# 3. A Global Overview

## ■ Fishing Patterns of DWFs 1950-1994

Although our research focuses on the activities of DWFNs in specific regions and fisheries around the world, we first provide a brief analysis of global trends in distant water fisheries. This study is based on catches reported to the Food and Agriculture Organization of the United Nations (FAO) and includes historical data from 1950 to 1994. The present analysis is approximate as it is impossible to obtain exact figures of the catches made by any one nation outside of its own EEZ from the FAO fishery statistics. The approach used here is to group the catches of each country by FAO Statistical Area, and then exclude the catches reported in the FAO area(s) pertaining to the EEZ of each country. Thus we work only with catches made outside each nation's own FAO areas. This method might produce somewhat underestimated catches for the DWFs, but it is hoped this bias will be similar for all nations and that these data will still reflect the relative importance of each fleet and preserve the most relevant trends. Catches from 1950 to 1994 were summed over species or species groups to arrive at cumulative totals by species. These numbers are the ones used to infer the most important patterns and trends in distant water fisheries.

Two countries stand out as the all-time most dominant DWFNs: the USSR (until its disappearance) and Japan. Together, they account for over half of the total catches by DWFs, the USSR with 32 per cent, and Japan with 21 per cent of the total. Spain follows in third place with about 10 per cent of the catches. Other important DWFNs are, in order of importance: the Republic of Korea (5 per cent), the Russian Federation and Poland (4 per cent each), Taiwan, Portugal, Germany, and France (3 per cent each), Ukraine (2 per cent), Norway, Romania, Cuba, Bulgaria, and the United States (1 per cent each), and then 53 other nations with smaller catches. Table A1 in the appendix is a complete list of all the DWFNs identified through this analysis.

Throughout its existence, the Soviet block and in particular the USSR, dominated the catches made by DWFs, together accounting for nearly 50 per cent of the total. Even today, the ex-Soviet block nations keep a very high profile in distant water fisheries. Asian countries, led by Japan, are the second most important group of DWFNs. Some other important DWFs are of western European origin: Spain, Portugal, France, and Norway are notable.

The main fishery resources pursued by each of the top 21 DWFNs and the FAO areas where they have centred their activities are shown in Table 1. For each DWFN, the list of species and areas follows a hierarchical order. Most fleets from eastern Europe and Asia have very long ranges of activity, whilst nations from western Europe tend to concentrate their fishing in more discrete parts of the world. Interestingly, there seems to be a very strong correlation in fishing practices among eastern European DWFNs, as well as between Japan and the Republic of Korea. In both cases the species and areas fished are strikingly similar among nations.

Table 1. **Main DWFNs and the resources and FAO areas they fish, arranged by total cumulative catches in distant waters 1950-1994**

| Country | Catch ($t \times 10^3$) | Main fishery resources caught | Main oceans and FAO areas fished |
|---|---|---|---|
| USSR | 74,370 | Diverse resources, horse mackerels, Chilean horse mackerel, Cape hake and horse mackerel, European pilchard | Worldwide, CE Atlantic Ocean, NW Atlantic Ocean, SE Atlantic Ocean, NE Pacific Ocean, SE Pacific Ocean |
| Japan | 49,570 | Diverse resources, Alaska pollock, skipjack and bigeye tunas, squids, yellowfin tuna | Worldwide, large catches in NE Pacific Ocean, then CW Pacific Ocean |
| Spain | 22,860 | Diverse resources, Atlantic cod, Cape hakes, European pilchard, yellowfin and skipjack tunas, octopi | Atlantic and Indian Oceans, CE Atlantic Ocean, NW Atlantic Ocean, SE Atlantic Ocean |
| Korea Rep. | 11,090 | Diverse resources, Alaska pollock, squids, yellowfin and skipjack tunas | Worldwide, NE Pacific Ocean, CW Pacific Ocean, CE Atlantic Ocean, SW Atlantic Ocean, W Indian Ocean |
| Russian Fed. | 10,450 | Diverse resources, Chilean horse mackerel, European pilchard | Worldwide, CE Atlantic Ocean, SE Pacific Ocean, SE Atlantic Ocean, Atlantic-Antarctic Oceans |
| Poland | 8,200 | Diverse resources, southern blue whiting, Cape horse mackerel, Atlantic mackerel, Pacific cod | Worldwide, NW Atlantic Ocean, SW Atlantic Ocean, SE Atlantic Ocean, CE Atlantic Ocean, NE Pacific Ocean |
| Taiwan | 7,370 | Diverse resources, albacore, Argentine squid, yellowfin and skipjack tunas | Worldwide, CE Pacific Ocean, SW Atlantic Ocean, CW Pacific Ocean, W Indian Ocean |
| Portugal | 7,090 | Diverse resources, Atlantic cod, Cape hakes | Atlantic Ocean, NW Atlantic Ocean, CE Atlantic Ocean, SE Atlantic Ocean |
| Germany | 6,850 | Diverse resources. Atlantic cod, Atlantic herring, Atlantic redfishes, horse mackerels | Worldwide, large catches in NW Atlantic Ocean, then CE Atlantic Ocean |
| France | 6,040 | Diverse resources, Atlantic cod, yellowfin and skipjack tunas | Atlantic and Indian Oceans, NW Atlantic Ocean, CE Atlantic Ocean, W Indian Ocean |
| Ukraine | 4,210 | Diverse resources, European pilchard, Cape horse mackerel, Chilean horse mackerel | Worldwide, CE Atlantic Ocean, SE Atlantic Ocean, Atlantic-Antarctic Oceans, SE Pacific Ocean |
| Norway | 2,820 | Atlantic cod, harp seals, sardines, horse mackerels | Atlantic and South Pacific Oceans, NW Atlantic Ocean, CE Atlantic Ocean |
| Romania | 2,530 | Diverse resources, Cape horse mackerel, horse mackerels | Atlantic and Indian Oceans, CE Atlantic Ocean, SE Atlantic Ocean |
| Cuba | 2,320 | Diverse resources, Chilean and Cape horse mackerels, Cape hake, silver hake, other hakes | Atlantic and South Pacific Oceans, SE Pacific Ocean, SE Atlantic Ocean |
| United States | 2,250 | Skipjack and yellowfin tunas | Pacific and Atlantic Oceans, CW Pacific Ocean |
| Bulgaria | 2,140 | Diverse resources, Cape horse mackerel, Atlantic mackerel | Worldwide, SE Atlantic Ocean, CE Atlantic Ocean, NW Atlantic Ocean, NE Atlantic, SW Atlantic Ocean |
| Latvia | 1,890 | Diverse resources, Chilean horse mackerel, horse mackerels, European pilchard | Atlantic and Pacific Oceans, SE Pacific Ocean, SE Atlantic Ocean, SW Atlantic Ocean |
| Italy | 1,810 | Marine fishes, marine molluscs | Atlantic and Indian Oceans, CE Atlantic Ocean, some NW Atlantic Ocean, W Indian Ocean |
| Lithuania | 1,790 | Diverse resources, Chilean horse mackerel, sardines, horse mackerels | Atlantic, Indian, and South Pacific Oceans, CE Atlantic Ocean, SE Pacific Ocean, SE Atlantic Ocean |
| Estonia | 1,460 | Diverse resources, Chilean horse mackerel, horse mackerels, European pilchard | Atlantic and South Pacific Oceans, CE Atlantic Ocean, SE Pacific Ocean, SE Atlantic Ocean |
| Faeroe Is. | 1,440 | Atlantic cod | NW Atlantic Ocean |

Data from FAO Fishery Statistics

Although most DWFNs catch a large variety of fishery resources there are clear patterns showing that eastern European nations specialize in fishing for high-volume, low-value small and middle pelagic fishes such as horse and true mackerels, and sardines. In contrast, Asian nations, while also fishing for a wide range of species, tend to diversify into both low-price high-volume species such as pollock, and high-price species such as tunas and squid. Other nations, such as the Faeroe Islands, concentrate on only one area and species.

Overall, tunas are the fishery resources most intensively fished by DWFNs, amounting to just over 32 million tonnes (t) during 1950-1994 (Table 2). These are followed closely by horse mackerels – and in particular the Chilean horse mackerel – of which over 31 million t have been fished. However, throughout modern fishing history, two species stand out as the most heavily fished by DWFNs: Atlantic cod (*Gadus morhua*) and walleye pollock (*Theragra chalcogramma*), each accounting for more than 20 million t of accumulated catch. Other important stocks are sardines and hakes. Cephalopods, true mackerels, flatfishes, grenadiers, billfishes, and crabs also rank prominently among the fishery resources sought by DWFs.

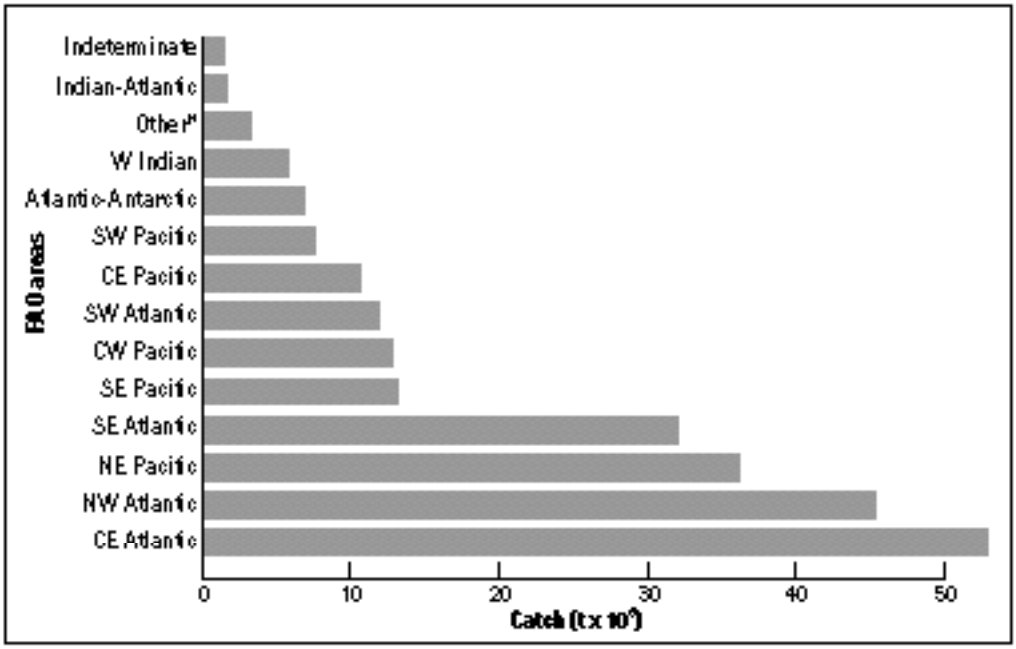
Table 2. **Main fishery resources pursued by DWFNs (cumulative catch 1950-1994)**

| Species | Catch 1950-94 ($t \times 10^3$) | Notes |
|---|---|---|
| Tunas | 32,096 | 38% Skipjack, 29% yellowfin |
| Horse mackerels | 31,779 | 65% Chilean and Cape horse mackerels |
| Sardines etc. | 23,502 | 77% Sardines (59% European pilchard), 18% herrings (74% Atlantic herring) |
| Cods | 23,152 | 91% Atlantic cod |
| Hakes | 21,290 | 53% Cape hakes, 19% silver hake, 13% North Pacific hake |
| Walleye pollock | 20,620 | - |
| Cephalopods | 14,997 | 77% Squids (22% Argentine shortfin squid), 14% octopi |
| True mackerels | 7,962 | 92% Atlantic and chub mackerels |
| Flatfishes | 3,825 | 26% Yellowfin sole, 19% Greenland halibut |
| Grenadiers | 2,777 | 59% Blue grenadier |
| Billfishes | 2,187 | 34% Indo-Pacific blue marlin, 23% swordfish |
| Crabs | 443 | 95% Snow and king crabs |

*Source:* FAO fishery statistics

Geographically, the activities of DWFNs cover the entire globe, from the Antarctic Ocean to the Arctic. However, the catch data of DWFNs show that most of the fishing activity has historically been centred on four main FAO areas: the Central Eastern Atlantic (FAO Area 34), the Northwest Atlantic (FAO Area 21), the Northeast Pacific (FAO Area 67), and the Southeast Atlantic (FAO Area 47) (Figure 1). Fishing in these four areas represents about 75 per cent of the total historical catches by DWFs as defined here. Fishing in Area 34 was dominated by the USSR and Spain. Fishing by DWFs in Area 21 (mainly for Atlantic cod) was dominated by the USSR which took by far the largest catches, although other countries such as Spain, Portugal, Germany, France, Poland, Norway, and the Faeroe Islands also had important catches. For Area 67, most of the catches were walleye pollock and were made mainly by Japan and to a lesser

Figure 1. **Cumulative catches (1950-94) of DWFNs by FAO Statistical Area**
The Central Eastern Atlantic, the Northwest Atlantic, the Northeast Pacific, and the Southeast Atlantic have been the hardest hit.




Other (*) includes Mediterranean-Black Seas, Pacific-Antarctic, Antarctic intermediate, E Indian, and NE Atlantic areas.

Based on FAO Fishery Statistics

extent by the USSR and the Republic of Korea. In Area 47, the main DWFN was the USSR, with Spain, Japan, and Poland having also very important catches.

## ■ Selected Case Studies of DWFs

Map 1 identifies the seven case studies selected for analysis within the global overview. There are two categories within these case studies: five are reviewed in detail and two are presented briefly as boxed cases. This division reflects both the relevance of each case and the availability of information.

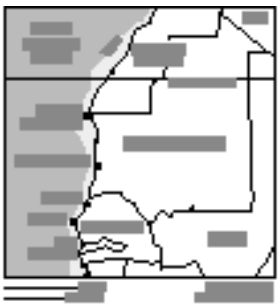
## ■ Case Study: DWFs off Mauritania and Senegal

### ECOSYSTEM

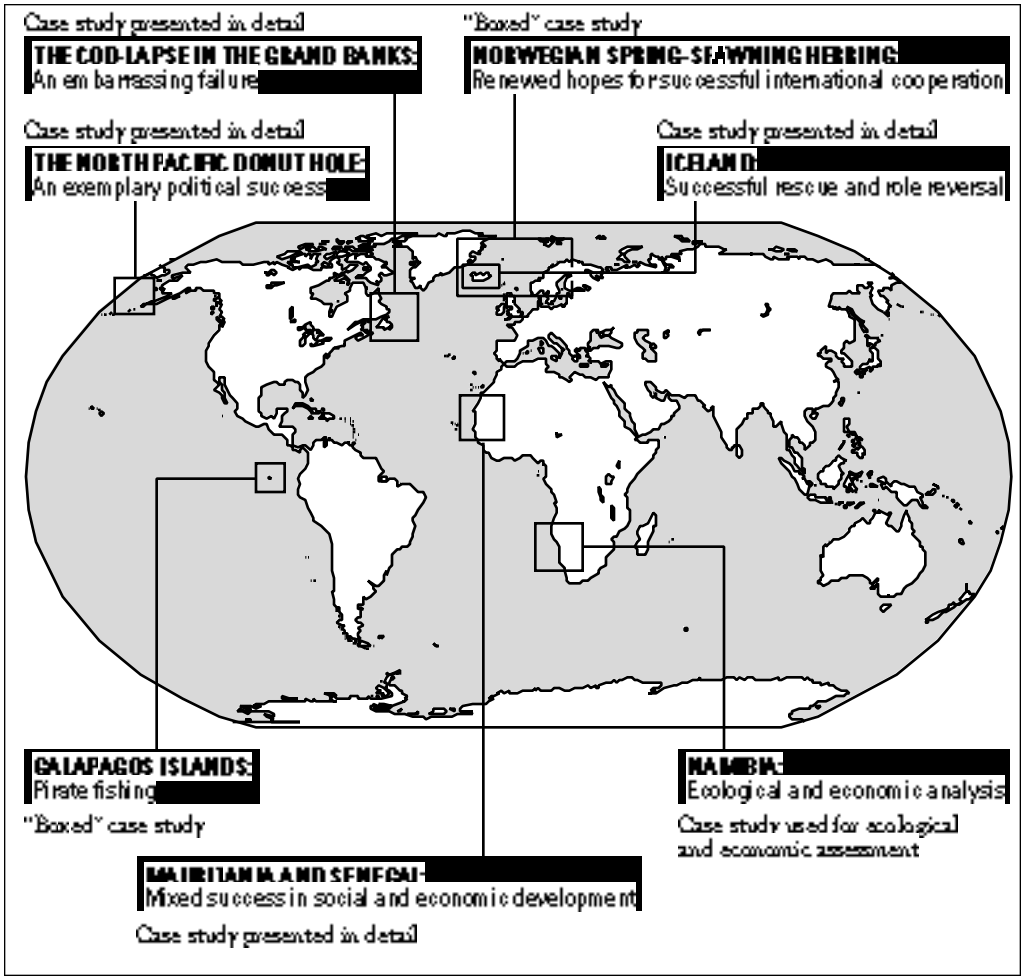
#### Environmental Conditions

The coasts of Mauritania and Senegal are situated in the eastern central Atlantic between 15° and 25° N in a very productive area of major upwellings, the Canary Current System. The coastlines of these two countries extend for more than 1,200 kilometres (km) (754 and 531 km respectively; Map 2). The continental shelf in this region is on average 50 km in width. According to Minas et al. (1982; cited by Mann and Lazier, 1991), this region is divided into two major zones by a front that separates North Atlantic central water from South Atlantic central water at around Cap Blanc.

Map 2. **Mauritania and Senegal lie along one of the richest coastal upwelling systems in the world**



Map 1. **The seven case studies of distant water fleets analysed provide a diverse mixture of situations**




The nutrient-rich water to the south of Cap Blanc is carried northwards well into the Cap Blanc area by the poleward subsurface counter-current of the upwelling region. The region around Cap Blanc and northwards enjoys year-round upwellings, whilst the southern region has upwellings mainly in winter and spring. The result of this combination of oceanographic features gives the area around Cap Blanc the highest primary productivity in western Africa (about 730 grams per square centimetre per year ($g\ cm^{-2}\ y^{-1}$) or 2 grams per square centimetre per day ($g\ cm^{-2}\ d^{-1}$) on average) because upwelling is from nutrient-rich South Atlantic central water and occurs year-round. The northern region's primary production is lower as North Atlantic central water is poorer in nutrients and to the south, upwelling is seasonal.

### Food Chain

In general, phytoplankton blooms occur in upwelling systems during the slack between upwelling events, when stratification occurs allowing phytoplankton to remain and thrive in the shallow nutrient-rich layers of water (Mann and Lazier, 1991). Strong upwelling in the Mauritania-Senegal area generally tends to carry offshore the abundant zooplankton production that follows phytoplankton blooms (Trumble et al., 1981; cited by Mann and Lazier, 1991). As upwelling intensity weakens towards the autumn,

zooplankton remains in the continental shelf and populations attain their peak of abundance (annual mean estimated at 60 g $cm^{-2}$ $y^{-1}$ wet weight; low and high of 40 and 120 g $cm^{-2}$ $y^{-1}$). This outstanding biological production means that the coast off sub-Saharan Africa is one of the world's most productive regions (during 1986, 2 per cent of the world's marine catch was taken in this area representing about 0.0002 per cent of the world ocean; Goffinet, 1992). Fish production in this system is dominated by pelagic species, mainly sardines (*Sardina pilchardus* and *Sardinella aurita*), followed by horse mackerels (*Trachurus trachurus* and *T. trecae*) and jacks (*Decapterus ronchus*); some redfish (Sparidae) are also abundant. The four first species mentioned constituted about 75 per cent of the fish catch in the early 1980s (Trumble et al., 1981; cited by Mann and Lazier, 1991). The two sardine species seem to occupy different parts of the system with *Sardina* dominating the cooler northern region and *Sardinella* the warmer southern part. The ranges of these two species are dynamic as seasonal northern migrations are observed with the approach of summer.

### The Coastal Nations

Mauritania is mostly a desert country that suffers from harsh periodic droughts. It is a very poor nation offering limited resources to its nearly 2.3 million inhabitants (CIA, 1997), many of whom are nomadic. Agriculture and mining (iron and copper) were the main economic activities, but protracted droughts and decreased world demand for iron and copper had strong negative impacts on these activities during the 1970s and 1980s. The government thus turned to the rich marine stocks as the main source of foreign currency and income. The declaration of the EEZ regime in 1979 was the first step of a new fisheries policy that set the stage for a more successful control over fishery resources. This policy required all foreign companies to establish joint ventures (with 51 per cent Mauritanian ownership), to land their catches in the port of Nouadhibou or have them inspected at sea, to construct fish processing facilities at Nouadhibou, and to employ at least five Mauritanians per vessel. This focus on fisheries provided clear initial benefits, but declines in the fishery sector were evident by the early 1990s (Maus, 1997). This decline was mainly caused by the deterioration of the industrial national fleet in the late 1980s. New policies adopted during this period encouraged expansion of the artisanal fisheries aimed at trying to solve pressing problems of unemployment and increased urban immigration, and the slowdown in fishing activity. The growth of the artisanal fisheries sector has been outstanding in the last few years. An estimated 93 per cent of the entire fleet was motorized by 1993 and the share of the valuable octopus production of this sector increased to about 20 per cent in 1992. However, a large part of this growth is at least partially due to the influx of Senegalese artisanal fishermen using pirogues (Maus, 1997). Thus, the aims of solving unemployment and developing a truly Mauritanian fishing capacity probably have not been fully met.

Nouadhibou, the oldest deep water port in Mauritania, has been in operation since 1919. A new deep water port off Nouakchott opened in 1986. Although these two ports concentrate all of the industrial fleet and about 56 per cent and 26 per cent of the artisanal fleet respectively, there are approximately 23 different landing sites for artisanal vessels along the Mauritanian coast (Maus, 1997).

In comparison with Mauritania, Senegal is a more densely populated country (9 million in 1996) and has more abundant water resources. Agriculture (peanuts and grains) and

phosphate mining were the main economic activities until the 1980s. With the downturn in world markets for peanuts and phosphates, fish became Senegal's main source of foreign exchange with seafood exports accounting for nearly 25 per cent (US$15 million) of this country's total export earnings (Goffinet, 1992). Senegal has a very long tradition of skilful artisanal fishermen unparalleled in western Africa. This capacity to take advantage of their rich natural marine fauna has meant that Senegalese artisanal fisheries account for most of the total catch in their EEZ, limiting the activity of DWFs to a minor role (Goffinet, 1992). Most of the total annual fishery catches of Senegal (about 350,000 t) are caught by artisanal vessels. Dakar is the only industrial port, but there are approximately 200 landing sites for small-scale vessels along the Senegalese coast (Samba, 1994a). After centuries of using sail-powered pirogues, Senegalese fishermen started motorizing their fleet in the early 1970s: in 1971 49 per cent was motorized and by 1976 this reached 73 per cent. Presently almost 100 per cent of the pirogues are motorized (Gerlotto et al., 1979; Kebe, 1994). This development, together with the successful introduction of purse seines for these pirogues initiated a steep expansion of the pelagic artisanal fishing sector and concurrent increases in the overall catches. The industrial fishing sector of Senegal relied mostly on shrimp and flatfish stocks in the late 1960s, but declines in shrimp stocks in the late 1970s and most of the 1980s inspired the diversification of demersal catches. A suite of favourable conditions is responsible for the successful growth of Senegalese artisanal fisheries in the last 30 years. Among these, Kebe (1994) mentions: improvements in the pirogue (motorization and cold storage capacity); introduction of purse seines, introduction and improvement of cuttlefish traps, improvements in bottom longlines, etc.; adaptability to changes and dynamism of the fishermen; favourable conditions with strong local and external demand for fishery products; and adequate incentive and aid policies from the government.

## THE DWF NATIONS

The poor monitoring and enforcement capabilities of these two west African countries allowed several DWFs to fish unchecked for many years in this area, especially before 1977. The USSR, Spain, the Republic of Korea, Japan, Norway, Greece, Poland, Romania, Portugal, and Bulgaria were among the main fishing nations catching fish during the pre-EEZ period in the region. In fact, the USSR, Spain, and Japan were known to fish off Mauritania since the early 1960s (Maus, 1997). At least a dozen nations are suspected to have exploited fish stocks in the region, but since the establishment of the EEZ regime, many nations have signed fishing agreements or pursued joint ventures with Mauritania and Senegal. Still, monitoring and compliance remains an important problem. Table 3 lists the countries reporting catches off Mauritania and Senegal to the Commission for Eastern Central Atlantic Fisheries (CECAF) since 1972, together with the importance of their fishing operations. A total of 32 countries is included, however, it is worth noting that many countries seemed to have stopped fishing in the region more than 10 years ago (Norway, Poland, Egypt, Iceland, Libya, and France). Other nations have started fishing operations only in the last decade (Belize, China, Estonia, Georgia, Latvia, Lithuania, Russian Federation, Ukraine, Vanuatu). Several of the small nations included in the list are well known flag-of-convenience countries.

Nations and groups of nations fishing under agreements in this region presently or in the recent past are: Nigeria, the European Union (EU), Japan, and Ukraine. The joint-

Table 3. **The DWFNs known to have fished off Mauritania and Senegal**
Data include Mauritania and Senegal for comparison. Countries with mean landings less than 1,000 t have been combined.

| DWFN | Period fishing | Catch (t x $10^3$) | |
|---|---|---|---|
| | | Total | Mean |
| USSR | 1972-1991 | 17,856 | 893 |
| **Senegal** | **1972-1995** | **5,731** | **239** |
| Russian Fed. | 1992-1995 | 703 | 176 |
| Ukraine | 1992-1995 | 656 | 164 |
| Spain | 1972-1995 | 3,232 | 141 |
| Norway | 1972-1975 | 467 | 117 |
| Poland | 1972-1981 | 692 | 69 |
| Latvia | 1992-1995 | 273 | 68 |
| Romania | 1972-1993 | 1,470 | 67 |
| Lithuania | 1992-1994 | 180 | 60 |
| Estonia | 1992-1993 | 96 | 48 |
| Germany | 1972-1990 | 532 | 30 |
| Italy | 1972-1995 | 687 | 29 |
| Japan | 1972-1991 | 513 | 26 |
| Korea Rep. | 1977-1995 | 274 | 25 |
| Bulgaria | 1972-1992 | 314 | 22 |
| Georgia | 1992-1995 | 88 | 22 |
| Greece | 1972-1995 | 396 | 16 |
| **Mauritania** | **1972-1995** | **327** | **14** |
| Egypt | 1972-1977 | 69 | 12 |
| Iceland | 1975 | 11 | 11 |
| China | 1990-1995 | 48 | 8 |
| Portugal | 1972-1974/1986-1995 | 101 | 8 |
| Honduras | 1986-1995 | 47 | 5 |
| Côte d'Ivoire | 1972-1995 | 97 | 4 |
| Libya | 1980-1988 | 28 | 3 |
| Cuba | 1972-1995 | 58 | 2 |
| Panama | 1984-1995 | 21 | 2 |
| St Vincent | 1988-1993 | 5 | 1 |
| Others | 1973-1995 | 17,548 | 2,078 |

*Source:* CECAF Fishery Statistics

venture fishing scheme promoted by Mauritania since 1979 has resulted in partnerships with the following countries: Algeria, China, France, Libya, Romania (ceased early 1993), Russia, the Republic of Korea, and Tunisia. The main DWFs fishing off Senegal are the eastern European pelagic fish fleets and the demersal fish fleets of the EU (Samba, 1994a).

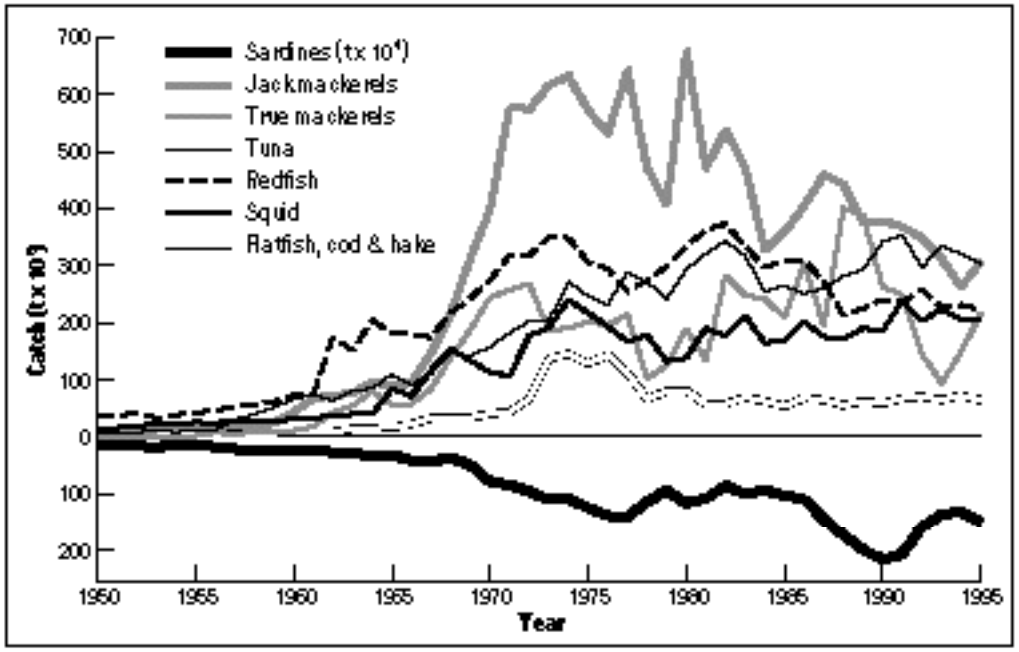
## THE FISHERY RESOURCES AND FISHING SECTORS

The waters off sub-Saharan Africa are favoured with diverse and very abundant fishery stocks, being one of the most productive marine ecosystems in the world. The total

reported catch of all species for the northwest Africa upwelling system in 1974 was 2.68 million t (Ansa-Emmin, 1982; cited by Mann and Lazier, 1991). One million t were clupeids, with 0.67 million t of these being sardines. Half a million t were horse mackerel and 0.2 million t were squid. A dozen industrialized countries led by the USSR took most of the catches. The USSR caught 287,000 t of sardines, 55,000 t of sardinellas, 360,000 t of horse mackerel, and almost 200,000 t of true mackerel *(Scomber* spp.). Fisheries production in the region has not grown since then, indicating perhaps that the sustainability of the fisheries has already been achieved or surpassed.

In general terms, fisheries production in Area 34 (from Morocco to Congo), has averaged about 2.8 million t for the last 20 years (Figure 2). However, there have been substantial fluctuations over this period principally attributable to variations in the catch of sardines and jack mackerels. Sardine production attained an all time peak of 2.2 million t in 1990 then dropped to 1.5 million t by 1995. Meanwhile, jack mackerel catches have shown an overall decrease from the circa 0.5 million t/y level of the 1970s to about 300,000 t in 1995. These reductions in catch might be more linked to decreases in effort in the early 1990s after the collapse of the Soviet bloc and the ensuing disarray of its former fishing fleet, rather than to decreases in fish abundance.

Figure 2. **Sardines account for the majority of the catches in the Western Central Atlantic – FAO Area 34** (All catches are in t x $10^3$, except sardines (t x $10^4$))




According to Resources Development Associates (1985; cited in Goffinet, 1992), cephalopod and sardine stocks in the western African area had been overexploited since the early 1980s, while sardinellas, mackerels, and sea breams were classified as "possibly fully exploited". Russian research suggests that the size and structure of the spawning populations of horse mackerels have remained unchanged over the last 10 years (Sedletskaya, 1995). Sutinen et al. (1980; cited in Goffinet, 1992) give tentative estimates obtained in the late 1970s of sustainable yields for the fisheries off northwest Africa. Reportedly, the potentials were of about 1 million t of sardine, 0.5 million t of

sardinella, 0.2 million t of mackerel, and 0.4 million t of demersal fishes (sea breams, hake, croakers). The abundance of very valuable stocks of octopus off the coasts of Mauritania and Senegal has been linked, to a certain extent, to changes in the community structure as a result of fishing activity (Pereiro and Bravo de Laguna, 1980 and Gulland and Garcia, 1984; cited in Caveriviere, 1994). This seems to be particularly true for the surprising increase in the abundance of octopus off the southern coast of Senegal starting in 1986, which prompted the development of a new fishery with artisanal as well as industrial vessels. The decrease in abundance of sparids and serranids in these areas has been proposed as one of the mechanisms to explain the increased recruitment in octopus populations (Caveriviere, 1994).

Most of the DWFs fishing in sub-Saharan Africa can be classified in three groups. Those fishing mainly for small and medium pelagic fish (sardines, sardinellas, jack mackerels, etc.) were mainly the Soviet-bloc DWFs and their descendants. Those fishing for demersal fish and shellfish were mainly European nations, while cephalopods were pursued chiefly by Asian nations such as the Republic of Korea, China, and Japan, along with some European countries. DWF trawlers fishing in the south of Senegal catch mainly cuttlefish, octopus, and Sparidae (Thiam and Gascuel, 1994). The DWFs of the EU (mostly Spanish) fish mainly hake and shrimp, although some vessels fish for lobster and tuna (Maus, 1997).

According to Maus (1997) the main species in Mauritania are: (1) demersal species: cephalopods such as octopus (*Octopus vulgaris*), squid (*Loligo* spp.), and cuttlefish (*Sepia officinalis hierredda*), hakes (*Merluccius merluccius*, *M. senegalensis*, and *M. polli*), prawns (*Parapenaeus longirostris*), rubber-lip grunt (*Plectorhynchus mediterraneus*), canary dentex (*Dentex canariensis*), burro (*Pamadasys incisus*), smooth hound (*Mustelus mustelus*), barbelled houndshark (*Leptocharias smithii*), and spiny lobster (*Panulirus regius*); (2) small pelagics: European sardine (*Sardina pilchardus*), Spanish sardine (*Sardinella aurita*), Madeiran sardinella (*S. maderensis*), Atlantic horse mackerel (*Trachurus trachurus*), Cunene horse mackerel (*Trachurus trecae*), bluefish (*Pomatomus saltator*), mullet (*Mugil* spp.), and false scad (*Decapterus ronchus*); (3) tunids: yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*), skipjack (*Euthynnus pelamis*), West African Spanish mackerel (*Scomberomorus tritor*), Atlantic bonito (*Sarda sarda*), and Atlantic little tuna (*Euthynnus quadripunctatus*).

There are three distinctive fishing sectors in Mauritania (Maus, 1997): the artisanal fishermen, the industrialized "local" fishermen (which can be further split into national and joint-venture components), and the DWFs. The artisanal fisheries target mainly octopus, burro, grunt, dentex, smooth hound and hound shark, spiny lobster, bluefish, mullet, Spanish mackerel, bonito, and little tuna. The industrialized local fleets target mainly cephalopods, but also some demersal fishes, lobsters, and some pelagic fishes.

In Senegal, artisanal fishermen are by large the most important sector accounting for more than two-thirds of the total catches of the country (Samba, 1994a). Pelagic pirogues comprise the largest part of the Senegalese fisheries production, landing more than 50 per cent of the total catches in 1991. Pelagic fishes (mostly clupeids, with some carangids and scombrids) account for about 80 per cent of the total artisanal catch. Demersal fisheries in Senegal used to concentrate on high-value species such as shrimps and soles, but reductions in shrimp stocks induced a diversification of this sector. More recently, fish

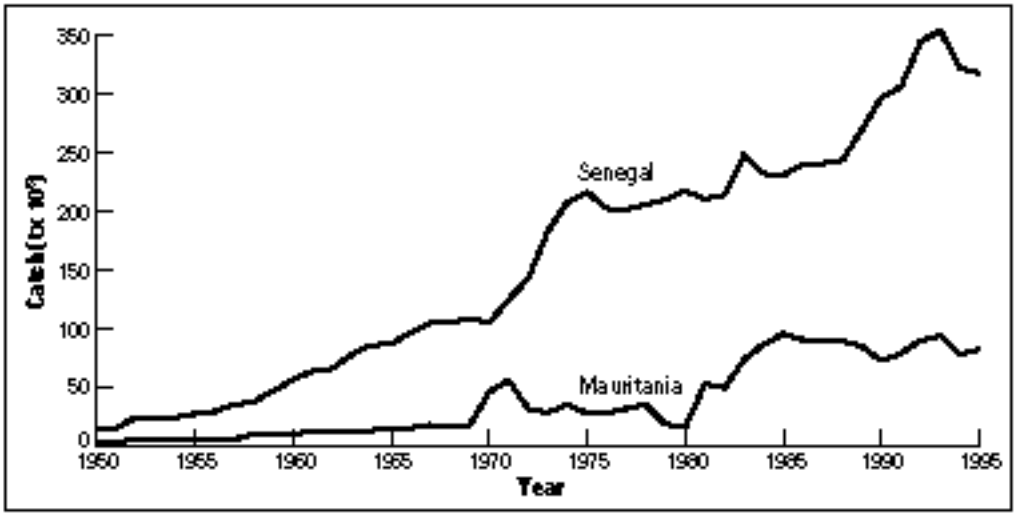
such as *Pagellus*, *Arius*, and *Pseudolithus* account for most of the demersal catches (Samba, 1994a). The artisanal pirogues of Senegal catch a wide range of species depending on the type of gear they use. Samba (1994a) lists about 25 major species for the pelagic pirogues and 22 for the demersal pirogues. Among the most important species reported in artisanal fisheries by Gerlotto et al. (1979) are: *Sardinella* spp., *Cybium tritor*, *Caranx ronchus*, *Pomadasys* spp., *Sphyraena* spp., *Euthynnus alleteratus*, *Ethmalosa fimbriata*, *Arius* spp., *Brachydeuterus auritus*, sharks and rays, soles, and others. More recently, *Octopus vulgaris* has become a very important species for the Senegalese artisanal sector (Caveriviere, 1994). According to Thiam and Gascuel (1994), the trawl fleet catches and lands at least 70 different species. The most important in weight for the Dakar-based trawlers are: *Pseudolithus*, *Arius*, *Galeoides decadactylus*, Sparidae, cuttlefish, and octopus.

## HISTORICAL CATCHES

### Catches of the Coastal Nations

The fisheries of Mauritania were minor before 1970 (10,000-20,000 t/y) when increasing but unstable landings were recorded. However, the real growth of Mauritanian fisheries took place between 1980 and 1985. Statistics from FAO indicate a peak of landings in 1985 with 95,000 t, and relatively stable landings fluctuating around 85,000 t/y since then (Figure 3). In contrast, the evolution of fisheries in Senegal shows a better performance. With the exception of the years 1994 and 1995, Senegalese catches have generally maintained a trend of growth since very early in the statistical record, with maximum growth during the early 1970s. Landings of Senegal currently attain some 320,000 t/y.

Figure 3. **Senegalese fishermen have capitalized more successfully on their rich fishery resources than their Mauritanian counterpart**




The bulk of Mauritanian landings is composed primarily of squids, redfishes, and sardines; unfortunately a large proportion of the landings of this country are masked under the term “various fishes” (Table 4). It is evident that despite the relatively large coast of the country, Mauritania does not utilize much of the very abundant pelagic stocks found in and just outside its EEZ, such as sardines and horse mackerels. In general, the participation of Mauritania in the exploitation of its fishery stocks continues to be very limited. While some reports quote the potential of Mauritania’s

Table 4. **Marine Catches of Mauritania for the years 1950-1995**

| Species | Mean catch (t) | Maximum catch (t) | Year of maximum |
|---|---|---|---|
| Octopus and squid | 14,480 | 55,344 | 1993 |
| Redfishes | 7,670 | 21,840 | 1989 |
| Various fishes | 9,317 | 33,859 | 1984 |
| Sardines | 4,835 | 17,400 | 1971 |
| Horse mackerels | 674 | 2,020 | 1989 |
| Sharks | 745 | 4,030 | 1979 |
| Shrimps | 199 | 2,718 | 1982 |
| Tunas | 75 | 564 | 1981 |
| Mackerels | 36 | 686 | 1981 |
| Lobsters | 93 | 921 | 1987 |

Table 5. **Marine Catches of Senegal for the years 1950-1995**

| Species | Mean catch (t) | Maximum catch (t) | Year of maximum |
|---|---|---|---|
| Sardines | 72,204 | 228,508 | 1993 |
| Redfishes | 26,248 | 60,730 | 1985 |
| Horse mackerels | 16,777 | 38,183 | 1978 |
| Various fishes | 16,091 | 42,050 | 1975 |
| Octopus and squid | 3,074 | 20,217 | 1991 |
| Flatfishes | 2,825 | 11,857 | 1994 |
| Conchs etc. | 2,645 | 10,000 | 1980 |
| Sharks | 2,126 | 7,477 | 1995 |
| Shrimps | 3,231 | 12,703 | 1989 |
| Tunas | 2,707 | 12,402 | 1985 |
| Tilapias | 7,483 | 19,215 | 1975 |
| Mackerels | 1,262 | 8,000 | 1987 |
| Clams and Cockles | 20 | 926 | 1995 |
| Molluscs | 6 | 267 | 1995 |
| Oysters | 115 | 600 | 1963 |
| Crabs | 99 | 520 | 1994 |
| Lobsters | 116 | 787 | 1994 |
| Aquatic plants | 33 | 360 | 1975 |
| Cods and Hakes | 3 | 33 | 1993 |
| Crustaceans | 5 | 108 | 1974 |

fishery resources to be around 930,000 t per annum, only about 90,000 t or slightly less than 10 per cent is caught by the national fleet (Anon., 1996a).

Senegal capitalizes to a greater extent on its availability of large fishery resources. The fisheries of Senegal are driven by sardine catches, which account for almost two-thirds of the total (Table 5) and peaked in 1993 at almost 230,000 t. Other significant stocks in order of importance include redfishes, horse mackerels, squids, shrimps, tunas, and flatfishes.

## CATCHES OF THE DWFs

It is very difficult to provide reliable historical catch statistics for DWFNs fishing off the coasts of Mauritania and Senegal. The most detailed geographical references used by FAO for purposes of reporting fishery catches (FAO Statistical Areas) do not provide enough geographical detail to pinpoint catches off Mauritania and Senegal since 1950. CECAF reports data starting only in 1972. The best we can do to provide figures for the 1950-1971 period is to speculate around the figures reported for the Central Eastern Atlantic (FAO Area 34) using available knowledge of the distribution of fishery resources within this area and ancillary information from the fishing operations of the DWF. A first approximation of the total catches of DWFNs off the coasts of Mauritania and Senegal can be made by subtracting the catches of all west African coastal states. After this, the catches of tunas and tuna-like fishes are estimated from the totals of Area 34 by pro-rating the catches of each species each year, according to the approximate proportion of each species that has been traditionally fished in Mauritanian or Senegalese waters. The maps of catches of tuna and related species by geographical grid reported by the International Commission for the Conservation of Atlantic Tuna (ICCAT, 1997) were used for this task. The results (Figure 4) show that high exploitation in the region started in1967 and reached a first peak of just over 2 million t in 1971. Catches decreased sharply in 1978 with the establishment of the EEZ regime, and bounced back in 1980. The period 1988-1991 again saw catches around 2 million t but fisheries production declined greatly after 1991 mainly due to political change in the ex-Soviet world, which before its collapse took the lion's share of the catches and accounted for over 50 per cent of all DWF catches over the same period.

Figures 4 and 5 illustrate the extremely disproportionate share of the total catches between coastal and DWF nations. Although there is a very slight trend of increased share of the fishery resources by the coastal nations, for over 45 years about 80 per cent of the total catch has been taken by the DWFs leaving only about 20 per cent to the coastal nations.

Figure 4. **DWFNs took peak catches of almost 2 million tonnes off the coasts of Mauritania and Senegal (FAO Area 34)**

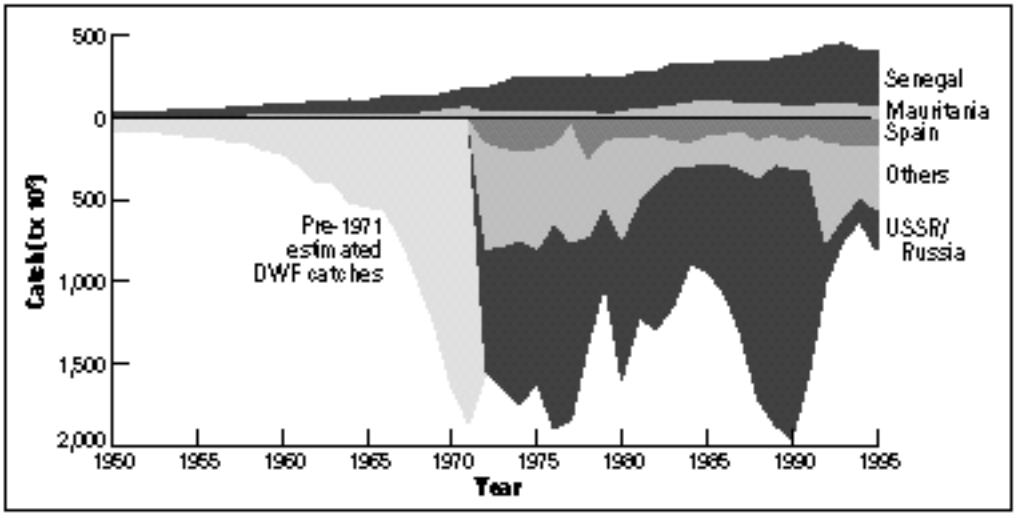
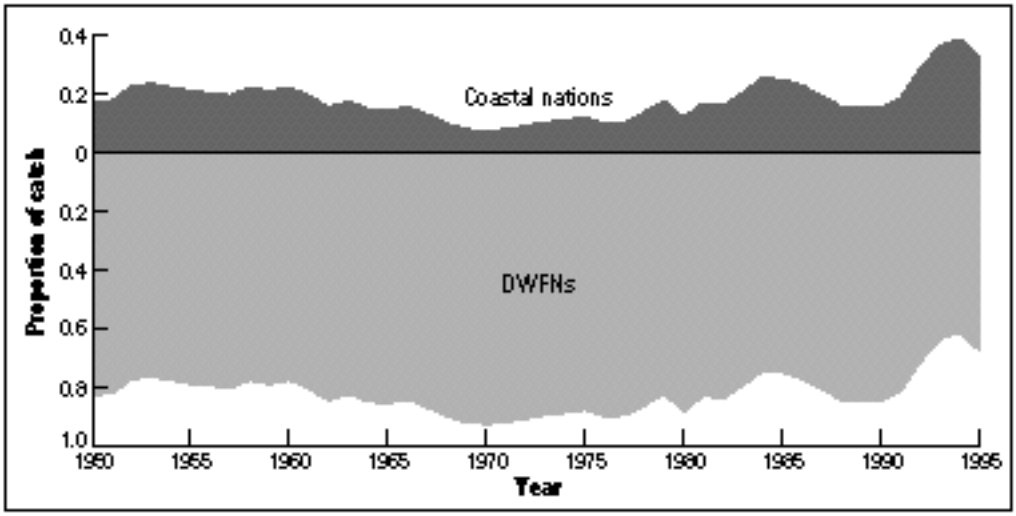


Figure 5. **DWFNs take the largest proportion of the catches in northwest Africa, fishing about 6.25 times more than the coastal nations**




## FLEET CHARACTERISTICS AND NUMBERS

There is little easily accessible information on numbers of vessels fishing off Mauritania and Senegal, especially historical data. Most of the information available is scanty and dispersed. However, two things seem to come out from this information: foreign fleets have always been more important off Mauritania than off Senegal and, with time, the DWFs fishing off Mauritania seem to have either increased in number or at least remained more or less constant.

Brulhet (1976) provides some figures for the fleets fishing off Mauritania in the mid-1970s before declaration of the EEZ regime. According to his report, there were three Mauritanian purse-seiners of 62 t and about 40 purse-seiners from the Canary Islands (maximum of 20 t) in operation. Norway had two large oceanic seiners and a factory ship supplied by about 15 catching vessels. Another large factory ship from the Netherlands was supplied by some 20 South African catchers under Dutch flag. Japan had 23 trawlers of 100-293 t fishing mainly for cephalopods which were iced and delivered at Nouadhibou. In addition, 30 large freezer trawlers from Japan were fishing for cephalopods but did not land their product in Mauritania. The USSR had 25 trawlers using ice, all of 273 t, also fishing mainly for octopus, some squid, and cuttlefish. Kuwait had four old shrimp freezer trawlers of 160 t fishing for octopus. Algeria had four trawlers of 62 t and Spain two smaller trawlers. There were also five French vessels fishing for lobster which landed their catches in Nouadhibou to be air-shipped to Europe. An unknown number of Spanish oceanic tuna freezers were also fishing in the area. Brulhet adds that while some 60 industrial vessels were based at Nouadhibou during those years, more that 100 larger vessels fished with licences off Mauritania without ever landing fish in Nouadhibou. These reports amount to a total of some 175-200 vessels with an installed fishing capacity of more than 20,000 t (not considering the factory vessels of Norway and the Netherlands).

Beaudry et al. (1993) report 65 vessels fishing in Mauritanian waters under joint-venture schemes in 1991. Before its disintegration, the USSR operated with fleets of

30-40 large stern factory trawlers managed by a commander with headquarters in a large mother ship which received and processed catch from the trawlers, then passed it to refrigerated carriers that took fish to home ports. More recently, Russia and Romania had "Super-Atlantic" freezer vessels of circa 80-100 metres (m) length specializing in pelagic fish. Libyan and Algerian joint ventures with Mauritania use refrigerator vessels fishing for demersal (deep-sea) fish and cephalopods (chiefly squid). By 1993, the Mauritanian industrial fishing fleet totalled 263 vessels (Beaudry et al., 1993). Of these, 149 had fishing permits, 106 were freezers, and 43 had refrigerators. The remaining 114 vessels were chartered (70 with freezers, 44 with refrigerators). Ismail (1992; cited in Maus, 1997) reports chronic problems of old age and poor maintenance that led to high operating costs in the Mauritanian industrial fishing fleet. Of the 327 vessels operating in 1992, 165 were national, 74 joint-venture, and 88 EU and Japanese, but only 250 of them were fishing. Up to 38 of the national vessels were permanently out of operation (22 freezer and 16 ice box). Most of the national and joint-venture vessels in Mauritania are Chinese made and chartered to national companies.

The small-scale fishing sector has been consciously promoted by the Mauritanian government since the early 1990s and it is currently the fastest growing fisheries sector (Maus, 1997). The aims of the government are to promote employment, national food production, currency generation, and distribution of wealth. The small-scale fleets operate out of Nouadhibou (56 per cent) and Nouakchott (26 per cent) and by 1995 comprised some 1,800 boats, 96 per cent of which were motorized. This compares to only about 60 Senegalese pirogues operating out of Nouadhibou in the mid-1970s (Brulhet, 1976). The rapid growth of this sector in the 1990s is mainly attributable to an increase in participation of Senegalese pirogue fishermen and the establishment of an aluminium boat-building facility in Nouadhibou. By 1993, nearly 6,000 people were employed by the small-scale fishing sector while only about 1,500 took part in the industrial fishing sector (CNROP, 1995; cited in Maus, 1997).

There are very few statistics about the number of foreign vessels fishing in Senegal. It is known that shrimp trawlers as well as groundfish trawlers – both with freezing capabilities – were fishing in Senegal in the 1980s. Thiam and Gascuel (1994) report between 8 and 17 of these vessels in the period 1979-1982, and 6 to 12 in 1983-1990, with this number increasing after 1990. Since 1986, some large Korean trawlers with freezing capabilities have fished off Senegal, mainly for octopus (Thiam and Gascuel, 1994).

In Senegal, the predominant artisanal fishing sector is composed of pelagic and demersal pirogues, the former fishing with purse seines, encircling nets, and beach seines, and the latter with bottom longlines, traps, jigging hooks, and setnets (Kebe, 1994; Caveriviere, 1994; Samba, 1994a). There is also a smaller industrial sector mainly composed of bottom trawl vessels and some small sardine seiners. The number of artisanal fishing vessels in 1977 was 2,400 pirogues with motor and 600 with sail, employing a total of about 25,000 artisanal fishermen (Gerlotto et al., 1979). Data presented in Table 6 (Samba, 1994a) indicate that while some 3,900 pirogues were recorded in 1960, their numbers had increased to nearly 4,500 in 1970, 8,500 in 1980, and reached 10,900 in 1991. Reportedly, some 7,000 of these are motorized, but this information seems at odds with reports from Kebe (1994) stating that 100 per cent of the artisanal fleet is motorized. Meanwhile, the number of fishermen involved in the

Table 6. **Number of fishing vessels by type and subtype in Senegal**

| Year | Pirogues | | Trawlers | | Sardine seiners | |
|---|---|---|---|---|---|---|
| | with oars | with motor | based | non-based | local | foreign |
| 1960 | 3,900 | - | 11 | - | - | - |
| 1961 | 3,900 | - | 20 | - | 1 | - |
| 1962 | 3,100 | - | 26 | - | 1 | - |
| 1963 | 5,500 | - | 23 | - | 1 | - |
| 1964 | 5,500 | - | 33 | - | 1 | - |
| 1965 | 5,400 | - | 36 | - | 1 | - |
| 1966 | 4,600 | - | 39 | - | 2 | - |
| 1967 | 4,400 | - | 34 | - | 3 | - |
| 1968 | 5,100 | - | 38 | - | 3 | - |
| 1969 | 4,400 | - | - | - | 4 | - |
| 1970 | 2,451 | 1,995 | 68 | 4 | 4 | 1 |
| 1971 | 2,715 | 2,578 | 69 | 14 | 1 | 4 |
| 1972 | 2,408 | 3,209 | 67 | 25 | 3 | 2 |
| 1973 | 2,369 | 3,561 | 68 | 24 | 12 | 0 |
| 1974 | 2,255 | 4,187 | 64 | 23 | 13 | 0 |
| 1975 | 2,000 | 4,041 | 71 | 19 | 11 | 0 |
| 1976 | 2,257 | 3,743 | 76 | 4 | 12 | 0 |
| 1977 | 3,593 | 3,263 | 82 | 85 | 9 | 0 |
| 1978 | 3,796 | 3,957 | 88 | 91 | 8 | 0 |
| 1979 | 3,986 | 4,631 | 99 | 85 | 13 | 0 |
| 1980 | 3,869 | 4,616 | 103 | 89 | 17 | 0 |
| 1981 | 4,180 | 4,931 | 110 | 65 | 14 | 0 |
| 1982 | 4,327 | 4,774 | 128 | 58 | 19 | 0 |
| 1983 | 3,226 | 5,300 | 140 | 28 | 20 | 0 |
| 1984 | 3,904 | 5,138 | 133 | 30 | 12 | 0 |
| 1985 | 1,445 | 3,640 | 142 | 43 | 8 | 0 |
| 1986 | 2,813 | 4,808 | 136 | 43 | 5 | 0 |
| 1987 | 2,731 | 5,830 | 144 | 43 | 3 | 0 |
| 1988 | 2,413 | 6,210 | 137 | 80 | 5 | 0 |
| 1989 | 3,580 | 6,425 | 139 | 81 | 9 | 0 |
| 1990 | 3,889 | 6,522 | 121 | 78 | 9 | 0 |
| 1991 | 3,920 | 6,979 | 131 | 60 | 8 | 8 |

*Source:* Samba, 1994

artisanal sector grew from 25,000 in 1966 to 32,000 in the early 1990s (Kebe, 1994). In total, over 100,000 people are employed in the fisheries sector in Senegal (Goffinet, 1992), although it is not clear if this includes only direct employment in fishing or added-value activities such as processing and services.

The industrial fleet grew at a slower, but still rapid, rate during this period, from 20 trawlers and a single sardine fishing vessel in 1961, to 72 and 5 respectively in 1970, 192 and 17 in 1980, and slightly decreased to 191 and 16 in 1991 (Samba, 1994a; Thiam and Gascuel, 1994). Trawlers are of diverse types, some with freezers others with

ice boxes. Since 1985, the number of vessels with freezer has surpassed ice-box vessels, and in 1991 about 100 freezers and 50 ice-box vessels were recorded (Thiam and Gascuel, 1994). Foreign high-seas tuna and sardine vessels fishing out of the Senegalese coast are not considered in this table.

## FISHERIES MANAGEMENT BY COASTAL STATES

There is little information available about specific fishery regulations in Mauritania. A system of closed areas and seasons is in place but it is unknown if total allowable catches (TACs) are set for the different stocks. According to Maus (1997), catch limitation for the industrial fisheries is set through controls on effort (maximum length of trips for pelagic fisheries is 40 days and for demersal fisheries 60 days). Each type of industrial fishery has to follow particular specifications on allowed fishing areas, targeted species, legal sizes, bycatch levels, gear types, mesh sizes, engine power, etc. All demersal catches (except those from EU vessels) must be landed in Mauritania; pelagic catches are transhipped under the supervision of Mauritanian customs officers. Other requirements are that bycatch from demersal vessels should not exceed 10 per cent and only 3 per cent for pelagic fisheries, crews must be 80 per cent Mauritanian in joint-venture vessels and 35 per cent on foreign chartered vessels. For joint-venture fisheries, at least 35 per cent of the turnover in the case of cephalopod/demersal fisheries and 33 per cent in the case of small pelagic fisheries, must go to the Mauritanian partners. Observers should be allowed in all fishing vessels.

The DWF and industrial sectors of Mauritania are controlled through licensing. The artisanal fleet, although not controlled through a licence system, has to follow area and season restrictions. Artisanal fleets have no restriction on which species they can target, but cannot use trawl nets and cannot have freezing facilities on board (Maus, 1997). There are conflicting reports about some of the management policies. While Maus (1997) reports that until 1995 the costs of fishing licences in Mauritania were negligible (only administrative charges), Kaczynski (1989) reports on DWF (not joint-venture) vessels having to pay licence fees that are set according to the vessel's gross registered tonnes (GRT). What is clear, is that the main source of fisheries revenue in Mauritania is through export taxes. These are set according to the commercial value of the processed products and vary from 6.5 per cent to 17 per cent (Kaczynski, 1989). This strategy, combined with compulsory landing of most of the catch and inspection of transhipped catches is the basis of the Mauritanian fisheries policy.

Senegal has a system of zoning to allocate exclusive fishing rights to the different sectors involved in the industry. The "Grande Côte" north of Dakar and the region of Casamance have a 6 nautical mile-wide zone from the shoreline set exclusively for artisanal boats (pirogues) where industrial vessels are prohibited. This zone is 7 miles wide in the "Petite Côte" south of Dakar (Diallo, 1994). The Centre of Oceanographic Research of Dakar-Thiaroye has collected fishery data since the early 1970s (Ferraris et al., 1994). The few available reports on stock assessment indicate that trawl survey estimates of total exploitable biomass for demersal fish in 1974 were of 266,000 t between Cape Timiris and Cape Roxo (Samba, 1994b). Further research indicated reductions in the biomass from 173,000 t in 1983 to 81,000 t in 1991. Acoustic surveys for pelagic fish are very variable and indicate biomasses of 1,600,000 t in 1974 and 755,000 t in 1980 (Freon and Lopez, 1983; cited by Samba, 1994b). More recent acoustic survey estimates average about 588,000 t for the period 1983-1988 (Marchal, 1991; cited by Samba, 1994b).

## BYCATCH

There is almost no information available on bycatch and discard for the fisheries of Mauritania and Senegal. However, some reports indicate that bycatch in squid and shrimp fisheries can be five times larger than the targeted species (Kaczynski, 1989).

Mauritanian fishing regulations stipulate that bycatch should not exceed 10 per cent and 3 per cent in demersal and pelagic fisheries respectively (Maus, 1997). The Senegalese shrimp trawlers had discard rates of 75 per cent in the early 1980s (Monoyer, 1980; cited in Thiam and Gascuel, 1994), mainly from small bottom fishes. Caveriviere and Rabarison (1988; cited in Thiam and Gascuel, 1994) report discard rates of 68 per cent and 71 per cent in cold and warm seasons respectively for Senegalese shrimp trawlers. According to Lamourex (1985; cited in Thiam and Gascuel, 1994) during 1983 foreign trawl vessels in Senegal had discard rates (mainly Balistes, gastropods, and rays) of 69-73 per cent (shrimp boats) and 52-56 per cent (groundfish boats). The discards were of adults of non-commercial species as well as of juveniles of species of importance to the Senegalese artisanal and industrial sectors.

## FISHING AGREEMENTS

Nigeria had fishing agreements with Mauritania and Senegal in the mid-1980s (Fadayomi, 1987). Furthermore, Mauritania and Senegal have bilateral fishing agreements with each other and Senegalese pirogue fishermen are known historically to fish in Mauritanian waters. According to Beaudry et al. (1993), Mauritania signed agreements between 1987 and 1992 with the EU and Japan (only minor Japanese catches were taken during this period). An agreement with Ukraine was signed in 1993. A renewed agreement with the EU for August 1993-July 1996 allowed some 100 EU-flagged ships to fish in Mauritania. The terms of this latter agreement stipulated quotas for crustaceans (10,000 t/month annual average), black hake (15,000 t/month annual average), and pelagic trawlers and seiners (9,000 t/month annual average). The EU agreement included provisions stipulating legal mesh sizes, gear restrictions for lobster fishing, catch reporting, and employment of 25 per cent Mauritanian crews. Further fishing agreements were recently signed between the EU and Mauritania for the period 1996-2001, and between the EU and Senegal for 1997-2001.

## BENEFITS

The benefits of granting fishing rights to DWFs can be of various kinds. The most obvious is direct cash revenue and foreign currency acquisition, but additional benefits can occur in the form of training, infrastructure (processing plants, ship yards, patrol vessels, etc.), and development of local fishing capacity. While it is difficult to assess the real economic benefits of DWFs in sub-Saharan Africa because of limited information, it seems that at least in the case of Mauritania, there have been clear benefits but these seem to have fallen short of their full potential (see principal-agent discussion in chapter 6 of this report).

Because of structural and cultural differences, Mauritania has a larger and more complex interaction with DWFs than Senegal. The latter is much less dependent on DWFs to realize benefits from its fishery resources which are largely exploited by its own very strong artisanal sector. Mauritania has only half-heartedly tried to develop its own fishery

Table 7. **Estimated proportion of fishery catches taken by each fleet out of each country's EEZ**

| Year | Mauritania | DWFs | Senegal | DWFs |
|---|---|---|---|---|
| 1972 | 0.051 | 0.949 | 0.312 | 0.688 |
| 1973 | 0.039 | 0.961 | 0.572 | 0.428 |
| 1974 | 0.016 | 0.984 | 0.671 | 0.329 |
| 1975 | 0.011 | 0.989 | 0.762 | 0.238 |
| 1976 | 0.009 | 0.991 | 0.970 | 0.030 |
| 1977 | 0.012 | 0.988 | 0.770 | 0.230 |
| 1978 | 0.028 | 0.972 | 0.623 | 0.377 |
| 1979 | 0.028 | 0.972 | 0.704 | 0.296 |
| 1980 | 0.014 | 0.986 | 0.622 | 0.378 |
| 1981 | 0.039 | 0.961 | 0.618 | 0.382 |
| 1982 | 0.017 | 0.983 | 0.612 | 0.388 |
| 1983 | 0.025 | 0.975 | 0.806 | 0.194 |
| 1984 | 0.041 | 0.959 | 0.972 | 0.028 |
| 1985 | 0.040 | 0.960 | 0.788 | 0.212 |
| 1986 | 0.031 | 0.969 | 0.759 | 0.241 |
| 1987 | 0.024 | 0.976 | 0.717 | 0.283 |
| 1988 | 0.016 | 0.984 | 0.709 | 0.291 |
| 1989 | 0.014 | 0.986 | 0.778 | 0.222 |
| 1990 | 0.014 | 0.986 | 0.661 | 0.339 |
| 1991 | 0.018 | 0.982 | 0.676 | 0.324 |
| 1992 | 0.031 | 0.969 | 0.688 | 0.312 |
| 1993 | 0.038 | 0.962 | 0.849 | 0.151 |
| 1994 | 0.047 | 0.953 | 0.941 | 0.059 |
| 1995 | 0.035 | 0.965 | 0.956 | 0.044 |

sector and relies heavily but inefficiently on DWFs to exploit its fisheries. Table 7 illustrates how Senegal has consistently kept control over its fishery stocks by developing its artisanal and industrial fleets, while Mauritania has virtually remained with the same share of its own fishery resources throughout the last 25 years. Thus, Mauritania has not benefited from DWFs in terms of developing its independent fishing capacity.

Economic benefits have certainly been obtained through Mauritania's government-led open policy for foreign investment (encouragement of joint ventures with at least 51 per cent local capital). This policy brought initial tangible benefits to the nation as fisheries grew at an annual rate of 28 per cent during the period 1980-1986 to become the most important sector in the economy. By 1988 the rent from fisheries attained US$308 million and constituted 68 per cent of the total foreign income (Maus, 1997). Despite some success, there continued to be problems of surveillance whilst illegal fishing still accounted for about 50 per cent of the total catches (see next section). During 1991 the fisheries sector shrank to US$236 million, but continued to account for about 20 per cent of foreign revenues. Currently, fish processing is one of the main industries in Mauritania. DWFs have usually agreed to land at least part of their catch in Mauritania, but at least in the early years, large quantities of fish never made it to the mainland. Brulhet (1976) reports Dutch and Norwegian vessels in the mid-1970s

transhipping part of their catches of pelagic fishes and landing another part in the port of Nouadhibou. The Mauritanian system of taxation and licensing as a way to harness revenues from fishery resources seems to be favoured and praised by Cunningham et al. (1995) and Maus (1997), but is seen with scepticism by other authors such as Kaczynski (1989) and Goffinet (1992)(see next section).

Aid programme assistance has been given to Mauritania's fishing sector by France, Germany, Japan, and Spain, as well as from the African Development Fund, European Development Fund, Arab Fund for Social and Economic Development, and the World Bank. These resources have been used to develop local fisheries and coastal surveillance programmes, and to promote traditional fishing development (Beaudry et al., 1993). During 1994, Germany agreed to aid Mauritania with US$4.4 million to support surveillance, monitoring, and control of fisheries (Anon., 1996a).

There is little information about licensing, and about any benefits accrued from DWF operations in Senegal. Goffinet (1992) observes that United States and Canadian aid has been granted to the Senegalese navy in order to reinforce its surveillance and monitoring capabilities.

## CONFLICTS

Having one of the most productive fishing regions in the world off an underdeveloped coast poses serious problems for management. These problems range from poor or non-existent knowledge of the biological potential of the stocks, to lack of capability to set adequate management policies, and inability to implement monitoring and surveillance effectively. In this region of the world, very frequently the limited regulations that exist to control fisheries are not adequately enforced (Goffinet, 1992).

Under-reporting and illegal fishing have been old problems for Mauritania and Senegal and many vessels are still suspected to be fishing illegally (Anon., 1996a). The most obvious consequence of this problem is loss of revenue through taxes and licence fees, but longer-term concerns are overfishing and the lack of accurate statistics to assess the levels of exploitation of the stocks.

In Mauritania, a joint-venture policy failed during the 1970s as there was widespread under-reporting of catches because of poor inspection systems, Mauritanian crews were paid to stay on shore, and most of the foreign companies failed to process their catches on shore preferring instead to tranship at sea and transport them to foreign ports (Maus, 1997). The very limited surveillance and enforcement capability of Mauritania has allowed widespread overfishing (Beaudry et al., 1993). Industrial fishing vessels continuously violate areas reserved for small-scale fisheries and when fines are imposed these are not always paid by violators (from 1988 to 1992 only US$3 million of fines were paid out of a total of US$5 million in violations).

As mentioned above, the benefits of DWF activities seem to have fallen short of expectations in this region. According to Kaczynski (1989) the share of the catches between DWFs and local nations in the sub-Saharan region remained practically unchanged between 1977 (90 per cent for DWFs) and 1985 (81 per cent for DWFs). In contrast, a 25 per cent reduction in total catches was observed for the whole of the

CECAF area between 1976 and 1985, mainly because of lower catches of the DWFs, increased costs of access, and overexploitation of some commercial stocks by long-range fleets (Kaczynski, 1989).

Another problem is that of lost revenue. In Mauritania, Kaczynski (1989) estimates that perhaps some 50 per cent of the fees payable by the total permitted fleet and only 33 per cent of the fees payable by DWF vessels are actually paid to the government. On top of this, taxation on fishery exports, the largest source of income, also falls short of its supposed targets. Kaczynski estimates that in 1983, only about 38 per cent of the expected revenues from fish exports were actually collected by the Mauritanian government. Under-reporting of up to 50 per cent of the total catches by DWF nations is one of the main reasons for the low level of revenue.

Poor investment and overcapacity are additional pressing problems. Due to the lack of shipyards in the country, Mauritania promoted the purchase of fishing vessels in the 1980s. However, this has turned into a financial problem as many owners have been unable to pay back loans to the local banking system, causing major losses to the banks. As a consequence, a large part of the fleet is ageing and paralysed. In 1993, more than 50 per cent of the cephalopod fishing fleet was over 15 years old. Large-sized freezer vessels are sub-optimal for the relatively low-volume cephalopod catches so that very frequently they return to port with only 25 per cent of their hold capacity filled after their 40-day allowed trips (Maus, 1997).

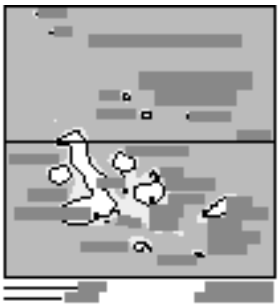
Although the zoning system of Senegal is supposed to avoid any possible direct interaction between the industrial and artisanal fleets, in practice the illegal fishing of industrial vessels inside the artisanal exclusive zone and the non-regulated fishing of artisanal vessels outside their 6-7 mile zone are known problems in the region (Diallo, 1994). Additionally, the exploitation of mutual stocks by the two fleets leads to indirect competition for the resource and for the corresponding markets.

In short, lack of adequate surveillance systems and lack of compliance by the developed nations' DWFs is one of the main factors responsible for the lack of fully realized benefits to the coastal countries in this region. However, due to the prohibitive costs of effective surveillance systems, it seems unlikely that the coastal countries will be able to take full control and obtain fair benefits from their rich fishery stocks without external technical and financial aid. What is needed here is a more involved participation of DWF countries that assumes full responsibility of their role as developed nations trying to do honest business with coastal nations, instead of taking advantage of the difficulties these countries have in managing and surveying their natural resources. On the other hand, the full control of these countries' fisheries will not come only from effective surveillance through (typically) military bodies, but will need improvements in the civilian monitoring, control, management, and policy-making functions (Kaczynski, 1989).

Ironically, the above problems are compounded by the relatively good management of fisheries in other parts of the world (i.e. developed countries). Comparatively speaking, more-developed countries are more successful at managing their fishery stocks than less-developed countries. This effectiveness, although beneficial to the more-developed

nations, usually has the effect of shifting the effort towards overseas fisheries and therefore increasing the pressure on fishery stocks belonging to countries with less effective or absent management systems (Goffinet, 1992). The only solution to the problem of fisheries management in coastal nations allowing DWFs is for the DWFNs to assume a more responsible role. One option for this, proposed by Goffinet (1992) is the internationalization of fisheries management.

Map 3. **The Galapagos Islands lie more than 1,000 km from Ecuador in the Equatorial Pacific Ocean**



**Boxed Case Study 1. Illegal Fishing in the Galapagos Islands**

**Background**

The Galapagos are a group of volcanic islands situated about 1,050 km off Ecuador in the Equatorial Pacific Ocean. This 7,844 km$^2$ archipelago is a province of Ecuador consisting of 15 large and many small islands. Although situated right in the equator, the climate and oceanographic regime of the islands are influenced by cold waters from the Antarctic, thus providing a unique setting for a very diverse marine life. In addition, its isolation from the mainland has allowed terrestrial life to evolve into singular forms. These islands are home to 11 subspecies of giant tortoise, the only marine iguana and flightless cormorant in the world, the only tropical penguin, and 13 unique finches. Overall, the Galapagos are regarded as one of the most important places in the world for their unique biodiversity and high rate of endemism. For these reasons, in 1959 Ecuador set aside 97 per cent of the land area of the archipelago as a national park. The islands have also been recognized internationally as a Man and Biosphere Reserve and as a World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Furthermore, in 1986 the Galapagos Marine Resources Reserve was established to protect the waters around the archipelago.

**Conservation Issues**

Despite the protected status of the Galapagos Islands, they suffer some serious conservation problems. There are severe issues of infestation by exotic land species introduced by man which threaten the local flora and fauna. In addition, because agriculture and fishing are economically important they are often at odds with conservation objectives.

Since early this century, the fishery resources of the Galapagos have been under exploitation. First, local fishermen using oar and sail powered boats caught mainly *Mycteroperca olfax* and a suite of serranids, labrids, lutjanids, and carangids (Merlen, 1995), and pole and line tuna vessels from the United States fished for yellowfin tuna. After World War II, a fish processing plant and up to 30 diesel powered boats 5-10 m long formed the "traditional" fishery in the archipelago. During those years, fishing was almost exclusively a locally owned industry. In the 1960s and 1970s, four 20-30 m large-capacity ships carrying 12-16 divers arrived from the mainland to exploit rock lobsters. Foreign boats started buying the catches from the local fishermen, thus creating a lucrative market for all fishery products. The export of lobster was banned and foreign vessels were prohibited from entering the archipelago in 1974. But the local fishermen remained and the exploding human population of the islands motivated by the tourism industry created conditions for increased fishery exploitation. To make matters worse, scientific investigation in fisheries ceased in 1981 leaving a void of vital catch statistics (Merlen, 1995).

**Recent Problems of Illegal Fishing**

The last two decades have been characterized by the activities of high-mobility fibreglass boats. Fisheries diversification and lack of control led to all kinds of illegal fishing practices and conflicts between government and fishermen (Merlen, 1995). The trade of shark fins, based exclusively on finning practices, was initiated and stimulated by Asian fishing vessels in earlier decades and is now widespread among local fishermen. Fishing for sharks within 80 nautical miles from shore was banned in 1989, but the fishing close inshore continued. Lobsters (*Panulirus* spp.), sea cucumbers (*Isostichopus fuscus*), and shellfish are also heavily exploited. The government closed the lobster fishery in 1992, but illegal fishing carried on. In the late 1980s, the sea cucumber industry became one of the most important fisheries, causing not only depletion of sea cucumbers in some areas of the ocean floor, but also inducing mangrove cutting in the delicate island ecosystem for preservation of the cucumbers (boiling). This fishery was closed in 1992, but illegal fishing continued.

Although the Galapagos Marine Resources Reserve – declared in 1986 – protects an area more than 15 nautical miles from shore, the regulations of usage within the reserve have never been fully enforced. According to Merlen (1995), among the many reports of illegal fishing practices in recent years in the Galapagos Islands are: fishing by purse-seine tuna vessels within 500 m from shore; gillnets close to shore so full of hammerhead sharks (*Sphyrna lewini*) that they could not be lifted by fishermen; fishing for sea cucumbers and opening of illegal camps on shore plus transhipment of the product by tuna vessels; and large fishing vessels operating at night 5 km from the coast. Camhi (1995) reports that up to 80 major DWF fishing vessels from Japan, the Republic of Korea, and Taiwan licensed to fish for tuna have illegally longlined for sharks and traded for other marine stocks within the reserve.

During 1997 the fishing vessel *Magdalena* was captured by personnel from the Galapagos National Park within the confines of the biological reserve carrying 40,000 processed sea cucumbers on board. This vessel also acted as a mother ship to small boats fishing illegally for sea cucumbers. As a result of the seizure, a park guard was seriously injured when he was shot by illegal sea-cucumber fishermen. After a long and difficult judicial process marred with accusations of extortion, breach of confidence, bribery, and legal irregularities, the original penalty allowing the auction of the *Magdalena* was still not acted upon and the legal battle continues.

It is evident that there are great conflicts between the objectives of conservation and those of pursuit of economic growth and development in the Galapagos Islands. This has often led to ineffective conservation measures that are not enforced properly or that are overturned as a result of political pressure. The list of ineffective or not-respected measures is impressive: the declaration of the Marine Resources Reserve in 1986, prohibition of lobster exports from the archipelago in 1974 and closure of the fishery in 1992, banning of shark fishing near shore in 1989, closure of sea-cucumber fishing in 1992, the management plan for usage of the marine reserve in 1992. All have failed to attain control of the exploitation of natural resources in the region. Clearly, one of the most pressing problems in the archipelago is the lack of a capacity and perhaps a will to monitor illegal activities and enforce compliance with regulations. There is a strong need for effective patrolling of the national park and the marine resources reserve.

On 6 March 1998, the Galapagos special law was passed. The new law recognized the islands as a "priority area", banned commercial fishing, imposed limits for immigration to the islands, implemented an inspection and quarantine system, and required that a larger part of the hard currency earned through ecotourism be used towards conservation. It remains to be seen if this time finally, the laws will be respected.