidelity, and noting some discontinuity in the longline catches in the offshore area, in the 1970s ICCAT divided the population into eastern and western stocks (Figure 2.11). However, the overall distribution of the catch in 1990s is much more continuous across the North Atlantic than in previous decades. Tagging evidence indicates that movement of bluefin across the current east/west management boundary in the Atlantic does occur, and that it can be extensive (including trans-Atlantic) and complex. Management plans by ICCAT have been based on two stocks, but the Commission is now revisiting the problem of management units. Even though the bluefin tuna in the East Atlantic and the Mediterranean are considered to belong to the same stock, the fisheries in these two areas have been quite different.

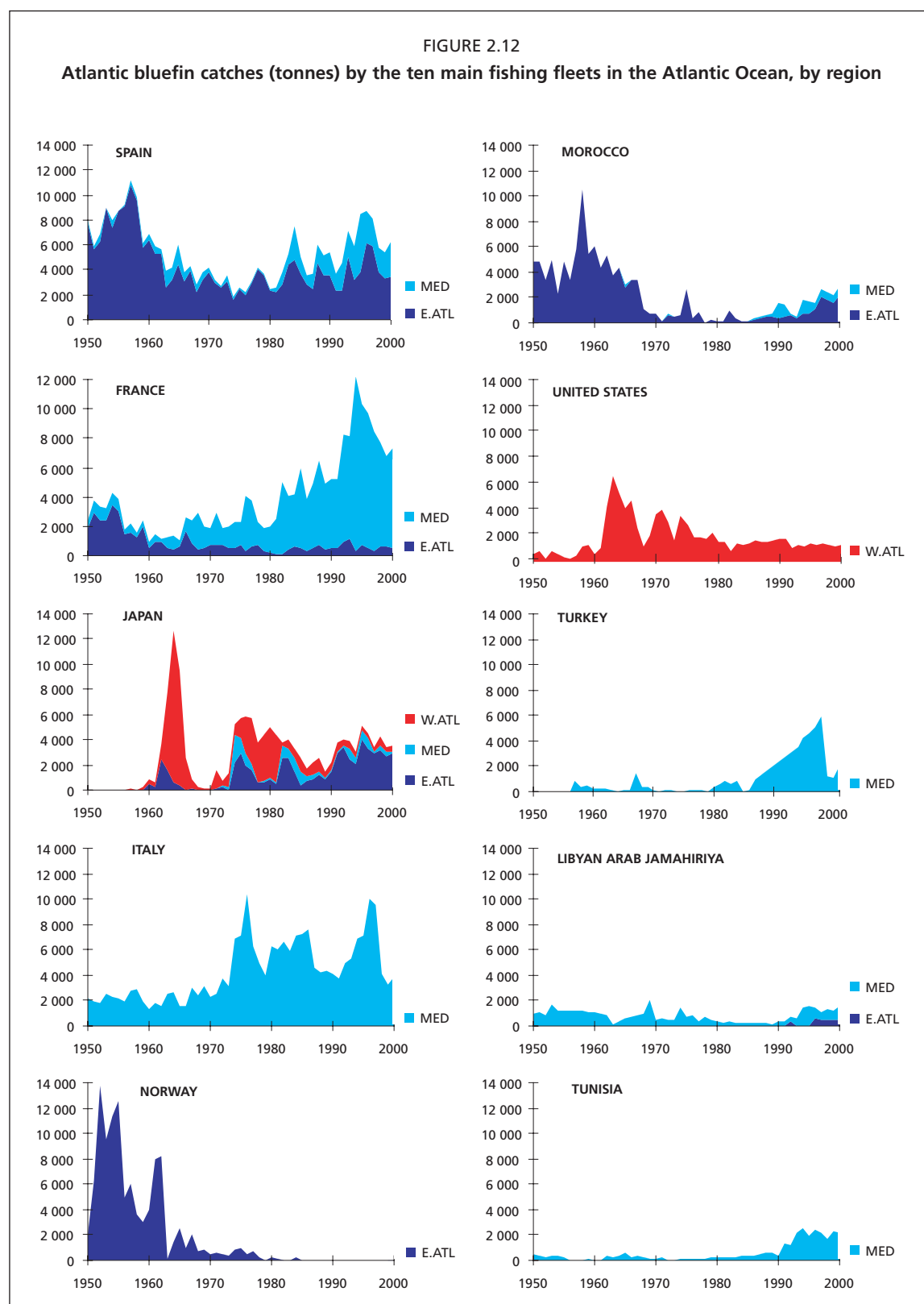
The catches of bluefin from the Atlantic Ocean during 1950–2000 by the ten main fishing fleets are shown in Figure 2.12.

In general, the catch of bluefin in the East Atlantic has been greater than in the West; particularly until the end of the 1950s, the west catch was far less than the east catch. In the early 1960s, the west catch started increasing while the east catch declined, and in 1964 the west catch exceeded that of the east. However, the west catch declined very rapidly thereafter, while the east catch had increased very rapidly.

#### *East stock (including Mediterranean)*

The East Atlantic catch stayed at a fairly high level of 30 000 tonnes in the 1950s and into the early 1960s. The major gears were traps in the Mediterranean and near Gibraltar and purse seiners in the northeastern Atlantic. However, the trap catch peaked in 1958, and then declined sharply into the early 1960s. Purse-seine catches during this period were mostly made by the Norwegian fleet in the northeastern Atlantic: the catches showed large yearly fluctuations, declined very sharply in the early 1960s, and ceased in the 1970s.

Annual catches of bluefin by the Bay of Biscay baitboat fishery were at a relatively high level of about 4 to 5 thousand tonnes until the mid 1950s, then they dropped sharply to 1 to 2 thousand tonnes throughout the 1960s. The total Mediterranean bluefin catch was stable at 5 to 7 thousand tonnes until the mid-1970s, as the reductions of trap catches were compensated by increased gillnet and longline catches. Therefore,



the overall catch of the east stock (including the Mediterranean catches) dropped to a lower level of 10 to 15 thousand tonnes from the early 1960s until 1973.

Starting in 1974, the Mediterranean catch showed a very rapid increase until it reached the first peak in 1976. Although the east Atlantic catch stayed at a low level of less than 10 000 tonnes, the overall catch from the eastern stock (Atlantic and the

Mediterranean) resumed its upward trend in the late 1970s, and after some decline in the early 1980s, increased very rapidly in the 1990s to a peak in 1996.

These increases in the bluefin catch in the East Atlantic (including the Mediterranean) were possibly the result of an increase in fishing effort, generated by the increasing demand for bluefin for the *sashimi* market. Until the 1970s, most of the bluefin caught in the Mediterranean and northeastern Atlantic by the coastal states was sold in the local European market for consumption as fresh fish and/or for canning, with some minor exceptions of trap catches of large fish just about to spawn, which were exported to the Japanese *sashimi* market. The longline catches by oriental longliners were also for the Japanese *sashimi* market.

Starting in the mid-1980s, Japan started importing fish caught by purse seiners, and as a result purse-seine effort has continued to increase. Also, more oriental longliners concentrated in the Atlantic near Gibraltar and in the Mediterranean, and their catches increased as well. In the 1990s, many IUU longliners joined the Mediterranean fishery, and their catches became very significant. Learning from these longliners, the coastal states (e.g. Spain and Italy) also developed bluefin longlining in the Mediterranean in the 1990s. In the meantime gillnet catches decreased, as a consequence of the ban on gillnets by the UN Resolution.

Bluefin tuna farming activities in the Mediterranean have had a strong effect on the increasing effort. Farming started in the 1980s in Ceuta, where spent lean large bluefin caught by traps were fattened and sent to the Japanese market. However, in the mid-1990s a new type of farming was developed in the Mediterranean, in which medium or small bluefin caught by purse seines were fattened and shipped to Japan. This product developed a new market in Japan and, in consequence, farming spread out in the Mediterranean and stimulated more interest in the purse-seine fishery.

The east bluefin catch has been under the ICCAT management scheme since 1995, and this is reflected by the reduction of the total reported catches since 1996.

### **West stock**

The West Atlantic bluefin fisheries are not as traditional as in the east and the Mediterranean Sea, and catches used to be low. In the 1950s, the only fisheries were Canadian trap and harpoon fisheries and United States trap and recreational rod-and-reel fishing. When Japanese longliners started operating in the Atlantic in 1957, they found a high concentration of bluefin tuna in waters off Brazil. This fishery peaked in 1964 at well over 10 000 tonnes, but finished by the end of 1960s. Then the Japanese longliners found new grounds off New England and in the Gulf of Mexico, and their catches started increasing again in the late 1970s until 1981; however, their catches were now kept in super-freezers for the *sashimi* market, so they were two different types of fisheries.

The United States purse-seine fishery started in the late 1950s, and peaked in 1962 and again in 1970. The catch fluctuated widely during this period. The catches declined, due partly to domestic regulations, towards 1980. In the meantime, Canadian trap catches were reduced to almost nil. The catches of the US recreational rod-and-reel fishery started to increase substantially, though there were very wide fluctuations, particularly in the 1970s. The large fish caught in this fishery have been sold to the Japanese *sashimi* market.

ICCAT adopted strict catch quota regulations for West Atlantic bluefin tuna in 1981, and these came into effect in 1982. As only three countries (Canada, Japan and the United States) were fishing bluefin in this area until recent years, and the regulations were strictly implemented, the catches since 1982 have corresponded to the total allowable catches set by ICCAT.

### 2.4.2 Catch by fishing gears

Bluefin tuna catches in the east (including Mediterranean) and west Atlantic, by fishing gears, are given in Figures 2.13 and 2.14, respectively.

#### *Longline fishery*

In the late 1950s Japanese longliners entered the Atlantic and started fishing for bluefin off Brazil. These longliners were equipped with normal freezers (about  $-20^{\circ}\text{C}$ ) and catches were mostly exported for canning. In the early 1960s the catch increased very rapidly to a peak of over 12 000 tonnes in 1964, but in the late 1960s bluefin started disappearing from these waters. Around the same time, the Japanese longline fishing grounds started expanding towards the northeast, and reached the Bay of Biscay in the mid-1970s. As longliners with super-cold freezers (under  $-40^{\circ}\text{C}$ ) started fishing for the *sashimi* market, the bluefin fishery in the western Atlantic, off New England in winter and in the Gulf of Mexico during the early summer spawning season, became very important. However, as ICCAT started a very stringent quota system in 1982 for the west bluefin stock, these fisheries became minimal.

Meanwhile, in the early 1980s Japanese longliners started fishing in the Atlantic near Gibraltar, and later in the Mediterranean, for spawning bluefin tuna. In the 1990s, as regulations on bluefin fishing were set by ICCAT, many IUU longliners entered the Mediterranean fishery and their catches became very significant. Learning from these longliners, the coastal states (e.g. Spain and Italy) also developed bluefin longlining in the Mediterranean in the 1990s. However, theft of fish and fishing gear in the Mediterranean became a widespread practice, and many Japanese boats left the Mediterranean in more recent years. Besides, since the early 1990s, a new fishing ground was developed in the north central Atlantic, east of the west-east boundary lines, and expanded further north to near Iceland and the Faeroe Islands in the late 1990s.

#### *Trap fishery*

Some fisheries (definitely with traps and likely with gillnets) for bluefin tuna in the Mediterranean existed already in ancient Greece and Rome. More recently, until the end of the 1960s, one of the major bluefin fisheries was the trap fishery in the Atlantic near the Strait of Gibraltar and in the Mediterranean. The greatest catches were made by Spain on the Atlantic side of Gibraltar,

FIGURE 2.13  
Catches of Atlantic bluefin in the East Atlantic (including Mediterranean), by fishing gear

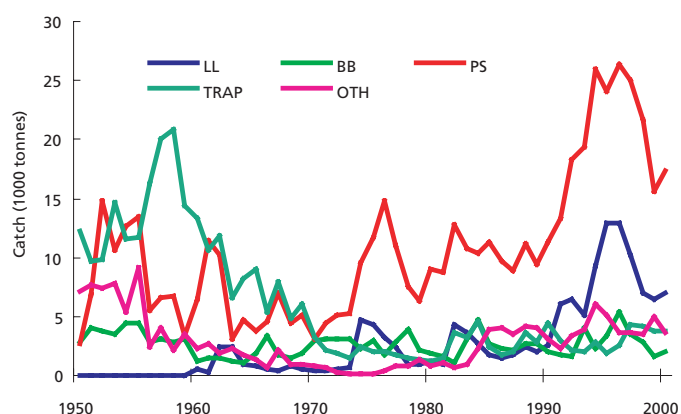
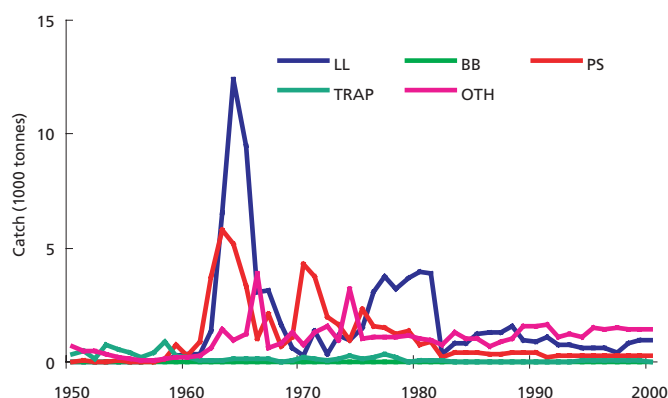


FIGURE 2.14  
Catches of Atlantic bluefin in the West Atlantic, by fishing gear



followed by Italy, Tunisia and Morocco in the Mediterranean. However, these catches peaked in 1958, then declined sharply in the 1960s and stayed at a very low level during the 1970s. The major reason for the decline was the decreasing availability of fish to the traps. Catches recovered moderately in the 1980s, with large annual fluctuations.

In the western Atlantic, a minor trap fishery was operated in northeast Canada and also on the northeast coast of the United States, and this was almost the only bluefin fishery until 1957. Since then, the trap catch decreased almost to nil, and has never recovered.

#### *Purse-seine fishery*

From the 1930s to the mid-1960s, the Norwegian purse-seine fishery was as important as the trap fishery in the east bluefin catches. However, in the late 1960s bluefin started disappearing from Norwegian waters, and the fishery was almost terminated by the late 1970s.

In the West Atlantic, US purse seiners started fishing for bluefin towards the end of the 1950s, and the catch increased rapidly in the 1960s and 1970s. Particularly in the early 1970s, seiners caught a great number of small bluefin off the east coast of the United States. This fishery declined in the 1970s, and has been very minor since 1982 as a result of ICCAT and domestic quota regulations.

In the Mediterranean Sea, purse-seine fishing was started in 1966 by France, and it developed very quickly until 1977; it then levelled off until the mid-1980s, when other countries such as Spain and Italy joined the fishery. Thereafter, the catch started picking up very quickly, to reach a historical high in 1996. Since that peak the reported catch has been declining, most likely due to the catch quota set by ICCAT. In the 1990s, Croatia, Greece, Algeria, and Turkey also joined this fishery.

#### *Baitboat fishery*

The baitboat fishery in the Bay of Biscay was one of the important fisheries for east Atlantic bluefin even in the 1930s. This fishery has been conducted both by French and Spanish fishermen from the Basque area, and shows significant yearly fluctuations without any long-term trend.

Baitboat fisheries also exist in the Canary Islands and Madeira, and from time to time in the Azores Islands. However, the quantity of catch is minor.

In the Mediterranean area, some minor local baitboat fisheries have been developed by Spain, Greece and Morocco. The quantity of catches has been minor.

In the West Atlantic, a Canadian tended-line fishery (similar to the baitboat fishery) has developed since the mid-1980s, but again the catch quantity has been minor.

#### *Other fisheries*

Recreational fisheries for both small and large fish exist in the West Atlantic off the United States since the 1950s; they increased continuously until the beginning of the 1980s, when the catch quota was set for the west bluefin stocks. They also developed recently in the Mediterranean Sea.

Another important coastal fishery in the Mediterranean area is gillnet fishing. This type of fishery has been widely conducted in all the coastal areas of the Mediterranean Sea. However, it has been curtailed significantly after the UN Resolution to ban drift gillnets.

Harpoon fisheries exist on the east coasts of Canada and the United States and widely in the Mediterranean area. However, the catches are minor.

Handline fishing has been also developed widely along the Mediterranean coasts, and recently the catch has been increasing.

### 2.4.3 Catches by country

Since catches by countries are discussed under each gear and stock, only a very brief summary is given here. **Spain** has constantly had the greatest catches throughout the last 50 years. In the early years, most of the catches were by trap and baitboats in the Atlantic, and later by purse seiners and longliners in the Mediterranean. **France** and **Italy** have increased their catches since the mid-1970s in the Mediterranean, using purse seines.

The **Japanese** catch is solely by longline. The peak seen in the 1960s was off Brazil, while more recently catches were distributed evenly between both stocks. **Norway** and **Morocco** made big catches in the early period, by purse seine and various fishing methods, respectively. US catches are solely from the West Atlantic, and peaked in the early 1960s; the recent low level is due to ICCAT regulations.

## 2.5 BIGEYE TUNA

### 2.5.1 General overview

In the Atlantic bigeye tuna are widely distributed across the ocean, between 50°N and 45°S. The spawning area is in tropical waters. In general, juvenile fish form surface schools with other tropical tunas (mostly yellowfin and skipjack) in coastal waters, particularly in the Gulf of Guinea, but when they reach maturity they do not form dense schools and live at a much greater depth. ICCAT considers that there is a single stock of bigeye in the Atlantic.

Figure 2.15 shows the total cumulative Atlantic bigeye catches by fishing gears. Bigeye tuna are harvested by three major gears, baitboat, longline and purse seine, in that chronological order of entry into the fishery. Catches by all of these gears, and hence total catch in the Atlantic, increased steadily since 1950 to about 130 000 tonnes in 1994, and thereafter declined slightly. The recent decline in the catch may have been partly due to the various management measures taken by ICCAT.

### 2.5.2 Catch by fishing gears

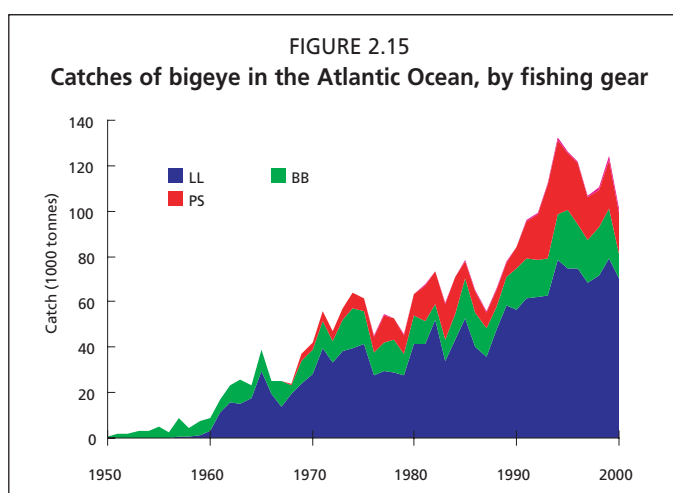
#### *Baitboat fishery*

There are two types of baitboat fisheries, one targeting large bigeye near the northeastern Atlantic islands (Azores, Madeira and Canaries), and another on schooling juveniles in the Gulf of Guinea. From 1950 up to the mid-1960s, most of the baitboat landings were of the first category, i.e. large fish near the islands, and hence by Spain and Portugal. The catch level of this fishery during that period was about 2 000 to 6 000 tonnes, with wide fluctuations due to the availability of fish near the islands. This fishery continues at present at a similar level.

The second fishery, for small bigeye, was started in 1962 by Japanese baitboats based in Tema, Ghana. Later, the Republic of Korea, Panama and Ghana joined this fishery. Currently only Ghana continues baitboat fishing in this area. These fisheries target yellowfin and skipjack, and bigeye is only by-catch, so the level of the bigeye catch is relatively low, about 1 000 to 2 000 tonnes.

#### *Longline fishery*

The longline fishery in the Atlantic started with the Japanese exploratory fishing off Venezuela in 1957. From the mid-1960s to the 1970s, the Japanese longliners concentrated on yellowfin, albacore and bigeye for the



canning industry. In the 1960s, the Republic of Korea and Taiwan Province of China followed Japan and started longline fishing. Their total bigeye catch was about 20 000 to 30 000 tonnes. In the late 1970s the Taiwanese fleet started concentrating on albacore in temperate waters, and its bigeye catch declined considerably, while the Korean fishery stayed in tropical waters.

In the late 1970s, the Japanese fleet changed target to bigeye for the *sashimi* market, as these fish are of higher value than yellowfin or albacore tunas, using deep longlines. Conversion to this type of longline also started in Taiwanese vessels at the beginning of the 1990s. However, some Taiwanese vessels are still targeting albacore, while almost all the Japanese vessels are targeting bigeye. The total catch of bigeye by these three countries was stable at 40 000 to 60 000 tonnes during the 1970s and 1980s, with an increasing trend in the 1990s.

In the Atlantic, longliners flying the “flags of convenience” were very commonly seen. Until the early 1990s, these flags were used mostly to avoid national regulations on licensing, labour conditions, etc., but since then the characteristics of the fleet have changed; those vessels fly “flags of convenience” in order not to comply with international management measures, and are thus considered IUU vessels. ICCAT has estimated that the catches of such vessels have increased sharply in the last 10 years to over 25 000 tonnes. As a result, the total longline catch has increased very sharply from the late 1980s to the present.

As ICCAT took several management measures, the longline catch has been stabilized at the high level of 70 000 to 80 000 tonnes in the last several years.

### *Purse-seine fishery*

Purse seiners fishing in the Gulf of Guinea concentrate on the tropical tunas, yellowfin and skipjack. It is suspected that, until the late 1960s, some bigeye were mixed with yellowfin in the landings, but was reported as yellowfin. Distinguishing juvenile bigeye from yellowfin by appearance is difficult, and the commercial value of both species was the same, so the catches were not separated by species. Since the early 1970s bigeye landings have been reported separately, based on port sampling. Bigeye catches increased from the mid-1970s and stayed at the level of 10 000 to 15 000 tonnes in the early 1980s. In the mid-1980s the purse-seine effort in tropical waters dropped significantly, and accordingly the bigeye catch dropped to about 5 000 to 6 000 tonnes. However, in the 1990s, as FAD fishing become very common in the east tropical Atlantic, the catch started increasing, and is now at nearly 20 000 tonnes. As these catches consist of very small fish, the number of fish caught is very significant. Since 1996, area-time regulation of FAD fishing has been introduced, and the increase in the catches of small bigeye appears to have halted.

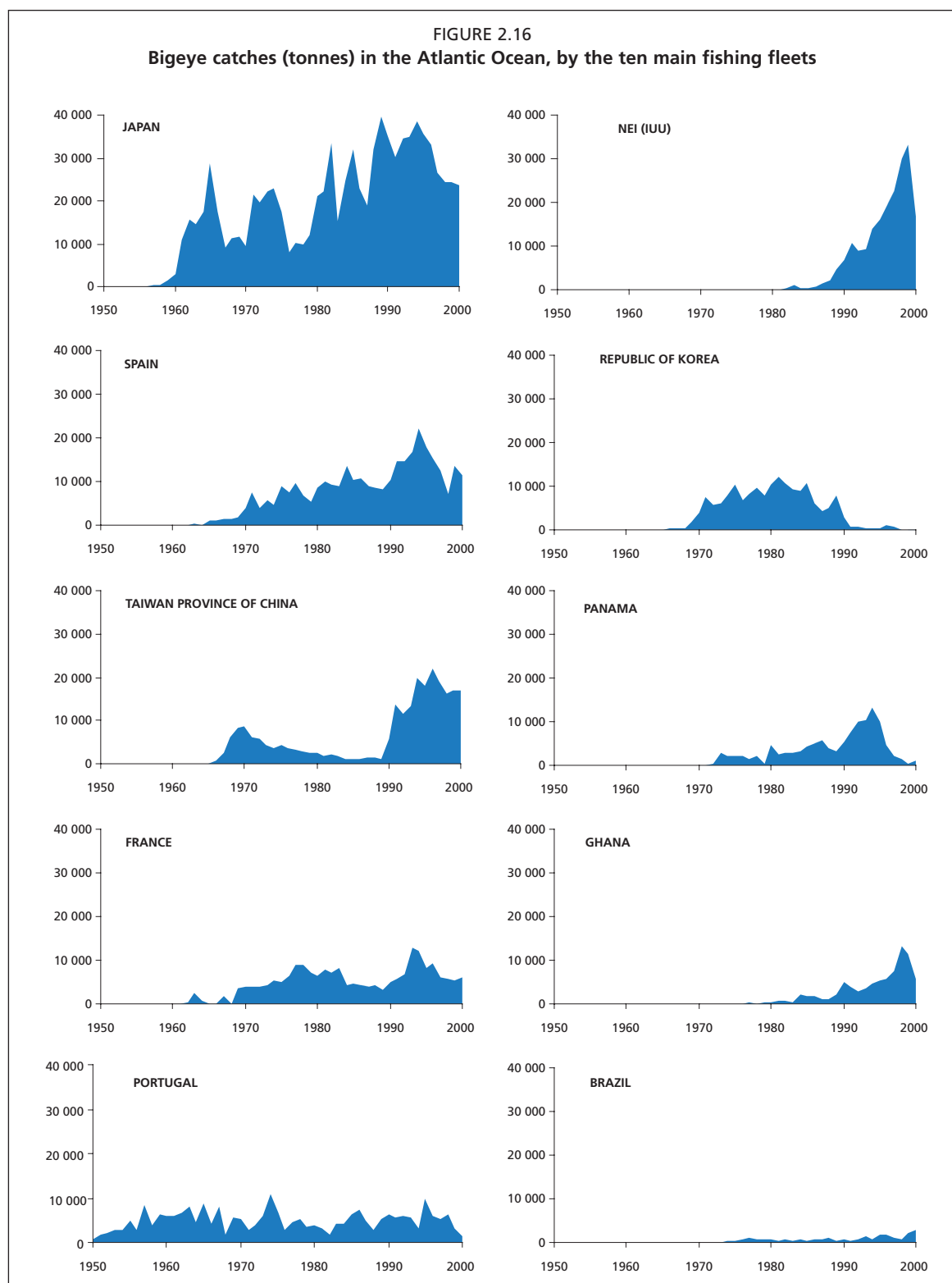
## **2.5.3 Catches by country**

The catches by the ten main bigeye fishing fleets are shown in Figure 2.16. **Japan** has been the largest producer; its catches rose until the mid-1990s, but have since been declining. A **Spanish** baitboat fishery existed for a long time near the Canary Islands, and in the 1990s the catch by purse seiners increased rapidly, due to the adoption of FADs. **French** purse seiners had always caught a certain quantity of bigeye, and this increased in the 1990s with FAD fishing. **Taiwanese** and **IUU** longliners started targeting bigeye in the 1990s and their catches have increased rapidly in the last ten years. **Portuguese** catches are made mostly by baitboats near islands.

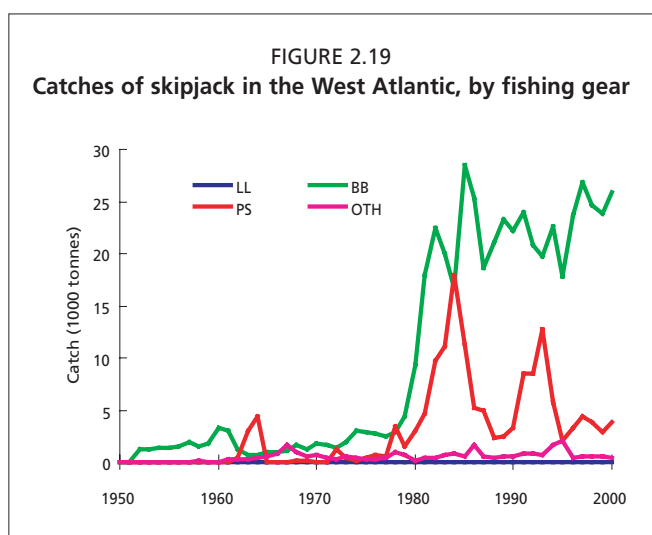
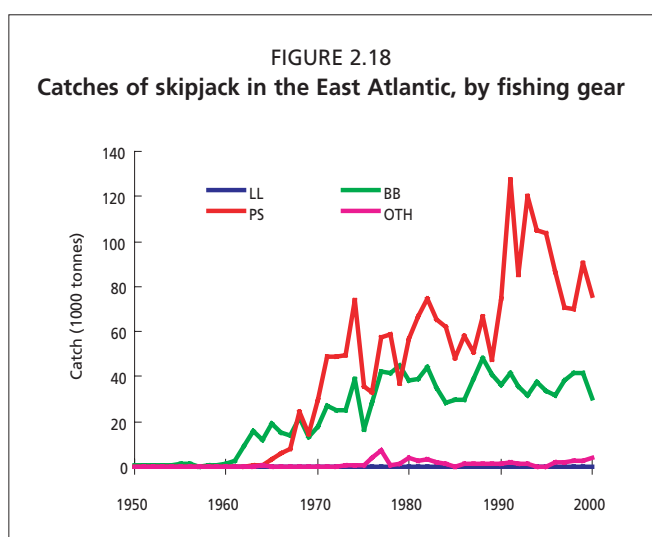
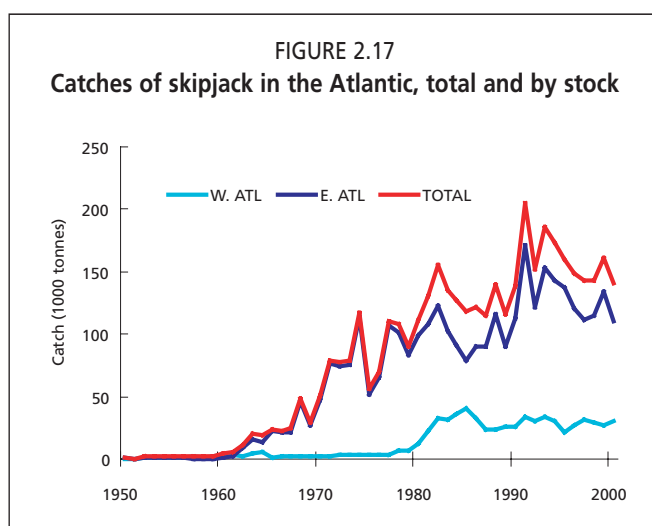
## **2.6 SKIPJACK TUNA**

### **2.6.1 General overview**

Skipjack are distributed widely in the tropical and subtropical waters of the Atlantic Ocean. In general, they school near the surface, and are taken almost exclusively by



surface gears (baitboat and purse seine). The skipjack fisheries started in the late 1950s and developed rapidly. Figure 2.17 shows the total Atlantic catch and those of the east and west Atlantic. The total catch increased until the beginning of the 1980s, except for 1974 and 1975, then decreased until 1990 due to the reduction of purse-seine effort. In the early 1990s the catch jumped up to almost 200 000 tonnes with the return of purse seiners from the Indian to the Atlantic and with the commencement of FAD fishing. In last few years the catch has levelled off.



Two stocks, east and west, are assumed in the Atlantic, based on geographical distribution of catches and tagging data. The catch level in the east has always been much higher than that of the west. Catches of the east stock increased rapidly from the early 1960s until the early 1980s and stabilized at the level of 60 000 tonnes; they started increasing again in the 1990s. The west stock catches started only in the early 1980s, and have been stable at about 20 000 to 30 000 tonnes until now.

One characteristic of the skipjack fishery is that it is multi-species fishery. Most of the fleet targets yellowfin tuna, and the effort for skipjack is secondary. Also the availability of skipjack to the fisheries varies from year to year, leading to large inter-annual fluctuations in the catch.

### 2.6.2 Catch by gears

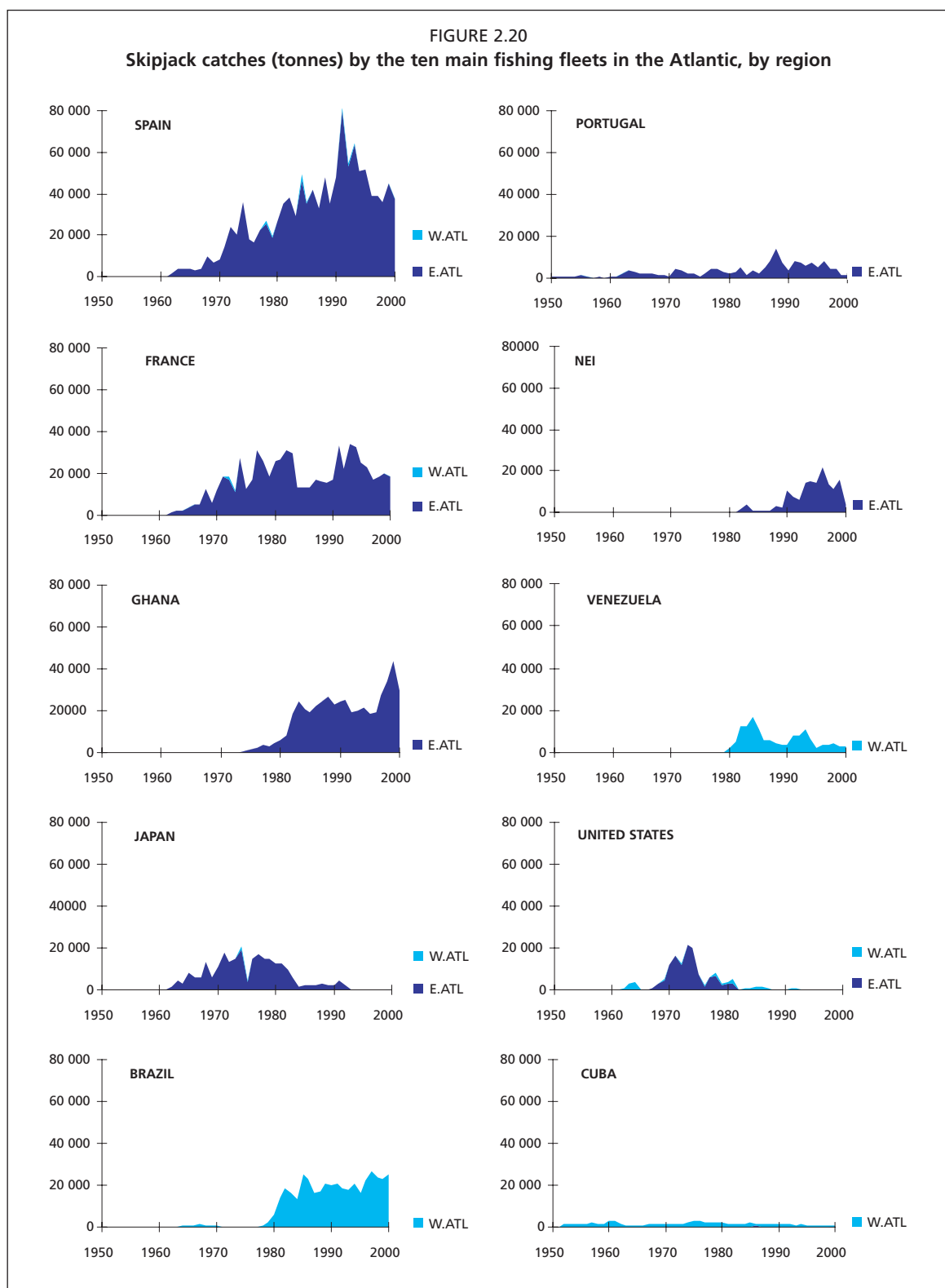
Figures 2.18 and 2.19 show Atlantic skipjack catches by major fishing gears for east and west stocks, respectively. The catches of skipjack during 1950–2000 by the ten main fishing fleets are shown in Figure 2.20.

#### *Baitboat fishery*

**East:** The baitboat fishery started with Spanish and French boats in the Gulf of Guinea in the early 1960s. However, this was soon replaced by the purse-seine fishery. Japanese baitboats based in Ghana, started operations in the early 1960s, followed by Korean and Panamanian baitboats; the fishery is still active with Ghanaian boats. Catches stayed at about 30 000–50 000 tonnes. Unlike the purse-seine fishery in the same area, the main target is skipjack rather than yellowfin.

**West:** The baitboat fishery off southern Brazil was started by Japanese boats that moved from Ghana in the mid-1970s, and in the late 1970s Brazilian baitboats started fishing off

central Brazil. Both these fisheries, which target skipjack, continue at present, and their total catch is about 20 000 to 30 000 tonnes.



### Purse-seine fishery

**East:** The purse-seine fishery, started by Spain and France in the Gulf of Guinea a couple of years after their baitboats started fishing in that same area, developed very quickly and replaced the baitboat fishery. The catch reached the first peak of 70 000–80 000 tonnes in the early 1970s, then stabilized until the early 1990s when FAD fishing started. With the development of FAD fishing, the purse-seine catch started increasing again, reaching a level of 120 000–140 000 tonnes. In the last few years, it has fallen

slightly, due partly to the regulation of FAD fishing in the tropical eastern Atlantic. Purse seiners target mainly yellowfin.

**West:** The purse-seine fishery in the west has been mostly opportunistic. It was started in the late 1970s by boats that usually fished in the eastern Pacific, and fishing in this area is generally done by seiners on their way to and from the Pacific. The catch has never exceeded 20 000 tonnes.

### 2.6.3 Catches by country

The largest skipjack producer in the Atlantic is **Spain**, with baitboats in the 1960s and purse seiners since 1970. The fishing grounds are mostly in the Gulf of Guinea, which expanded over time, mostly towards the south and west. The catch peaked in the early 1990s. While Spanish seiners target skipjack together with yellowfin, **French** seiners target mostly yellowfin, and thus the skipjack catch is less. **Ghana** is growing in importance as a skipjack producer, mostly with former **Japanese** and **Korean** baitboats that were based in Tema in the 1960s and 1970s, and more recently with seiners. Many of the **Japanese** baitboats formerly in Ghana moved to Brazil and started the **Brazilian** skipjack fishery. Recent **NEI** catch is by FOC purse seiners, in the Gulf of Guinea. **United States** seiners also fished in the Gulf of Guinea during the 1970s, but left the area in the early 1980s.

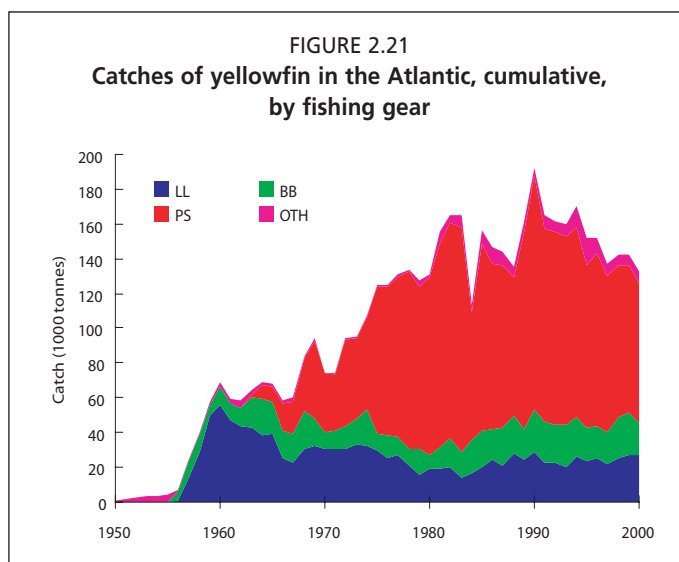
## 2.7 YELLOWFIN TUNA

### 2.7.1 General overview

The total catch of yellowfin tuna in the Atlantic, accumulative by fishing gear, is shown in Figure 2.21.

Yellowfin are distributed across the Atlantic between 45°N and 40°S. The spawning area is in tropical and subtropical waters. Juveniles are found near the surface and relatively near the coast, particularly in eastern tropical waters, schooling with juveniles of other tropical tunas such as skipjack and bigeye. As they grow, the fish move offshore and towards the west Atlantic but, unlike bigeye, their habitat is still relatively near the surface. The juveniles are caught by surface gears, and adults by both surface gears and longlines. It is considered that only one stock exists in the entire Atlantic.

The fishery started with baitboats and longlines in the late 1950s, and catches reached 60 000 to 75 000 tonnes. Purse seiners started fishing in the mid 1960s, and the catch rose to over 150 000 tonnes by the early 1980s; it then declined somewhat, but reached another peak of 210 000 tonnes in the early 1990s. The catches by purse seiners have dominated the total since the early 1970s.



### 2.7.2 Catch by gear

The Atlantic yellowfin catch by fishing gears is shown in Figure 2.22, and the catches during 1950–2000 by the ten main fishing fleets are shown in Figure 2.23.

#### *Baitboat fishery*

The baitboat fishery for yellowfin was started by Spain and France in the eastern tropical Atlantic in the 1950s. This type of fishing still continues in Senegal and Angola, although its scale has been reduced. Japanese baitboats started operating out of Ghana, in the early 1960s, and were followed

by the Korean and Panamanian fleets. They have now been replaced by Ghanaian-flag baitboats, which are still operating. This fishery is of a multi-species nature and catches mostly skipjack, but also fishes for yellowfin and bigeye. The yellowfin catch in the East Atlantic has been stable at about 20 000 tonnes.

#### *Longline fishery*

The large-scale longline fishery was started in the late 1950s by Japan, and expanded very rapidly in tropical waters from west to east during the 1960s. As the Republic of Korea and Taiwan Province of China started longline fishing, the total catch increased very rapidly to nearly 60 000 tonnes. These catches were generally frozen and sold for canning, but in the 1970s the Japanese fleet changed its target to bigeye for the *sashimi* market, and the Taiwanese fleet changed its target from yellowfin to albacore. As a result, the Republic of Korea, Cuba, Venezuela, Brazil and FOC-IUU fleets became the major producers of longline yellowfin catches. Now even yellowfin are frozen with super-cold freezers and sold in the *sashimi* market, although their value is less than that of bigeye. Recent longline catches have been between 20 000 and 30 000 tonnes.

#### *Purse-seine fishery*

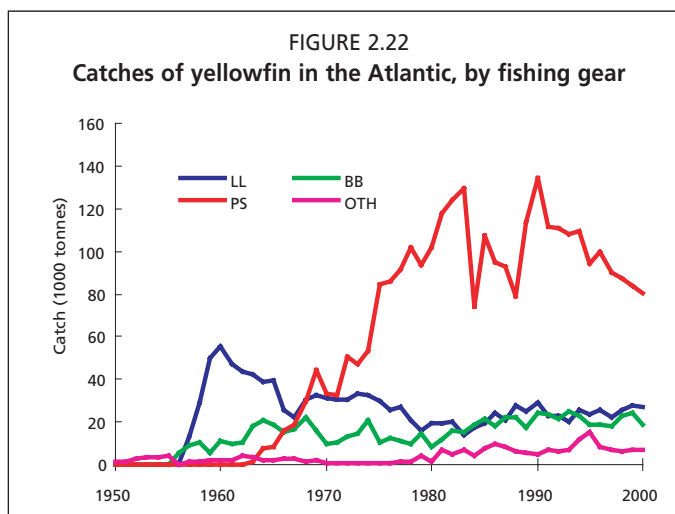
The purse-seine fishery was started by Spain and France in the same fishing grounds as, and soon after, the baitboat fishery in the Gulf of Guinea. This fishery developed very quickly and replaced their baitboat fishery. The catch reached its first peak of 130 000 tonnes in the early 1970s. In the early 1980s, the catch rate of yellowfin in the eastern tropical Atlantic declined, while fishing grounds with very high catch rates were developed in the western Indian Ocean. As a result, many French and Spanish purse seiners moved from the Atlantic to the Indian Ocean, and the yellowfin catch was reduced to 70 000–100 000 tonnes.

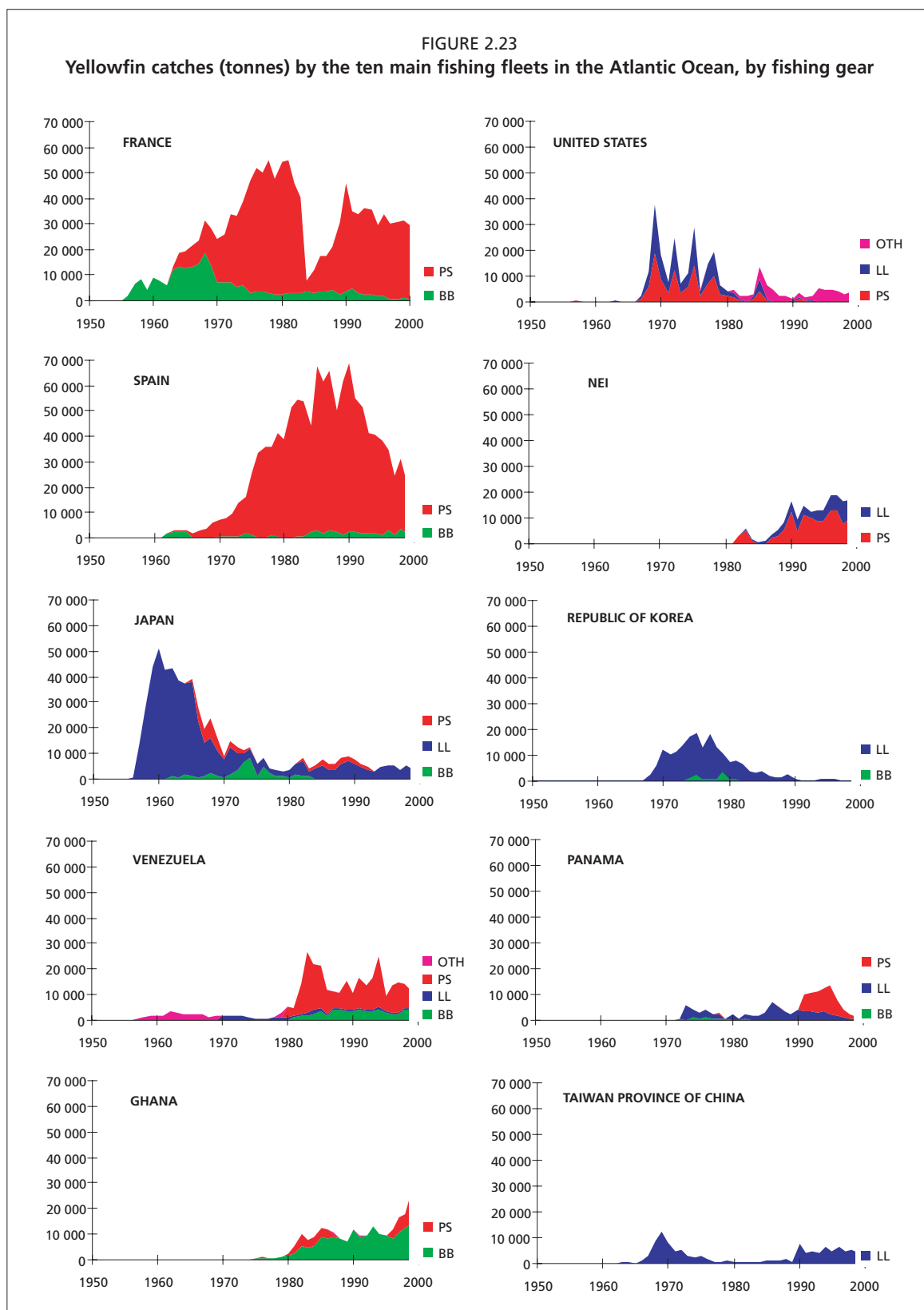
When some of these purse seiners returned to the Atlantic in the late 1980s, the catch started increasing again and attained the maximum of over 130 000 tonnes in 1990. When FAD fishing started, the catch stabilized at a high level until mid-1995. FAD fishing increased the catch of small fish, and the purse-seine catch of large yellowfin in offshore waters declined. In general the catch in last several years has been decreasing, due partly to the shift from large fish to smaller fish and partly to the regulations on FAD fishing in the eastern tropical Atlantic.

The purse-seine fishery in the western Atlantic is opportunistic. It was started in the late 1970s by Venezuelan purse seiners that fished mostly in the eastern Pacific. The vessels that fish in this area are generally from the Pacific, and the catch has never exceeded 20 000 tonnes.

### **2.7.3 Catches by country**

Purse-seiners of **France**, **Spain** and **NEI** fleets are by far the largest producers of yellowfin in the Atlantic. Their catch trends reflect the development of the purse-seine fleet in the eastern tropical Atlantic. Until the end of the 1960s the largest catches of yellowfin were made by **Japanese** longliners. The **Venezuelan** catch since the early 1980s has been mostly by longliners near coasts. The **United States** catch in the 1960s was by purse seiners in the east Atlantic, but more recently from near the coast of the





United States. **Ghanaian** catches, which started in the late 1970s, are made mostly by baitboats, but more recently also by seiners. **Korean** and **Panamanian** catches are by baitboats and longliners.

## 2.8 SWORDFISH

### 2.8.1 General overview

Swordfish are widely distributed in the Atlantic Ocean between 50°N and 40°S and in the Mediterranean Sea. Swordfish in the Mediterranean and North Atlantic are considered as two separate stocks, as there are two spawning areas, one in the tropical waters of the Atlantic and another in the Mediterranean. In the Atlantic it is considered that there are two further stocks, one in the north and one in the south, tentatively divided at 5°N. Catches, total and by stock, are shown in Figure 2.24.

During the 1950s, the swordfish catch was all from the North Atlantic, and remained at a low level. It increased moderately from the 1960s until the early 1980s, and very rapidly during the 1980s. In the 1990s it levelled off between 45 000 and 55 000 tonnes.

**North:** The North Atlantic catch of about 5 000 to 9 000 tonnes dominated the total during the 1960s and 1970s. From the mid-1970s it increased, to 20 000 tonnes in 1987, but decreased thereafter, mostly due to catch regulations.

**South:** The South Atlantic catch was almost nil until the 1970s, and in the 1970s and early 1980s was mostly by-catch in the tuna longline fisheries and much less than the North Atlantic catch. However, with the commencement of longline operations targeting swordfish at the end of 1980s, it increased very rapidly to 15 000 to 20 000 tonnes, and in the 1990s was at about the same level as the North Atlantic catch.

**Mediterranean:** Mediterranean catch statistics are not as accurate as those for the Atlantic Ocean, and are possibly under-estimated. Catches were low until the mid-1980s, at about 5 000 tonnes, but increased very rapidly in the late 1980s. In the 1990s they stabilized at around 15 000 tonnes, and in the 1990s were at about the same level as the North and South Atlantic catches.

### 2.8.2 Catch by fishing gears

The swordfish catch from the North and South Atlantic and Mediterranean, by fishing gears, is shown in Figures 2.25, 2.26 and 2.27, respectively. Swordfish are harvested almost exclusively by longlines; the only significant exceptions are harpooning and gillnetting.

FIGURE 2.24  
Catches of swordfish in the Atlantic, total and by stock

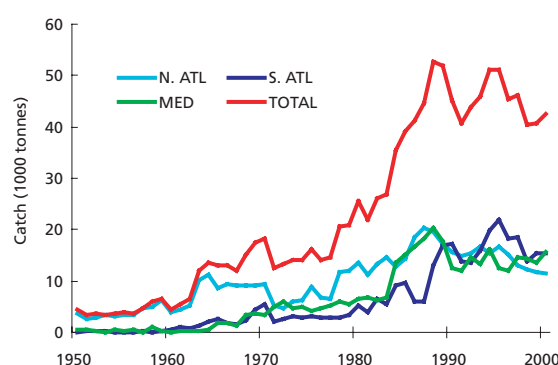


FIGURE 2.25  
Catches of swordfish in the North Atlantic, by fishing gear

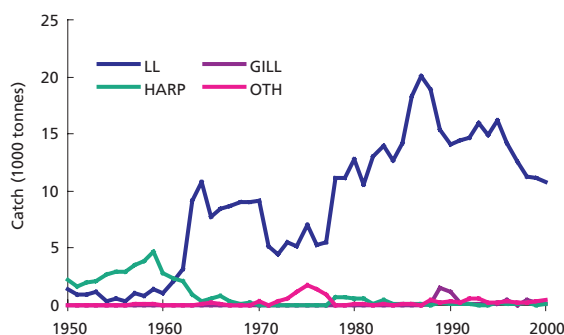
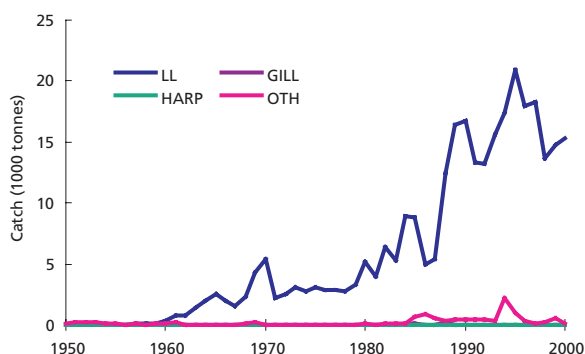
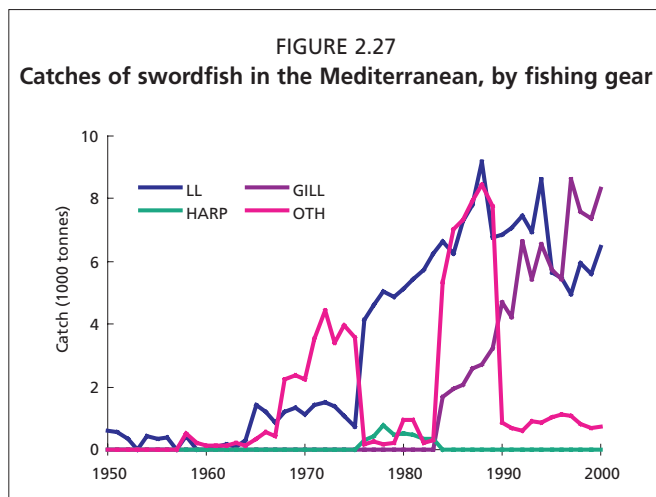


FIGURE 2.26  
Catches of swordfish in the South Atlantic, by fishing gear





### Longline fishery

Longlines that target tunas are generally set in the daytime at depth and catch swordfish as by-catch, whereas those targeting swordfish are set at night and at relatively shallow depths. The structures and materials of the longlines are also different.

**North:** In the late 1950s and early 1960s, longline fisheries targeting swordfish were developed very quickly by Canada, the United States and Spain, while large-scale multi-species longlining by oriental fleets (Japan, and later the Republic of Korea and Taiwan Province of China) started catching

swordfish as by-catch. In the early 1970s, due to restrictions on mercury content in fish, the swordfish fisheries, particularly those of Canada and the United States, were reduced to a very low level, if not nil. The fishery resumed in the mid-1970s.

The annual catch was mostly less than 10 000 tonnes until the beginning of the 1980s. During the 1980s it increased very rapidly, corresponding to the expansion of the market, and reached 20 000 tonnes. However, in the early 1990s the ICCAT catch quota regulation was introduced, and since then the catch has been controlled at between 12 000 and 15 000 tonnes.

**South:** The South Atlantic swordfish catch, by fishing gears, is shown in Figure 2.26. Initially fisheries targeting swordfish existed exclusively in the North Atlantic, but since the early 1960s the southern stock has been harvested at the level of 3 000 to 5 000 tonnes by longline vessels, mostly Japanese and Taiwanese, while targeting other species. In the late 1980s, the Spanish, and to a lesser extent the Portuguese and US, longline fisheries for swordfish in the North expanded their fishing ground to the south, and this was accelerated in the early 1990s when ICCAT set a quota for northern swordfish. At the same time, Brazilian longliners also started targeting swordfish. Since the late 1990s, swordfish in the South Atlantic has also been under ICCAT management measures, with a TAC and quota system, and the catch has been reduced to the level of 15 000 tonnes.

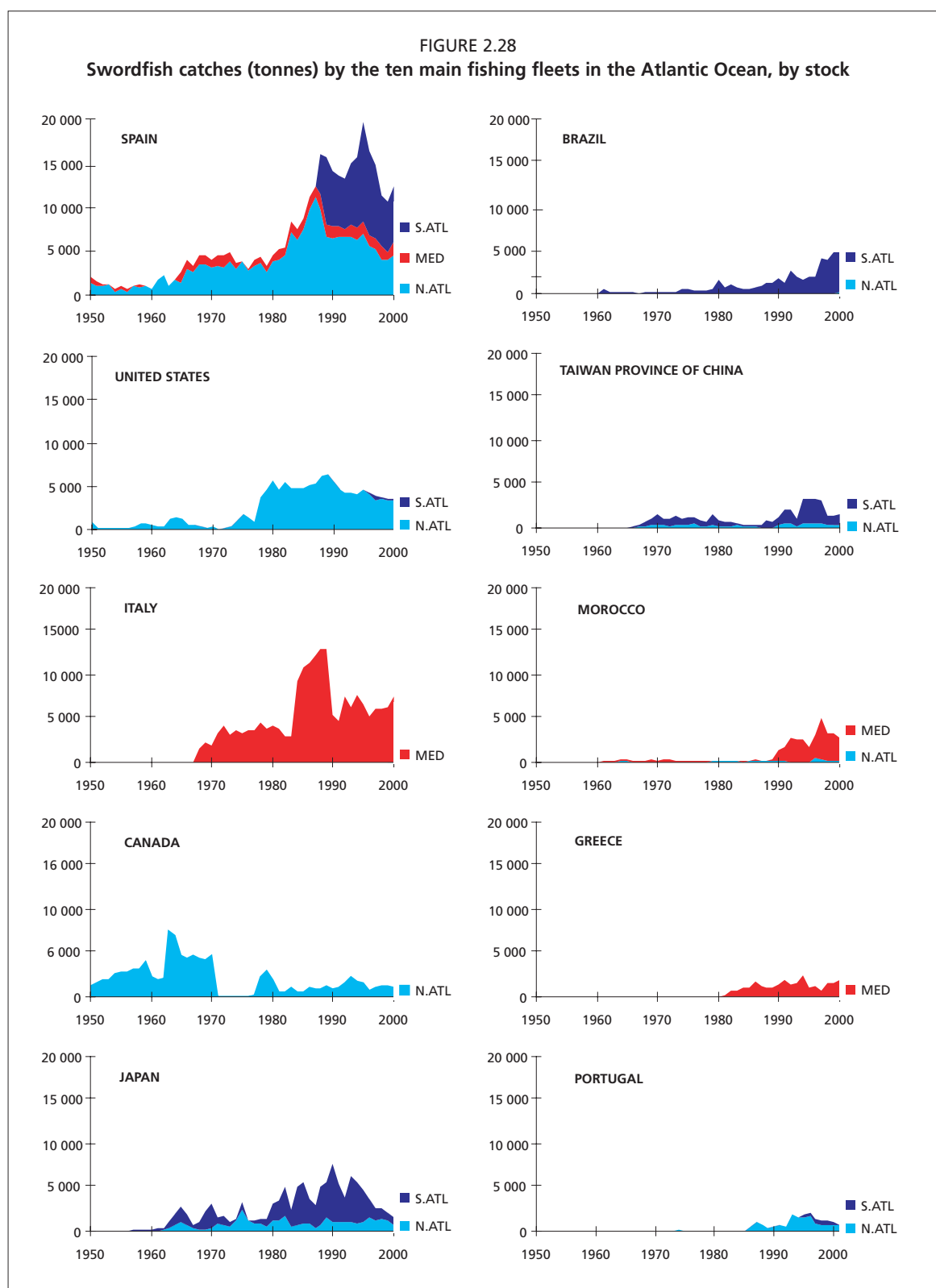
**Mediterranean:** The Mediterranean swordfish catch, by fishing gears, is shown in Figure 2.27. Longlines have become important only since 1975. The catch increased rapidly to 9 000 tonnes by 1988, but has since declined to about 6 000 tonnes.

### Gillnet fishery

The only notable gillnet catches in the Atlantic were by Taiwanese vessels from the late 1970s to 1982. However, this fishing method has been widely practised in the Mediterranean, and it is likely that the unclassified catches of about 4 000 tonnes reported in the 1960s and 1970s were by gillnet. Reported gillnet catches started only in 1983, but increased very rapidly and exceeded the longline catch by the mid-1990s. The current gillnet catch in the Mediterranean is about 8 000 tonnes.

### Harpoon fishery

In the 1950s, swordfish were mostly harvested by harpoon in the northwestern Atlantic. However, in the late 1950s the catch of this fishery declined, and by the 1980s was at a minimal level. In the Mediterranean, harpoons have been widely used to harvest swordfish, but the catches have been very minor and/or are reported as by other or unclassified gears.



### 2.8.3 Catches by country

The catch by the ten main swordfish-catching countries is shown in Figure 2.28.

The **Spanish** longline fishery is by far the largest producer of swordfish in the Atlantic. It became significant in the 1960s, and the catch has increased rapidly since the beginning of the 1980s; it levelled off in the 1990s, due mostly to ICCAT quota regulations. The **United States** started significant longline fishing for swordfish

in the 1970s, after the mercury restriction was eased. **Italian** catches are all from the Mediterranean, and are made by various gears, including gillnet, harpoons and longlines; they have been quite high in recent years. **Canada** used to have the greatest catches of swordfish, but after the mercury restriction in the 1970s its catches never returned to their previous level. The **Japanese** and **Taiwanese** fleets catch swordfish as by-catch, particularly when targeting bigeye, and hence catches of swordfish have increased in recent years together with the increase in bigeye catches. **Morocco** and **Brazil** started fisheries targeting swordfish in recent years.