EUROPEAN TRAWLERS ARE DESTROYING THE OCEANS

Introduction

Nearly 100,000 vessels make up the European Union fishing fleet. This includes boats that fish both in EU waters (the domestic fleet), in the waters of other countries and in international waters (the deep-sea fleet). In addition, there is an unknown number of vessels belonging to other European countries that are not members of the EU which could approach a figure half that of the EU fleet.

The majority of these vessels sail under the flag of a European country but there are also boats, particularly those fishing on the high seas, which despite being managed, chartered or part owned by European companies, use the flag of the country where they catch their fish or sail under flags of convenience (FOCs).

The Fisheries Commission has called for a reform of the Common Fisheries Policy (CFP) to achieve a reduction of 40% in the EU fishing capacity, as forecasts show that by simply following the approved multi-annual plans, barely 8.5% of vessels and 18% of gross tonnage would be decommissioned[1]; an achievement very distant from scientific recommendations.

Moreover, from among these almost 100,000 vessels, the EU is home to a particularly damaging fleet: the 15,000 trawlers that operate in European waters, as well as those of third countries or those fishing on the high seas. These trawlers are overexploiting marine resources and irreversibly damaging some of the most productive and biodiverse ecosystems on the planet.

The 40% reduction called for by the Commission could be easily achieved if the primary objective of this proposal was focused both on eliminating the most destructive fishing techniques and reducing fishing overcapacity. A significant reduction in trawler fleets would enable a dramatic reduction in the fishing effort, the conservation of marine ecosystems and the establishment of a European Union fishing policy with a future. Failing to address the problems posed by the trawler fleet and ceding to pressure from their lobbies will mean perpetuating the destruction of ecosystems and marine resources, and condemning tens of thousands of fishermen to a more than uncertain future.

THE EUROPEAN FLEETS

The EU has the third largest fishing fleet in the world after China and Peru. It has more than 95,000 fishing boats from 13 different countries, which in terms of numbers represents 3% of the world fishing fleet. Each year it unloads some 7-8 million tonnes of marine catches (fish, crustaceans, molluscs, etc.)[2], a volume that represents around 10% of global catches.

Table 1: Total EU fleet[i][3]

Country	Nº vessels	GRT	Power (Kw)	Landings (ton)
Belgium	127	23,054	63,355	33,949
Denmark[ii]	4,160	159,854	373,037	1,404,879
Finland	3,689	18,857	198,863	145,962
France[iii]	8.173	218,281	1,106,878	650,261
Germany	2,314	71,419	167,197	239,988
Greece	20,094	104,482	619,407	136,699
Ireland	1,193	59,830	193,955	322,458
Italy	17,664	225,098	1,425,164	296,155
Netherlands	1,075	208,166	503,870	514,611
Portugal	10,811	111,835	398,336	219,170
Spain	16,674	518,025	1,333,168	1,198,869
Sweden	1,838	45,806	223,387	351,612
UK	8,517	263,847	1,050,206	875,528
Total	96,329	2,028,554	7,656,823	6,389,573

In 2002, the number of fishing vessels had fallen to 90,380, but in terms of both Gross Registered Tonnes (GRT) and vessel horsepower, there was a less significant drop (to 1,949,269 tonnes and 7,272,752 Kw respectively). Only the fleets of Belgium and, notably, Holland, increased in terms of both vessel numbers and fishing capacity.

Some 74% of boats dedicated to fishing are less than 12 metres long. The majority specialise in small-scale fishing, using fishing techniques that range from set gill nets, fish pots or long lines to multi-purpose licences. This kind of licence allows boats to use various different techniques throughout the fishing season, including trawling techniques such as dredging and others. Some countries have thousands of examples of this kind of boat, notably Germany, Greece and France, while others (such as Belgium or Holland) have almost totally lost their small, traditional fishing boats and have fleets almost exclusively based on high-powered vessels, in the majority of cases trawlers.

Denmark is a special case because their territories of Greenland and the Faroes do not belong to the EU. The Faroes Islands fleet consists of 186 boats with a GRT of 69,600 tonnes[4] and is made up of vessels that range from simple wooden coastal fishing boats to powerful freezer trawlers (some 66), while in

[i] Information for 2000/2001, except regarding catches, which corresponds to 1999/2000.

[ii] Greenland and Faroes fleets are not included due to these Islands are not part neither of the EU nor the EFTA. They have a separate agreement with the EU.

[iii] There are some 2,820 fishing vessels in the overseas French territories of Guadeloupe, Martinique, Reunion and Guyana that are not included here due to almost 95% are very small artisanal boats, except for some 54 shrimp trawlers in Guyana.

Greenland there are some 380 boats with a GRT of 36,210[5], of which almost 300 are coastal trawlers and 40 are shrimp trawlers.

However, the United Kingdom and France and other countries with overseas territories have not provided information on their characteristics, with the exception of the fleets shown in Table 1.

With the inclusion of 10 new member states in the EU, the community will gain another seven countries with fishing fleets. This represents an increase of 6% in the number of vessels, but in a few years, with the accession of new countries who have submitted their candidacy to join the EU, the increase in the number of boats will be 23%, with an 18% increase in catches[6] and a more than 30% increase in terms of fishing capacity (see Table 2).

The four largest fishing states joining the EU are Poland (205,057 tonnes caught in 2000) and the three Baltic states (Latvia with 136,403 tonnes; Estonia with 113,347 and Lithuania with 78,986)[7]. Turkey is notable amongst candidate states, with a catch of 503,352 tonnes in 2000.

Table 2: Fleets of new EU member states and candidate states[8]

Country	Nº vessels	GRT	Power (Kw)	Catches (ton)
Bulgaria	30	67,095	N/A	27,000
Croatia	1,028	N/A	N/A	15,364
Cyprus	507	1,153	N/A	3,100
Estonia	1,786	119,268	N/A	114,869
Latvia	351	73,233	N/A	125,389
Lithuania	131	142,693	N/A	33,594
Malta[iv]	1,740	19,220	N/A	840
Poland	1,315	187,159	N/A	239,899
Romania	33	38,005	N/A	69,000
Slovenia	55	905	N/A	2,170
Turkey	17,000	N/A	N/A	575,097
Total	**23,976**	**648,711**	**N/A**	**1,206,322**

The other two big European fishing fleets are those belonging to the European Free Trade Association (EFTA)[v] countries, which have a large number of boats sharing the same fishing zones and stocks as the EU, and the Confederation of Independent States (CIS)[vi]. The latter includes amongst its vessels the enormous Russian fleet which deploys fishing boats on three different oceans: the Atlantic, the Arctic and the Pacific, as well as its huge deep-sea fleet. Some 25% of Russian fish catches come from the Atlantic and the Arctic, 15% from inland seas (the Caspian, the Black Sea and the Azov) and the remaining 60% from the Pacific.

[iv] Only 275 boats are considered full-time fishing

[v] Iceland, Norway, Lichtenstein and Switzerland are members of the EFTA (European Free Trade Association), a Convention that establishes an area of free trade between its Member States, but only Iceland and Norway have fishing fleets.

[vi] Of the 12 member states of the CIS, only Russia, the Ukraine and Georgia have fishing fleets while the rest have fishing boats that fish on lakes, rivers or the Caspian Sea.

Table 3: Other fishing fleets in Europe[9]

EFTA Fleet				
Country	**Nº vessels**	**GRT**	**Power (Kw)**	**Catches (ton)**
Iceland	1,997	180,203	528,711	1,980,000
Norway	13,014	392,281	2,443,145	2,894,502
Total	**15,011**	**572,484**	**2,971,856**	**4,874,502**
CIS Fleet				
Country	**Nº vessels**	**GRT**	**Power (Kw)**	**Catches (ton)**
Georgia	N/A	N/A	N/A	N/A
Russia[vii]	N/A	N/A	N/A	1,025,000
Ukraine	N/A	N/A	N/A	364,668
Total	**N/A**	**N/A**	**N/A**	**1,389,668**
Others				
Country	**Nº vessels**	**GRT**	**Power (Kwh)**	**Catches (ton)**
Albania	198	N/A	N/A	1,466
Yugoslavia	N/A	N/A	N/A	333
Bosnia	N/A	N/A	N/A	N/A
Total	**198**	**N/A**	**N/A**	**1,799**

Overcapacity

Since 1989, the European Union has reduced the number of boats operating under a member state flag by 10%, tonnage by 6% and horsepower by 13%[10], but information on the situation of European fishing stocks indicates that this reduction should have been much greater (at least another 40%) if the real intention was to prevent the collapse of even more fisheries and protect marine ecosystems. The reduction of fishing capacity in the EU has been achieved by three methods: by decommissioning fleets, by exporting overcapacity to third countries by means of the promotion of joint ventures, and by reflagging fishing vessels, on many occasions in the registers of so-called “flags of convenience” (FOCs). This demonstrates that the actual reduction is far from the official one.

However, during this time the EFTA countries have considerably increased their fishing capacity: the number of boats by 58%, tonnage by 31% and horsepower by 6%[11].

Recent reports on the Norwegian fishing industry puts the country’s overcapacity at more than 50% in the case of trawlers and nearly 17% for the coastal fleet, while Iceland’s overcapacity is estimated at 30% in general[12].

FISHING ZONES

[vii] Data from the Atlantic and Arctic oceans only.

The main fishing grounds for the European domestic fleet are in the North-East Atlantic and the inland and semi-enclosed seas in this part of the hemisphere (the Mediterranean Sea, the North Sea, the Baltic, the Black Sea, etc.), while the deep-sea fleets can be found in any of the world's oceans (Pacific, Indian, Arctic and Antarctic, as well as the South and West Atlantic).

Around 85% of EU and EFTA catches come from the North-East Atlantic, 5% from the Mediterranean, 4% from the Central Eastern Atlantic, 1% from the North-West Atlantic and 5% from other areas (Indian Ocean, South-West Atlantic, Central and Southern Pacific and the Antarctic)[13].

The fish stocks of the North-East Atlantic are, generally speaking, overexploited. The most recent estimates indicate that more than 70% of commercial stocks are subject to overfishing. The fishing grounds in the worst state are those off the West and South of Ireland, in the Atlantic around Spain and Portugal and in the Azores. Even those in the "best" condition (in the Arctic and Eastern Mediterranean) have had, at the very least, over 60% of their stock overexploited[14].

As shown in the latest report from the European Environmental Agency (EEA)[15], "most fish stocks of commercial importance in European waters appear to be outside safe biological limits. For most of the North-East Atlantic, between 62% and 91% of commercial stocks are outside safe biological limits, while the figures for the west of Ireland, the Baltic Sea and the Mediterranean are 100%, 75% and 70%, respectively".

The Mediterranean and Black Seas are not very significant for many European countries in terms of the volume of catches registered there. However, some of the largest fleets in Europe (Italy, Greece and Turkey) catch almost 100% of their fish in these seas.

The Black Sea is where the big industrial fleets of the Ukraine, Russia and Bulgaria come to fish, together with small-scale or semi-industrial fleets from Turkey.

THE DESTRUCTIVE EUROPEAN TRAWLER FLEET

Trawlers in the ICES area

More than 7,000 EU trawlers work in the ICES (International Council for the Exploration of the Sea) area, which encompasses the entire European North-East Atlantic between the Arctic and the Strait of Gibraltar. There are various kinds of trawling techniques which can be classified into two types – bottom trawling and pelagic trawling – and six different categories[16]: single-rig trawling (a boat with a single net), double-rig or twin trawling (a boat with two parallel nets – and recently boats have been operating with a new triple-rig system), pair trawling (two boats pulling one net along the bottom), beam trawling and single or two-boat/pair pelagic trawling.

The main trawler fleet catches are gadiform fish (cod, white pollack, whiting, haddock), flatfish (megrim, sole, flounder), crustaceans (Norway lobster, prawn, shrimp) and other species such as hake and monkfish, plus a significant fleet of vessels for the fish processing industry, catching low commercial value species such as sprats, sandeel and capelin to turn into fishmeal and fish oils.

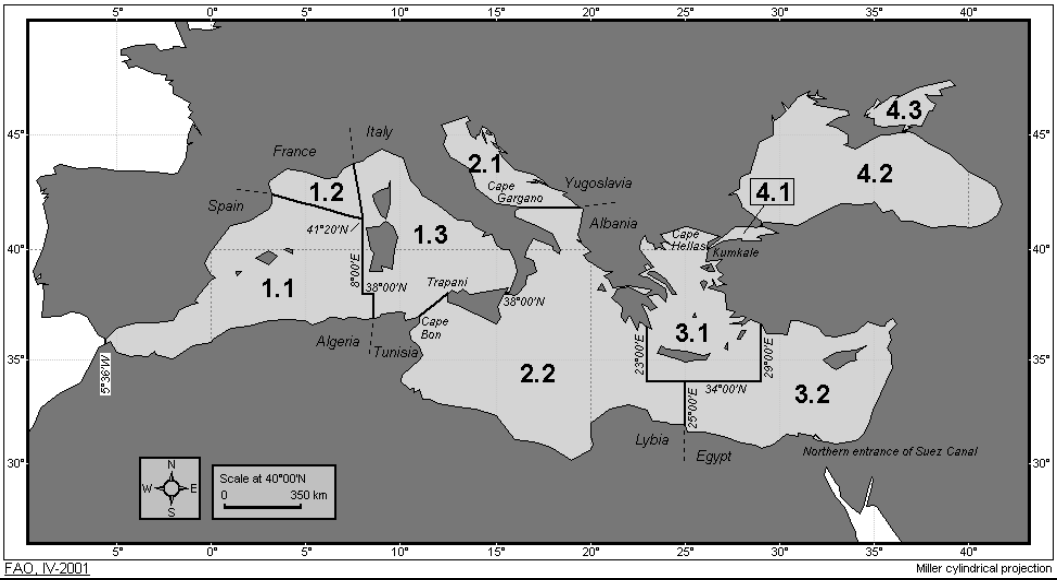
Figure 1: ICES area

ICES divisions	
I Barents Sea	VIId Eastern English Channel
IIa Norwegian Sea	VIIe Western English Channel
IIb Spitzbergen and Bear Island	VIIf Bristol Channel
IIIa Skagerrak and Kattegat	VIIg South-east Ireland
IIIb Sound	VIIh Little Sole
IIIc Belt	VIIj Great Sole
IIId Baltic Sea	VIIk West Great Sole
IVa Northern North Sea	VIIIa South Brittany
IVb Central North Sea	VIIIb South Biscay
IVc Southern North Sea	VIIIc North and North-west Spain
Va Iceland	VIIId Central Biscay
Vb Faroes	VIIIe West Biscay
VIa West Scotland	IXa Portuguese coast
VIa Clyde West	IXb West Portugal
VIb Rockall	X Azores
VIIa Irish Sea	XII North Azores
VIIb West Ireland	XIVa East Greenland
VIIc Porcupine Bank	XIVb South-East Greenland

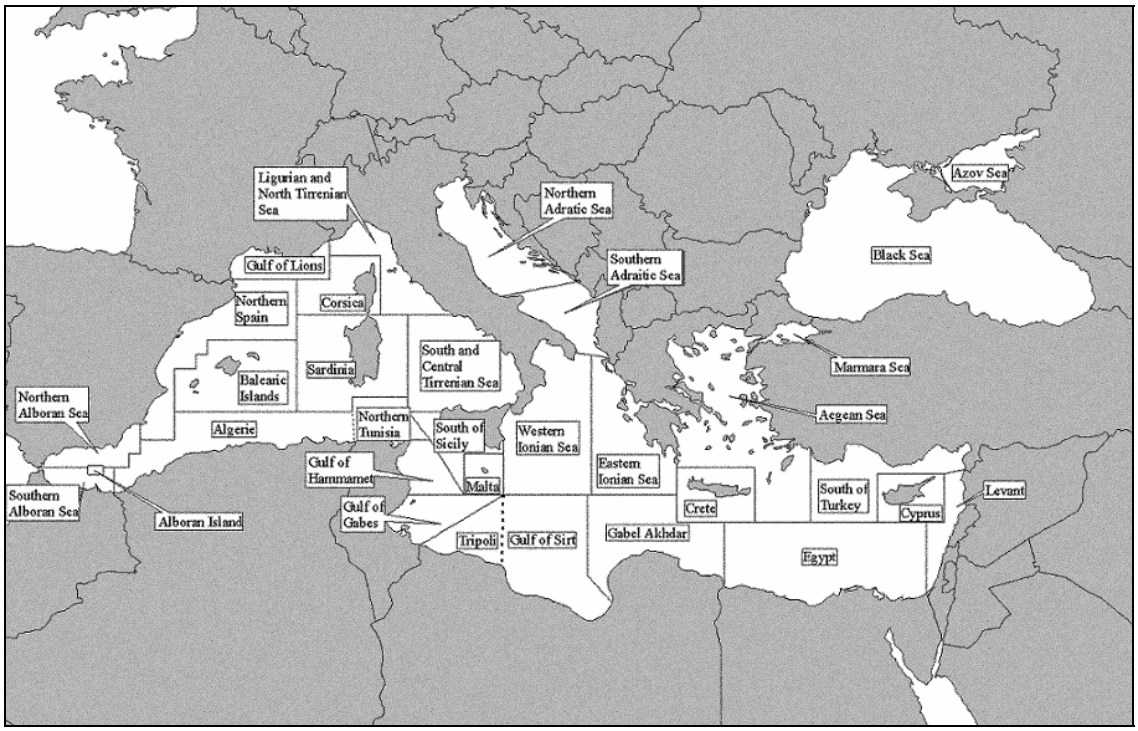
Fishing grounds of the Mediterranean and the Black Sea

The European Mediterranean fleet accounts for 46% of the total European Union fishing fleet, 22% of its tonnage and 34% of its horsepower, but it catches barely 8% of the EU total[17]. The total volume of catches made by EU countries in the Mediterranean amounts to some 500,000 tonnes per year. In this area, the EU has a fleet or more than 40,000 fishing boats (80% of which are less than 12 metres in length), of which almost 4,500 are trawlers. The majority of bottom trawlers work in multi-species fisheries. Moreover, the most representative vessels are bottom trawlers fishing demersal species, although there are also pelagic trawlers catching sardines, mackerel or anchovies.

Figures 2 and 3: Sub-areas and divisions in the Mediterranean and Black Seas



Mediterranean and Black Sea areas and sub areas	
1 Western Mediterranean	**3 Eastern Mediterranean**
1.1 Balearic and Alboran Seas	**3.1 Aegean Sea**
1.2 Gulf of Lyons	**3.2 Levant**
1.3 Tyrrhenian, Sardinia, Corsica	**4 Blacks Sea and surroundings**
2 Central Mediterranean	**4.1 Marmara Sea**
2.1 Adriatic Sea	**4.2 Black Sea**
2.2 Ionian Sea and Strait of Sicily	**4.3 Azov Sea**



Management units (MU's)	
1. Northern Alboran Sea	**16. South of Sicily**
2. Alboran Island	**17. Northern Adriatic**
3. Southern Alboran Sea	**18. Southern Adriatic Sea**
4. Algeria	**19. Western Ionian Sea**
5. Balearic Island	**20. Eastern Ionian Sea**
6. Northern Spain	**21. Libya**
7. Gulf of Lions	**22. Aegean Sea**
8. Corsica Island	**23. Crete Island**
9. Ligurian and North Tirrenian Sea	**24. South of Turtkey**
10. South and Central Tirrenian Sea	**25. Cyprus Island**
11. Sardinia	**26. Egypt**
12. Northern Tunisia	**27. Levant**
13. Gulf of Hammamet	**28. Marmara Sea**
14. Gulf of Gabes	**29. Black Sea**
15. Malta Island	**30. Azov Sea**

Table 4: Trawler fleets of the EU and EFTA[18]

Country	Type of trawlers[viii]				
	Beam	**Otter**	**Pelagic**	**Polyvalent**	**Distant water**
UE fleet					
Belgium	124	6			
Denmark		988	11		
Finland		3	178		

[viii] Vessel over 12 meters long except for the polyvalent that range from 8 to15 meters approximately.

France		1,619	143		
Germany	286	140			12
Greece		363		976	53
Ireland	7		22	1,032	
Italy		1,655	10	1,608	23
Netherlands		421			18
Portugal		111			52
Spain		1,520			403
Sweden		254	124		
UK	108	1,026	42		10
Total UE	*525*	*8,106*	*530*	*3,616*	*571*
EFTA fleet					
Iceland		53		327	49
Norway[ix]		369			142
Total EFTA	*36*	*405*		*327*	*191*
Total UE + EFTA	***561***	***8,511***	***530***	***3,943***	***762***

This table does not include dredgers and similar vessels due to the lack of reliable information on their number and activities, as well as the fact that the majority of them are less than 12 metres long and thus tend to be classified under the category of "coastal fishing".

Other significant trawler fleets in Europe[19] can be found in Croatia (with over 360 bottom and pelagic trawlers), Albania (with some 125 trawlers) and in big fleets with a long fishing tradition such as Poland (with more than 450 trawlers), Russia and the Ukraine (an unknown total which must amount to several thousand), Lithuania (some 50 deep-sea trawlers), Latvia and Estonia (with dozens of different sized trawlers) and Slovenia (with more than 150 deep-sea trawlers and coastal fishing boats). In other cases, for example Cyprus, with barely 17 bottom trawlers, Malta, with just 12, and Yugoslavia with 19, trawler fleets still represent a very small percentage. In other countries, fishing and economic crises have meant that certain big fleets of just a few decades ago have been considerably depleted, such as Bulgaria, which barely maintains around twenty big trawlers between the Black Sea and the high seas, or Rumania, with fewer than 40 big trawlers in the North-East Atlantic and the Black Sea. Data on Turkey is scarce and not very reliable.

Figure 4: Percentage of over-exploited commercial stocks

[ix] There are some 50 boats more that have licenses to combined pelagic gears, like purse seines, with trawl nets, and 400 small boats using bottom trawling nets.

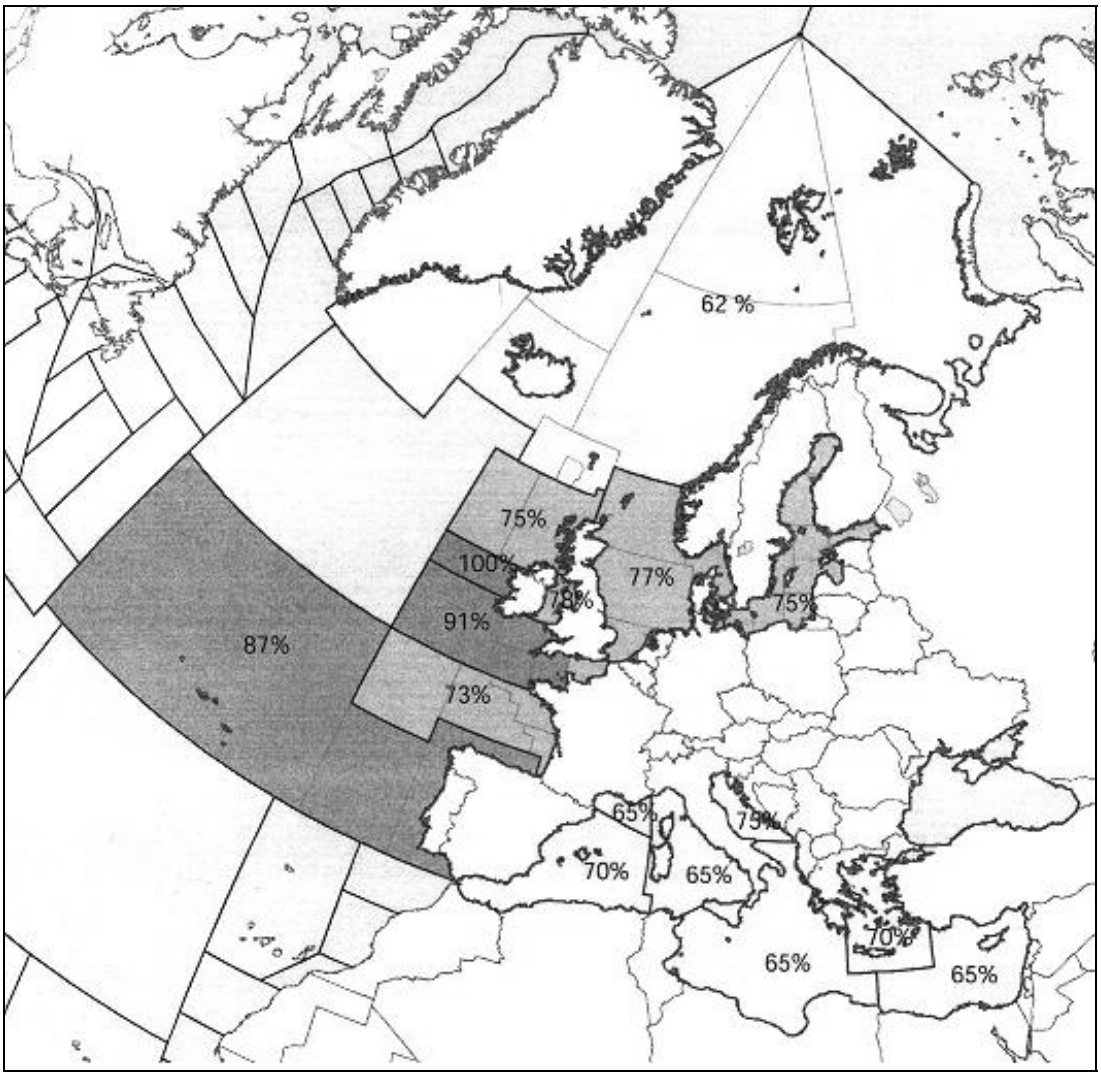


Table 5: Distribution of target species of trawlers in the ICES area

Species	Main fishing grounds in ICES area		
	Very important	Important	Other
Anchovy	VIII, IX, X		
Anglerfish	VII	IIa, IV	VIIc, IX, X, VIIIa-b, VIIId-e, Vb, VI, XII, XIV
Blue ling	VI, VII	II, IV, V	III
Blue whiting	V, VI, VII, XII, XIV	VIIIa-e, IX, X	IIa, IV, Vb, V, XIV
Capelin	V, XIV		
Cod	I, II, IIb	IIb, IIIc, IIId	IV
Dab & Flounder	IIa, IV		
Greenland halibut	V, XIV, I, II		
Haddock	IIa, IV	V, VI, VII, VIII, IX	X, XI, XII, XIII, XIV
Hake	Vb, VI, VII, XII, XIV	VIIa, VIIb, VIId, VIIe	IIa, IV
Herring	IVa-c, VId,	IIIb-d	IIIa, I, II
Horse mackerel	Vb, VI, VII, VIIIa-b, VIIId-e, XII, XIV	IIa, IV, VIIIc, IX	
Lemon sole	IIa, IV		
Ling	IV, Vb, VI, VII, VIII	IX, X, XI, XII, XIV	

Mackerel	IIa, IIIa-b, IIIc-d, IV, Vb, VI, VII, VIIIa-b, VIIId-e, XII, XIV	VIIIc, IX, X	
Megrim	VII	Vb, VI, XII, XIV	IIa, IV, VIIIa-e, IX, X
Northern prawn	IIIa	IIa, IV, V	XIV
Norway lobster	VII, IIa, IV	IIIa-d	VIIIa-b, VIIId-e
Norway pout	IIa, IIIa, IV		
Plaice	IIa, IV	IIIa, VIId-e	
Pollack	VII	VIII	V, VI, XII, XIV
Redfish	V, XII, XIV	Vb, Va	I, II
Roundnoise grenadier	Vb, VI, VII	V, XIV, III	
Saithe	IIa, IIIa-d, IV	Vb, VI, XII, XIV	VII, VIII, IX, X
Salmon	IIIb-d		
Sandeel	IIa, IIIa	IV	
Skate/ray	IIa, IV		
Sole	II, IV	VIId, VIIIa-b	VIIIc-e, IX, X, VIIa, VIIf-g
Sprat	IIIb-e, IIa, IV	IIIa	VIId-e
Turbot	IIa, IV		
Tusk	V, VI, VII	IV	I, II, III, XIV
Whiting	VIIb-k	IIa, IV	VIII, Vb, VI, XII, XIV

The status of key species for trawlers in the ICES area[20]

Numerous stocks targeted by European trawlers in the North-East Atlantic are depleted, overexploited or under severe pressure. Notable amongst these are the **cod** stocks *(Gadus morhua)*, the majority of which are outside safe biological limits and in danger of collapse[21], such as those in divisions VIa[22], IV, VIId, IIIa[23] and IIId[24], fished predominantly by trawlers from Denmark, the United Kingdom, France and Ireland. ICES[25] and the Scientific, Technical, and Economic Committee for Fisheries (STECF)[26] have recommended establishing a moratorium on catching cod in these divisions, but neither the European Commission nor the Council of Fisheries Ministers have accepted the scientists' proposals. In their place, they have put forward reductions in certain fishing grounds, as well as a plan for recovering the species[27].

Of equal concern is the situation of **hake** *(Merluccius merluccius).* Stocks[28] are outside safe biological limits in both the north, between sub-areas IV, VI and VII and divisions IIa, VIIIa, b and d (from the Barents Sea to the central part of the Bay of Biscay via the North Sea and the west of Scotland and Ireland), and the south in VIIc and IXa (from the Cantabrian Sea to the Portuguese coasts). In the southern sector, Spanish and Portuguese trawlers and longliners are responsible for almost all catches. In the northern sector, Spain is also responsible for the bulk of catches, with 60%, followed by France with 25%, the United Kingdom with 10% and Ireland with 5%[29]. Plans for recovering the species have also been put forward in this particular case[30].

Other species for which the EU has put forward special proposals are **sole** *(Solea vulgaris)* and **Norway lobster** *(Nephrops norvegicus)*[31]. In the case of

the former, the majority of stocks are outside safe biological limits, except those in the VIIa and VIId[32] divisions, while in another two cases the situation is unknown[33]. The most overexploited stocks are those in divisions VIIIa-b (South Biscay)[34], VIIe (Western English Channel)[35], IV (North Sea)[36], VIIf-g (Bristol Channel/Southeast Ireland)[37] and III (Skagerrak and Kattegat)[38]. In division VIIIa-b, France catches 90% of the TAC (Total Allowable Catch).

As far as the Norway lobster is concerned, stocks appear to be in a good condition, although there is a certain amount of concern about the high level of juvenile catches and the low biomass level which looks set to continue diminishing in IXa[39]. In divisions VIIIa, b, c and IXa, worrying falls in the biomass level have been detected, which has gone down to levels as low as just 33% compared to the initial information on these stocks. For this reason, calls have been made for a reduction in the fishing effort by between 20% and 80%, depending on the situation in specific zones and the tendency to regenerate which they show. The stocks in the worst state are those in the Cantabrian Sea and off the coast of Galicia[40], which is why the EU has included them as areas where the fishing effort must be reduced[41].

Also of concern is the situation of **monkfish** *(Lophius spp.).* Spain and France are the main countries fishing this species, catching up to 80% - 90% by trawling. Monkfish is known by two different species names: *Lophius piscatorius* and *Lophius budegassa*. All stocks of both species are outside safe biological limits[42], except in the case of *L. budegassa* in divisions VIIb-k and VIIIa, b and d (although in the last of these the stocks are on the verge of going outside safe biological limits).

There is a similar situation with **megrim** *(Lepidorhombus spp.),* the name under which two species are also classified, *Lepidorhombus whiffiagonis* and *Lepidorhombus boscii*. However, data on the status of these stocks is not conclusive, except for megrim in divisions VIIb, c, e-k and VIIIa, b and d, which is deemed outside safety limits[43]. Once again, Spain and France are the main countries fishing this species, catching up to 60% of the total, of which 90% is caught by trawlers.

Flounder *(Pleuronectes platessa)* has extremely overexploited populations in divisions VIIe[44], VIIf-g[45], IV, VIId[46] and IIIa[47], areas that are mainly fished by bottom and beam trawlers from Belgium, the United Kingdom, France, Denmark, Holland and Germany. Meanwhile, all the stocks for **blue whiting** *(Micromesistius poutassou)* which were assessed showed evidence of overfishing. The fleets from northern Europe, the EFTA, Russia, the Faroes and some EU countries are heavily exploiting this species[48].

As far as other species are concerned, various stocks of **haddock** *(Melanogrammus aeglefinus)* and **whiting** *(Merlangius merlangius)* are in a bad state (VIb[49], Vb[50] and I-II[51] in the case of haddock, and VIa[52], IV-VIId[53] and VIIa[54] in the case of whiting), while other divisions (IV-IIIa[55] and VIa[56]", and VIIe-k, respectively)[57] appear to be "healthy" or have slightly recovered in recent years, having spent almost a decade on the verge of collapse, although they are still under a lot of fishing pressure[58]. The majority of catches in the most

overexploited fishing grounds are made by trawlers from the United Kingdom (mainly Scottish), while France and Holland also catch a considerable amount. In division VIb, the main fishing fleets are trawlers from Scotland and Ireland, but part of this division falls within international waters where Russian trawlers also come to fish.

Saithe *(Pollachius virens)* seems to be in a better situation; its populations are showing signs of gradual recovery[59] after over a decade of overfishing which took stocks to totally unsafe levels, with the exception of the Arctic (I and II) where they have only partially recovered[60], and in the waters around the Faroes and Iceland, where the species is still outside safety limits and a recommendation has been made to reduce fishing mortality by 15% and 66%, respectively[61].

In the case of **turbot** *(Psetta maxima),* there is insufficient information to assess its status. Catches have increased tenfold in the last 30 years. Turbot is mainly fished in the Baltic by fleets from Denmark, Poland, Latvia, Lithuania, Germany, Sweden and Russia[62]. Meanwhile **blackspot seabream** *(Pagellus bogaraveo)* is one of the species in the worst situation; its populations in divisions VI, VII and VIII are regarded as depleted and the situation is unknown in divisions IX and X[63]. The main sea bream-fishing countries are Spain and Portugal.

Also of concern is the status of some of the populations of **Greenland halibut** *(Reinhardtius hippoglossoides)* fished by trawlers from the EU, Russia, Norway and Iceland[64],[65] as is the situation of **dab** *(Limanda limanda)*, in this particular instance due to the high numbers of discards and non-registered catches affecting this species[66].

In a better situation are many of the populations of **sprat** *(Sprattus sprattus)*[67], **Northern shrimp** *(Pandalus borealis)*[68] and **sandeel** *(Ammodytes marinus)* [69], although catches of these fish have increased considerably in recent years and their evolution should be very carefully monitored.

Table 6: Status of the main stocks fished by trawlers in the North-East Atlantic

Species	**Subarea ICES**													
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	**XIII**	**XIV**
Anchovy							O	I	D					
Herring			$O_{25\text{-}29,,32}$ $Ia_{.30,31}$ $D_{22\text{-}24}$	I	Ia	Da	Id Da-c,j							
Blue whiting	O													
Cod	O	O	O	O	Da	Oa Db	O							O
Mackerel	O													
Capelan	O	O Ia			D									D
Saithe	I	I	Ia	I	Ob	I								
Nephrops			Ia	Ia	Ia	Ia	Ob If-k Dc	Oa,b	Oa,c					
Haddock	O	O	Ia	I	O	Ia Dd	Oa Db-k							
Sprat			Da	D			Dd,e							

			I_{22-32}											
Norway Pout			Ia	I		Da								
Redfish *(Sebastes mentella)*	D	D		I		I						I		I
Redfish *(Sebastes maritimus)*	O	O			I	I								I
Other redifish	O	O			D	D						D		D
Megrim						D	O	Dc	Da					
Greenland hHalibut	D	D			O									O
Horse mackerel		Da	Da	D	Db	Da	Da,b,e,k	Da,b.e	Da					
Sandeel			Da	D		Da								
Dab	D													
Sole			Oa	O			Oa,d-g Db,c.h-k	Oa,b						
Whiting			Da	D		Oa Db	Oad Ie-k							
Hake			O	O		O	O	Oa-d	Oa					
Plaice	D													
Anglerfish			Oa	O		O	O*	O	Oa					
Turbot	D													
Salmon			D_{22-32}											
Sardine								Dc	Da					
Flounder			Oa	O			Od-g Ia Db,c,h-k							

O = Overexploited or harvested outside biological limits
I = Inside biological limits
D = Deficient Data or Unknown
* Small letters and numbers refer to divisions and subdivisions within ICES subareas

The enormous wastage in the ICES area: by-catches and discards

The FAO[70] regards the North-East Atlantic as the second largest area in the world in terms of volume of wastage, producing some 3.7 million tonnes of discarded fish per year.

Nine of the twenty areas in the world with the greatest amount of fish discarded at sea (in terms of the number of fish discarded compared to the number of fish unloaded) can be found in the North-East Atlantic. Six of these are fisheries plied by trawlers and the other three are fished by vessels using another kind of trawling technique: the “Danish seine”.

However, if we take into account the weight of accidental catches compared with landings, the trawling of dab generates the greatest wastage, with some 2.01 kg of accessory catches per kilo unloaded. The profligacy of this fishery is only exceeded by the big crustacean trawlers working in tropical waters: the fishery that is regarded as the most wasteful in the world, with discard levels that can reach almost 15 kg per kilo landed.

Table 7: The 20 most wasteful fisheries in the world[71]

Fishery	Area	Nº discards per Nº landed
Shrimp trawl	West Central Atlantic	12.13
King crab pot	Bering Sea	9.71
Halibut net	California	4.83
Whiting trawl	***Northeast Atlantic***	***2.83***
Tanner crab pot	Bering Sea	2.34
Haddock trawl	***Northeast Atlantic***	***1.94***
Finfish trawl	Arabian Gulf	1,75
Nephrops trawl	***Northeast Atlantic***	***1.70***
Spiny lobster pot	East Central Pacific	1.68
Swordfish longline	East Central Pacific	1.58
Hake trawl	***Northeast Atlantic***	***1.18***
Tuna longline	East Indian Ocean	1.13
Cod Danish seine	***Northeast Atlantic***	***0.79***
Haddock Danish Seine	***Northeast Atlantic***	***0.70***
Slipper lobster pot	East Central Pacific	0.67
Whiting Danish seine	***Northeast Atlantic***	***0.64***
Cod trawl	***Northeast Atlantic***	***0.51***
Plaice trawl	***Northeast Atlantic***	***0.42***
Tuna longline	Caribbean Sea	0.40
Japanese squid net	High Seas	0.39

The majority of fishing practices carried out in the ICES area are based on mixed stocks. Virtually all trawlers catch a mixture of cod, haddock, whiting, flat fish and crustaceans. It is thus impossible to manage these stocks from a single species perspective.

Haddock is one of the most common species in by-catches. Between 1991 and 2000, 50% of haddock catches were discarded[72].

In the Irish Sea, 60% of the catches made during Norway lobster trawling are whiting, which are subsequently thrown overboard. Recently, the increase of beam trawling in Ireland for fishing monkfish and megrim has meant high levels of accidental whiting catches in divisions VIIe-k[73].

In the North Sea (IV) and the eastern English Channel (VIId), it is estimated that 60% of catches in the fishing grounds of Norway lobster, prawn and flatfish are whiting, which are discarded[74].

Much of the fishing in the Atlantic is carried out by bottom trawlers and pelagic trawlers. However, as far as pelagic trawlers are concerned, although it is believed that accidental catches may be very high, data is fairly scarce except in the case of cetacean by-catches[75]. In pelagic trawls of herring fisheries in the West Atlantic, by-catches of some 100 tonnes were counted after just 12 trips with on-board observers, with some 30 tonnes being discarded. In other words, 2.5 tonnes of fish are discarded for every trip in a pelagic trawler[76].

In the Eastern Atlantic zone, the numbers of discarded fish also appear to be significant. In Norway, pelagic herring and mackerel trawlers are catching worrying levels of young salmon and in the Irish Sea, the recent development of pelagic trawling for cod fishing could be the reason behind the fact that the reproductive stock is not now reaching the Firth zone in the Hebrides[77]. Of equal concern are the by-catches of young tuna in the albacore fisheries by means of this form of trawling, which is carried out between Ireland, the Cantabrian Sea and North Africa[78]. We should not forget that in the case of pelagic trawling for the fish processing industry, up to 50% of accidental catches are authorised[79].

There are some studies available that have tried to assess the total losses resulting from discards. The work carried out was based mainly on estimating the direct effects on commercial species. The FAO estimated that the value of discarded fish from the demersal fisheries in the North Sea in 1997 was close to 700 million euros (similar to the value of unloaded fish). Other partial estimates on this sea show figures of some 100 million euros in losses resulting from the haddock fisheries[80]. These studies only reflect the value of the discarded biomass, not the medium and long-term effects on commercial stocks such as the reduction in recruitment and future spawning.

Recently, the EU has commissioned various studies to try to estimate the impact of discards on catches from other fisheries and its future effect. One of these studies[81] concludes that discarding immature fish in the common prawn fishery costs other fisheries around 25 million euros.

Table 8: Impact of discards on some examples of key fish stocks

Losses in common prawn fisheries in European waters				
Species	**Juveniles discarded annually**	**% loss of spawning stock biomass**	**Tones lost**	**Value of lost landings (millions)**
Plaice	928 millions	6%-16%	7,300-18,800	17,9
Whiting	55 millions	0.6%-2%	900-2,400	1,2
Cod	42 millions	0.5%-2%	1,000-3,200	1,9
Sole	16 millions	0.4%-2%	150-1,350	3,9
Total	**1,041 millions**		**9,350-25,950**	**24,9**

Some key sub-areas and divisions in the ICES area

Barents Sea (I)

- Used by the Norwegian fishing fleet and some Finnish boats.
- The trawlers catch cod, haddock, saithe, shrimp, Greenland halibut and redfish.
- Off Bear Island, in the south of the Barents Sea, catches of young cod represent up to 50% of the total.
- Trawlers catch 85% of cod and haddock, 35%-60% of saithe, 90% of redfish and 100% of prawn[82].

Skagerrak and Kattegat (IIIa)

- Many trawlers fish sandeel, Norwegian pout and blue whiting for fishmeal, accidentally catching cod, haddock and whiting at the same time.
- The fleets of Denmark, Sweden and Norway have the greatest presence in this area and focus primarily on catching Norway lobster[83].
- Pelagic trawlers and seiners catch herring, mackerel, horse mackerel and sprats.
- Cod discards represent up to 61% of the catches made by trawlers fishing Northern shrimp[84].
- Other by-catches in the crustacean fishing grounds include haddock, Norwegian pout, blue whiting, herring, witch flounder, whiting, Norway lobster and three-bearded rockling[85].

North Sea (IV)

- The fish processing trawlers catch sandeel, sprats, Norwegian pout, etc.[86], with by-catches of herring, haddock and whiting.
- The Danish fleet mainly fishes in this area, together with a large number of trawlers from the coastal countries.
- The sandeel fishing grounds seem to have a low number of by-catches (between 2% and 4% of the total weight caught).
- There are high numbers of accidental catches in the fisheries dedicated to catching Norwegian pout and blue whiting (especially of saithe), reaching up to 40% of the total weight caught[87].
- In this area there are demersal trawling fisheries that use different trawling techniques in a multi-species fishing ground for catching cod, haddock and whiting, or cod, flounder and sole. Smaller in size and importance are the trawlers that specialise in the crustacean fisheries, such as Norway lobster, shrimp and prawn.
- It is estimated that to unload 120,000 tonnes of sole, the Dutch beam trawling fishery[88] produces some 100,000 tonnes of discards (80% of which consist of other flatfish – dab and flounder) and almost 170,000 tonnes of invertebrates and rubbish.

Iceland (Va)

- A great many trawlers belonging to this country specialise in fishing small pelagic species (herring, capelin, horse mackerel and Norwegian pout), crustaceans (Norway lobster and northern shrimp) demersal fish in multi-species fisheries (cod, haddock, blue whiting, saithe) and flatfish (Greenland halibut, flounder, lemon sole).
- Other vessels with licences to fish in this division are trawlers from Norway and the Faroes Islands dedicated to multi-species demersal fishing, and the British and German fleets fishing redfish.
- The information available on by-catches catches in this zone lists dozens of species from different trawling fisheries[89].

- Some of the by-catches are kept on board and unloaded (such as halibut or common skate - *Raja batis*), while others are discarded. These include lemon sole, dab, American flounder *(Hippoglossoides platessoides)*, shagreen ray *(Raja fullonica)*, starry ray *(Raja radiate)*, large eyed rabbitfish *(Rhinochimaera atlantica)*, rabbitfish *(Chimaera monstrosa)*, greater fork-beard *(Phycis blennoides)*, black dogfish *(Centroscyllium fabricii)*, spiny dogfish *(Squalus acanthias)*, Portuguese shark *(Centroscymnus coelolepis)* and Greenland shark *(Somniosus microcephalus)*.
- The new deep-sea fisheries have led to an upsurge in by-catches of numerous new species not often caught in regular fisheries, such as black scabbardfish *(Aphanopus carbo)*, cardinal fish *(Epigonus telescopus)*, Atlantic catfish *(Anarhichas lupus)*, said smelt *(Argentina silos)*, grey gurnard *(Eutrigla gurnardus)*, lumpfish *(Cyclopterus lumpus)*, Mediterranean slimehead *(Hoplostethus atlanticus)*, spine eel *(Notocanthus chemnitzii)*, blue antimora *(Antimora rostrata)*, blue ling *(Molva dypterigia)*, brill *(Scophthalmus rhombus)*, grenadiers *(Coryphaenoides rubestris and Macrourus berglax)*, smoothheads *(Alepocephalus spp.)* and redfish *(Sebastes spp.)*[90].

West Scotland (VI)

- Some 200 Scottish trawlers fish in this division in the Norway lobster fisheries, accidentally catching young whiting, cod and haddock[91] in numbers that could reach up to 90% of the total catches in this zone. Large numbers of young saithe are also caught, particularly off the shelf north-west of Scotland.
- Other British trawler fleets also fish in these waters, together with the Germans and French. They fish cod, haddock, whiting and monkfish, giving rise to by-catches of saithe, megrim and lemon sole.
- The monkfish fishing effort is targeted at deeper waters where cod and megrim tend to be caught accidentally.
- In division VIb, trawlers from Scotland, Ireland and Russia fish for haddock, having replaced the regular seiners that used to specialise in this fishery.
- Pelagic trawlers from Great Britain, Holland, Germany and Ireland fish for mackerel, horse mackerel and, to a lesser degree, blue whiting.
- There is some major fish processing carried out by the Danish (Norwegian pout) and the Scottish (sandeel).
- In the monkfish fisheries, megrim is often caught accidentally. Due to sexual dimorphism, much higher numbers of female than male monkfish are being caught, with an effect which is still unknown on the species[92].
- The Norway lobster fisheries in division VIa produce 80 tonnes of discards every day, mainly young haddock, whiting and Norway lobster[93].

Irish Sea (VIIa)

- The majority are bottom trawlers from the United Kingdom and Ireland fishing for cod, haddock, whiting and flounder and giving rise to by-catches of monkfish, hake and sole.

- Double-rig bottom trawlers (most of which are from Northern Ireland) fish in this area catching Norway lobster. They tend to combine this fishing technique with pelagic trawling to catch cod, whiting and haddock.
- There are also some pairs of pelagic trawlers dedicated to herring fishing[94].
- Various Irish bottom trawlers are involved in ray fishing to the south of the Irish Sea, while others specialise in fishing for Norway lobster, involving high numbers of accidental catches of young whiting. In the last two years, discards of young whiting, which have reached almost 60% of the total weight caught, have increased in this zone as a result of these fisheries[95].

West Ireland (VIIb, c, h-k)

- Trawlers are the principal fishing boats fishing off the west of Ireland, operating in a multi-species fishery for cod, hake, haddock, megrim, sole, flounder, whiting and monkfish[96].
- Many trawlers specialise in fishing for Norway lobster, accidentally catching cod and whiting, amongst other species.
- Hake is mainly caught in divisions VIIh-k.
- In the haddock fishery to the west of Ireland, by-catches of cod represent 20% of total catches.
- The Norway lobster fisheries have an impact on haddock, especially on fish younger than two years old, which are totally discarded[97].

Eastern English Channel (VIId)

- There are numerous small fishing vessels carrying out artisanal fishing activities and many multi-purpose boats alongside the trawling fleets of France, the United Kingdom and Belgium[98].
- The main target species of the trawlers is sole, and many landings of flounder have resulted from accidental catches in this fishery.
- Cod and whiting are another two species that most commonly appear in landings in this zone, either as the target species of particular trawlers or as by-catches in a multi-species fishery.
- In demersal fisheries, sole and other species are the most common by-catches[99].
- The pelagic trawlers specialise almost exclusively in catching herring.

Celtic Sea (VIIf-k), Western English Channel (VIIe) and the Northern Bay of Biscay (VIIIa, b, d and e)

- Cod, Norway lobster, whiting, hake, monkfish, megrim, sole and flounder are caught together by bottom and beam trawlers from Belgium, France, Ireland and the United Kingdom; Norway lobster is the species with the greatest commercial importance in these catches.
- There are large hake and monkfish fisheries fished by trawlers from Spain and France in the Celtic Sea and the Bay of Biscay. Accidental catches are common in all these fisheries but the ones that give rise to the greatest concern are those of young cod and hake[100].

- Pelagic trawlers focus on catching herring in the Celtic Sea and horse mackerel and mackerel in the whole zone. Mackerel used to be discarded, but in the last two years the number of discards has diminished[101].
- The highest numbers of discards occur in the French fleet, which catches small pelagic fish in sub-areas VII (55.2%) and VIII (33.1%), particularly in the case of mackerel caught by demersal trawlers. The average number of discards made by the French fleet in this zone is estimated at 24%-28% in demersal fisheries and 26%-37% in pelagic fisheries[102].
- In the last two years, bottom trawlers have been gradually replacing beam trawlers. However, there are still some beam trawlers from Cornwall and Belgium that specialise in catching sole, giving rise to accidental catches of flounder, ray, brill, turbot and monkfish[103].

Iberian Region (VIIIc and IXa)

- The Spanish and Portuguese fleets are responsible for 90% of the catches in the Iberian region. The trawlers catch a wide range of demersal and pelagic species, amongst which are notable, hake, blue whiting and horse mackerel, competing with artisanal fishing fleets and a large number of seiners, long-liners, trammellers, etc.[104].
- The most important fishing grounds for the trawlers are the Gulf of Cadiz (south of division IXa) where they catch hake, prawn, molluscs, octopus and various types of flatfish.
- The Portuguese fleet, with some 25 trawlers fishing for crustaceans, has considerably increased its shrimp catches because of the decline in the stocks of Norway lobster and also because the former is not subject to a Total Allowable Catch regime (TACs)[105].
- In recent years, a fleet of pelagic trawlers has started operating in the Bay of Biscay, increasing the fishing effort on the anchovy stock. The opposite is the case in the mackerel fisheries, where trawlers are being replaced by seiners in divisions VIIIc and IXa. Mackerel is a very common by-catch in trawler fisheries in divisions VIIIc and IXa**[106]**.
- The high levels of accidental catches of hake in this zone are particularly disturbing as this is a breeding ground for the species.
- 21% of the weight of hake catches made by trawlers and 70% of the actual numbers are discarded because they are made up of young fish with a smaller than permitted size[107].

Mediterranean Sea

Given that there is no EEZ (Exclusive Economic Zone) in this sea, and that the jurisdictional waters are less than 12 miles in areas, many fishing grounds are located in international waters and are shared by different countries. There are only two exceptions to this: the Fisheries Protection Zone established unilaterally by Spain (of 49 miles to prevent private fishing in the spawning grounds of bluefin tuna between the mainland and the Balearic Islands) and by Malta (spanning a radius of 25 miles around its islands)[108].

The General Fisheries Council for the Mediterranean (GFCM[109]) has divided these two seas into three areas, 10 sub-areas and 30 divisions, known as Management Units.

Table 9: Distribution of species in the Mediterranean and Black Seas

Species	Main fishing grounds in the Mediterranean and Black Sea		
	Very important	Important	Other
Anchovy	Black Sea, Adriatic Sea	Gulf of Lyons	Aegean Sea, Marmara Sea
Anglerfish	Balearic/Alboran, Adriatic	Aegean Sea	Gulf of Lyons
Azov Sprat	Azov Sea		
Blue whiting	Balearic/Alboran, Adriatic Sea, Ionian/Strait of Sicily	Black Sea	
Cuttlefish	Adriatic Sea	Aegean Sea, Balearic/Alboran	Ionian/Strait of Sicily
Flounder	Adriatic, Ionian		
Hake	Adriatic Sea, Ionian/Strait of Sicily	Aegean Sea, Gulf of Lyons, Ionian/Strait of Sicily	Tyrrhenian, Corsica, Sardinia
Horse mackerel	Black Sea	Balearic/Alboran, Adriatic Sea	Aegean Sea
Mackerel	Balearic/Alboran, Gulf of Lyons	Ionian/Strait of Sicily, Adriatic Sea	
Mugilids	Black Sea	Ionian/Strait of Sicily, Aegean Sea	Adriatic Sea
Norway lobster	Adriatic Sea	Ionian/Strait of Sicily,	Tyrrhenian, Corsica, Sardinia
Octopus	Adriatic, Balearic/Alboran	Aegean Sea, Ionian/Strait of Sicily	Gulf of Lyons
Pandora	Tyrrhenian, Corsica, Sardinia	Adriatic Sea	
Picarels	Aegean Sea	Levant	
Rays	Aegean Sea	Ionian, Adriatic	
Red mullet	Adriatic Sea	Ionian/Strait of Sicily, Tyrrhenian, Corsica, Sardinia	
Red seabream	Balearic/Alboran		
Blue & red shrimp	Tyrrhenian, Corsica, Sardinia,	Balearic/Alboran, Ionian/Strait of Sicily	Levant
Rose shrimp	Adriatic Sea	Ionian/Strait of Sicily	
Sardine	Gulf of Lyons, Adriatic	Balearic/Alboran, Ionian/Strait of Sicily	Aegean Sea
Sparids	Tyrrhenian, Corsica, Sardinia	Levant	

Sprat	Adriatic Sea, Black Sea	Ionian/Strait of Sicily	Levant
Whiting	Black Sea		

Trawlers, accidental catches and discards in the Mediterranean

The European trawler fleet fishing in the Mediterranean is made up of some 5,000 vessels of a smaller size than those operating in the ICES zone. These vessels, on average, have a GRT of 30 and 300 horsepower[110], although the majority of trawlers generally have a GRT of 12 and a maximum horsepower of 100.

These trawlers fish at depths of up to 800 metres, although most of them tend not to cast their nets deeper than 300 metres. With the exception of certain specific fisheries, all the Mediterranean trawlers tend to specialise in multi-species fisheries which means they may catch hundreds of different species[111].

The bottom trawlers specialise in catching species such as hake, mullet, shrimp, sole, octopus, pandora, seabass, gilthead seabream, red seabream, ray, cuttlefish, etc.[112], while the pelagic trawlers look for sardines, anchovies, cephalopods, mackerel, horse mackerel and tuna, amongst other species.

Some of the most common illegal practices in Mediterranean trawling include using nets with a smaller mesh opening than that permitted, fishing in prohibited zones and seabeds and using engines with a higher power than officially declared.

Although the information available on discards in the Mediterranean is not very accurate, it is estimated that levels may be very high, reaching figures of between 13,000 and 22,000 tonnes per year which amounts to 12% of actual landings. However, the European Commission believes that these numbers are much higher in the case of trawlers, which it believes discard at least 20% of the total biomass caught, although figures could well be closer to 40%-70%[113]. Estimates made for Greek trawlers operating in the Aegean and Ionian seas put the level of discards at between 39% and 49% of total catches, although some studies concluded that the overall figure for discards must be nearer 60%, and 50% in the case of edible species[114].

Trawlers fish in three of the five most wasteful fisheries in the Mediterranean and Black Seas[115].

Table 10: The five most wasteful fisheries in the Mediterranean

Fishery	Kg Bycatch per Kg landed
Finfish trawl	***0.85***
Tuna longline	0.10
Hake trawl	***0.04***
Sardine purse seine	0.03
Flatfish trawl	***0.03***

Some key stocks for Mediterranean trawlers

Hake *(Merluccius merlucciust)* is one of the main catches of trawlers and many other kinds of fishing techniques. All the hake stocks in the Mediterranean are regarded as overexploited, especially in the SAMED area (Stock Assessment in the Mediterranean)[x]. The main recommendation of scientists is to protect the spawning grounds and reduce the fishing effort (especially with regard to trawlers)[116].

In unit MU9 there has been a call for a reduction of at least 15% of the fishing effort and in MU7, where the biomass of the recruitment stock is in danger due to fishing by longliners, netters and trawlers[117], a reduction of 20% is recommended as well as the adoption of stringent measures to prevent catches of young fish smaller than 20 cm long. Although controls have been increased and stricter measures have been established, the bulk of most hake catches in certain zones (for example, in the north of the Balearic Sea sub-area[118]), continues to be made up of sub-adult fish. In some Spanish regions, such as Alicante, 94% of the fish caught were between 4 and 20 cm long.[119]. Therefore, only 6% of catches were actually larger than the legally established size.

Mullet *(Mullus spp.)* is another of the most common trawler catches but information on the status of its stocks is not very accurate, as the majority of studies combine the two species: the striped mullet (*Mullus barbatus)* and the red mullet (*M. surmuletus)*. The most significant measure put forward by scientists is to establish a temporary closed season at the end of summer and beginning of autumn, when the majority of catches comprise young fish. In the SAMED area, particularly in unit MU9, stocks are regarded as either overexploited or totally exploited[120]. In MU3, the biomass is believed to be very low, possibly only 38%[121] of the original.

In spite of the poor situation that this species finds itself in, some scientists believe[122] that in most zones of the Mediterranean a reduction in the fishing effort of trawlers, along with an increase in the size of mesh openings, could result in a greater volume of catches (between 100% and over 300% higher) for vessels using trammel nets in many of the coastal areas of Spain and Italy.

Together with demersal fish, the most common catches of bottom trawlers are crustaceans. Almost half the Spanish and Italian fleets specialise in catching crustaceans[123]. The **red shrimp** *(Aristeus antennatus)* is overexploited in MU1, MU5 and MU6[124] (where scientific recommendations call for a reduction in the fishing effort of 50% in the case of females and 22% in the case of males). Around the Balearic Islands (MU5), it is believed that the current biomass must be less than 16% of the original one[125]. In the Ligurian Sea, the stock collapsed at the beginning of the eighties[126] and several years after its recovery, trawler catches are still only reaching half of what they used to[127]. In addition, 90% of the specimens caught are female.

[x] Name given to the Mediterranean area where the EU is undertaking studies, which coincide with the fishing grounds in which the European fleet operates (MUs 1, 6, 7, 8, 9, 10, 11, 15, 16, 17, 18, 19, 20, 22 and 23).

Information on the **giant red shrimp** *(Aristeomorpha foliacea)* is scarce. In MU11 it would seem that no overexploitation has been detected, but a recommendation has been made not to increase the fishing effort so as to preserve the current status of the stock[128]. The same is the case with the **pink shrimp** *(Parapenaeus longirostris).* In MU3[129] the stock seems to have managed to retain a "healthy" status, although there is a worrying trend towards catching specimens below the permitted size. And with regard to the **Norway lobster** *(Nephrops norvegicus)*, reports on the SAMED area have concluded that stocks range between slight exploitation to total exploitation, except in MU9 where, for the moment, no overexploitation has been detected[130].

Small pelagic fish have also undergone intensive exploitation which has led to collapses, such as the case of the **anchovy** *(Engraulis encrasicolus)* in the Alboran and the Adriatic; although it would appear that it is currently making a recovery, it has been recommended that the fishing effort is not increased[131]. With regard to the **sardine** *(Sardina pilchardus),* it has also been recommended that the fishing effort is not increased and concern has been expressed over the high level of discards in MU17[132]. Nor should we forget the drastic reduction of this species in the Eastern Mediterranean as a result of the construction of the Aswan Dam, as mentioned previously. However, both the **Mediterranean horse mackerel** (*Trachurus mediterraneus)* and the **Atlantic horse mackerel** *(T. trachurus)* are mainly caught by seiners and trawlers, both demersal and pelagic. In MU3[133], the stock is believed to be totally exploited. Its biomass is at 31% and the average size of the fish being caught is 9.8 cm, very much below the size of the mature fish, which has been put at 12 cm.

Unfortunately, despite the high value and volume of octopus, cuttlefish, squid, sparidae, etc., there is no accurate information on the status of many of these species.

Table 11: Assessment of Mediterranean Stocks

State of resources					
Species	**Assessments**	**Over-fished**	**Fully-fished**	**Under-fished**	**Comments**
Hake	4	3	-	-	General growth overfishing
Red and blue shrimp	2	2	-	-	Not to increase effort
Sand red mullet	3	2	1	-	Risk of depletion
Common pandora	3	-	-	-	Preliminary assessment
Norway lobster	1	-	-	1	No new management measures
Anchovy	4	-	-	-	Risk of recruitment overfishing
Sardine	4	1?	-	-	Reduce discards
Sardinella	1	-	-	-	Possibly eggs anchovy predator
Mackerel	1	1	-	-	Keep same fishing effort

The GFCM (General Fisheries Commission of the Mediterranean)[134] has published a list of 26 priority species for the assessment and establishment of management measures. Half of these species are a common target of trawlers:

Merluccius merluccius, Micromesistius poutassou, Merlangius merlangus, Mullus barbatus, Mullus surmuletus, Pagellus erythrinus, Psetta maxima, Engraulis encrasicolus, Sardina pilchardus, Sardinella aurita, Sprattus sprattus, Trachurus trachurus, Trachurus mediterraneus, Thunnus thynnus, Thunnus alalunga, Xiphias gladius, Coryphaena hippurus, Aristeomorpha foliacea, Aristeus antennatus, Parapenaeus longirostris, Nephrops norvegicus, Eledone cirrhos, Prionace glauca, Isurus oxyrhinchus, Lamna nassus and Acipenser sturio.

The European Commission (EC) has also expressed its concern about the status of Mediterranean fish stocks and has proposed a Plan[135] to conserve fishing resources, stressing the vulnerable situation of certain species such as hake, seabass, mullet, Norway lobster, white octopus, musky octopus, lobster and blue whiting[136].

Description of some of the key zones for trawlers in the Mediterranean

Balearic Zone (GFCM Division 1.1)

- Chartered by fleets from Spain, Morocco and Algeria. A large proportion of the fleet fishing here is artisanal, although there is also a considerable number of seiners and trawlers.
- The demersal stocks are regarded as overexploited, as are various pelagic species such as anchovy, although it is thought that others, such as the sardine, could be in a good condition[137].
- In unit MU1 (Northern Alboran Sea), the main commercial species fished by trawlers are mullet, hake, sparidae, conger, blue whiting, octopus, cuttlefish, squid, bivalves molluscs (such as the striped Venus clam – *Chamelea gallina*) and crustaceans, as well as others at greater depths, which tend to be caught below 350-400 metres, such as Norway lobster, shrimp and red shrimp[138].
- Other important species for trawlers are monkfish, pandora, auxiliary seabream *(Pagellus acarne)*, red bream, dentex *(Dentex dentex)*, horse mackerel, striped seabream *(Lithognathus mormyrus)*, greater fork-beard, lesser spotted dogfish *(Scyliorhinus canicula)*, small-scaled scorpion fish *(Helicolenus dactylopterus)* and bogue *(Boops boops)*. This last species is discarded almost 100% of the time along with harbour crabs and soldier shrimp.
- In the deep-sea fisheries, the species most regularly discarded are blackmouthed dogfish *(Galeus melastomus)*, velvet belly shark *(Etmopterus spinax)*, Mediterranean slimehead *(Hoplostethus mediterraensus)*, deep-water red crab *(Geryon longipes)* and some species of rabbitfish and grenadiers[139].
- In the south of unit MU6, Spanish trawlers specialise in catching red shrimp. This stock is regarded as totally exploited[140].
- In the central and northern zones of unit MU6 there are also large fleets of trawlers fishing crustaceans and other species.
- Shrimp are also the main target of the fleets operating in unit MU5. Shrimp trawlers in this zone, and in all the western Mediterranean fleets, are 21 metres long and have a GRT of 66[141].

- A recent study[142] counted 609 different species caught by Spanish trawlers, only 20% of which have any commercial value. In some zones, the level of discards is estimated at between 17.5% and 40%, while in some cases up to 800 kilos of fish have been thrown overboard per hour (mainly silver scabbardfish, *Lepidopus caudatus*).

Gulf of Lyon (GFCM Division 1.2)

- There are almost 200 trawlers operating in this zone, 140 of which are French, catching some 15,000 tonnes of demersal species per year[143].
- Since 1991, the status of the majority of demersal stocks in the Gulf of Lyon has been regarded as either overexploited or totally exploited[144].
- Today there are some 110 French pelagic trawlers operating, and their catches have increased six-fold since the beginning of the Eighties. This fleet catches some 6,000-7,000 tonnes of anchovy and 7,000-10,000 tonnes of sardine every year[145].
- The trawlers in this zone tend to average 20-21 metres in length[146]. The French trawlers catch two-thirds of the 3,000 tonnes of hake caught every year in this area; the remainder is caught by Spanish trawlers and longliners from both countries.
- The size of hake caught by the trawlers tends to be half that of the fish caught by the longliners[147].
- Most of the trawlers fishing on this shelf are multi-species. Although originally they specialised in fishing for hake, when this started to become scarce they broadened their scope with regard to commercial species to include fish that had previously been discarded.
- With regard to the most commonly caught species by trawlers, studies[148] carried out in this division list sardine, anchovy, sole, mullet, monkfish, red bream and various sparidae, seabass *(Dicentrarchus labrax)*, blue whiting, capelin *(Trisopterus minutus)* and white octopus *(Eledone cirrhosa)*.

Sardinia (GFCM Division 1.3)

- This is a fishing zone for the fleets of Italy and France, although in the southern sector it is more common to find Italians and Tunisians. It is believed that the majority of stocks are either overexploited or totally exploited, especially in the northern sector.
- There are serious problems with regard to the catches and discards of hake smaller than the permitted size in the Ligurian and North Tyrrhenian Seas (MU9), where almost 140 trawlers account for 90% of the total catches of this species[149].
- Hake has gone from being the main target species of these vessels to an important accessory catch. In the Ligurian Sea, trawlers specialise in fishing white octopus, spot-tail mantis shrimp *(Squilla mantis)*, cuttlefish, tub gurnard *(Trigla lucerna)*, kuruma shrimp *(Penaeus kerathurus)*, hake, black goby *(Gobius niger)*, scaldfish *(Arnoglossus laterna)* and mullet.
- In the Tyrrhenian Sea, the red shrimp fisheries give rise to high levels of by-catches[150]. The main accidental catches made while fishing for red shrimp are hake, blackmouthed dogfish, soldier shrimp *(Plesionika*

heterocarpus), giant red shrimp *(Aristaeomorpha foliacea)*, crabs *(Chaceon spp.)*, megrim, sparidae, silver scabbardfish *(Lepidopus caudatus)*, monkfish, blue whiting, greater forkbeard, rockfish and conger[151].

- Almost 100% of hake catches in the north of the Tyrrhenian Sea are made by trawlers. The Italian fleet catches almost 75% of the 600 tonnes of annual catches, while the French catch the rest[152].
- Other species with a high commercial value are crustaceans, such as shrimp, red shrimp or Norway lobster. Dozens of accessory species are also caught in these fisheries, some of which have commercial use, such as said smelt, monkfish, blue whiting, conger, shortnose greeneye *(Chlorophtalmus agassizi)*, white octopus, greater forkbeard, blackmouthed dogfish, octopus, squid, silver scabbardfish, white glass shrimp *(Pasiphaea sp.)*, greater forkbeard, mantis shrimp, horse mackerel, capelin, bogue, ray, anchovy, grey mullet *(Mugil cephalus)*, mullet, cuttlefish, picarel and John Dory *(Zeus faber)*, amongst others[153].
- Assessments made during the Eighties found that all the stocks of hake, blue whiting, red shrimp and mullet in the region to the north of Sicily were either overexploited or totally exploited. In the Ligurian Sea, it has been recommended that blue whiting catches are reduced by 28%[154].
- In the central Tyrrhenian Sea[155], a multitude of species are caught in the hake fisheries, including white octopus, mantis shrimp, cuttlefish, black goby, shrimp, mullet, capelin, tub gurnard, short-finned squid *(Illex spp.)*, squid, etc. The Norway lobster fisheries also give rise to by-catches of shrimp, blue whiting and greater forkbeard.
- In the southern part of this division (MU10), trawling is prohibited in the Gulfs of Sant Eufemia (Calabria) Patti and Castellammare (Sicily). The closure of the Gulf of Castellammare to trawling for four years resulted in an increase in the CPUE (catch per unit effort) of mullet 25 times higher than the previous years[156].

Adriatic Sea (GFCM Division 2.1)

- Pelagic species make up the majority of catches in these waters although molluscs fetch the highest prices[157]. These fishing grounds are shared by the fleets of Croatia, Yugoslavia, Slovenia and almost half the Italian fleet[158].
- Many of the vessels fishing in the Adriatic Sea are multi-purpose boats that combine dredgers, seining and gillnets with bottom and pelagic trawling.
- 46% of the Italian trawler fleet operates in this zone[159], focusing on crustaceans. It is estimated that the Italian Norway lobster fishery produces almost 35,000 tonnes of discards per year[160].
- Blue whiting, a frequent by-catch of hake trawlers, is mostly discarded.
- Since the end of the Eighties, many of the demersal stocks (especially hake and mullet; shrimp is rarer in this region) have been regarded as either overexploited or totally exploited. The pelagic species seem to be destined to have the same fate, but sardines are in a better position than anchovy[161].

- Some 60 Italian pelagic trawlers and two Slovenian ones catch around 12,000 tonnes of anchovy which amounts to two-thirds of the total catches in this area[162]; accidental catches include sardine, mackerel, horse mackerel, sardinella *(Sardinella aurita)* and sprats. In 1987, this fishery collapsed and since then the biomass has not managed to fully recuperate.
- The Croatians and Slovenians focus on catching sardines.

Ionian Sea (GFCM Division 2.2)

- Regarded as the second most productive zone in the Mediterranean after the Adriatic, the Ionian Sea is where the fleets of southern Italy, Tunisia and Malta come to fish alongside vessels from Libya.
- Trawling is the most common fishing technique in the area between Sicily and Tunisia. In the southern sector (Libya and Tunisia), it is believed that demersal stocks are not yet overexploited, with the exception of specific species in the Gulf of Gabes (Tunisia)[163].
- In the northern area, the situation is the opposite. Most of the demersal stocks are either overexploited or on the verge of becoming so. There are also large pelagic fisheries in this area.
- In unit MU18, trawling is the main fishing technique. The Italian fleet, with its 900 trawlers, is responsible for 97% of landings, while the Albanians, with some 100 trawlers, catch the other 3%[164].
- The species that fetch the highest commercial value are hake, Norway lobster, red shrimp, mullet, white octopus and mackerel.[165] In catching these species, accidental catches include white octopus, bogue, sole, cuttlefish, sea bass, red bream, picarel, tub gurnard, John Dory, rays and squid[166].
- Crustaceans of commercial interest, such as red shrimp, are very scarce in this zone.[167].
- An analysis[168] of the level of discards in the main commercial fisheries in this zone (hake, mullet, red shrimp, etc.) show considerable variations depending on the season, fluctuating between 4% and 80% of by-catches, while total discards could be, on average, 45-50%.

Aegean Sea (GFCM Division 3.1)

- This is the main fishing zone of the Greek fleet, but it is the small-scale fishing boats that take 80% of the catches. A few Turkish boats also operate in these waters but their catches only represent 20% of the total[169].
- There are few deep-sea trawlers and just a few seiners specialising in catching anchovy (a stock that would appear to be in decline). Crustaceans are hardly exploited at all in this area.
- The Greek trawlers fish in coastal areas for species such as mullet. In fact, these fishing boats catch 75% of this species in the Central Aegean[170].
- No comprehensive studies have been carried out in this zone, but it is assumed that the fishing effort is very high.

Levant (GFCM Division 3.2)

- This zone is not very productive, especially following the construction of the huge dam at Aswan on the River Nile which resulted in an 85% drop in sardine catches[171]. This zone is shared by fishing boats from Cyprus, Turkey, Libya, Syria, Israel and Egypt. There are few scientific studies on the zone but it would appear that stocks are overexploited, at least around Cyprus and the Nile delta.

THE ENVIRONMENTAL IMPACT OF TRAWLING

It is very difficult to assess the true impact of the European Union fishing fleets. While in some areas the impact of trawlers is very significant because of the horsepower and fishing capacity of the vessels, in others the damage is caused by the high number of boats operating in the same zone. In the North Sea, the area trawled by these vessels each year is equivalent to the size of the entire sea[172]. In some regions, the same zone is subjected to visits from trawlers seven times a year, while only 10% of this sea is trawled less than once every five years[173].

Many studies have tried to assess the impact of trawlers by focusing on the selectivity (whether species-specific or not) of fishing techniques; in other words, selectivity with regard to the target species and to catching young fish and other sea animals that do not correspond to the target species. However, a large number of these studies have only taken into account catches of other species of economic interest, without including species with no commercial value.

Selectivity

Selectivity is not a characteristic of trawlers. Indeed, it is common practice for them to catch a wide variety of species. For example, off the Portuguese coast, the trawler fisheries of demersal fish and crustaceans manage to catch up to 192 and 177 different species respectively[174]. In the Ionian Sea, 163 different species have been identified (95 fish, 43 crustaceans and 25 cephalopods) in catches taken during eight surveys of trawlers working between 1996 and 1998[175].

Some reports demonstrate that the selectivity of fishing techniques depends more on the target species (behaviour, life cycle, etc.) than on the size of mesh used. For example, catches of young mullet are higher in the summer/autumn season than in winter[176] regardless of the mesh size used. The same applies to hake, where trawlers fishing at greater depths find less immature fish. It has been proven that the larger the size of the mesh opening of the net, the greater the selectivity, but on occasions this means that to reach acceptable levels of selectivity the mesh must be so large that vast quantities of commercially viable fish also escape. An analysis of the codend in mullet fishing demonstrated that there were no substantial differences between mesh openings of 36 mm and 40 mm. Those with 44 mm were much more efficient in retaining adult fish and

allowing young fish to escape, while those of a larger size not only allowed the young fish to escape but also a large number of the adults[177].

However, this increase in selectivity was still not sufficient because even with mesh openings of 48 mm, half the mullet and blue whiting caught were still below adult size[178].

The selectivity of the net also depends on the shape of the species caught and the actual volume of the catch which, if very abundant, can block the escape route of young fish. This problem is made more acute when large amounts of rubbish are brought up along with the catch. A survey conducted into a Norway lobster trawler fishery in the Mediterranean showed that one piece of rubbish was brought up per six Norway lobsters[179]. But in coastal fisheries, trawlers may catch twice the amount of rubbish as fish.

When it comes to selecting species, the situation can get much worse[180], especially with regard to fishing crustaceans, for which smaller mesh openings are used (between 16 and 26 mm) than those used for fish. The results indicate that, as with the rest of the studies, the larger the mesh the better the selectivity, but even in cases where the mesh opening is larger, there was no way of totally avoiding the capture of young fish[181]. In Norway lobster fisheries, selectivity is improved with mesh openings in the codend of more than 52 mm[182].

The shape of the mesh opening has also been studied, demonstrating that diamond shapes generally tend to result in poorer selectivity than square-shaped ones[183] (this is particularly true for species such as hake, mullet, Norway lobster, auxiliary seabream, pandora, capilan, etc.). The square-shaped mesh is only less effective in terms of selectivity for flatfish and other non-circular species (e.g. annular seabream - *Diplodus annularis*)[184].

Other studies on the selectivity of trawling have based their observations on the position of grilles for distinguishing between fish in different parts of the net and with different angles[185] and positions[186]; as well as the differences between "traditional" trawler nets and the new ones with a wide vertical opening[187]. The different materials used for making nets have also been analysed[188], as well as the separation of catches in two codends[189]. Although some of these studies showed an increase in selectivity (and others none at all), many of the results depended on the behaviour of the target species and accidental catches, as well as on the species' life cycle[190]. These mechanisms have been shown to be more effective when it comes to selecting between species with an obvious size difference, as in the case of avoiding catching fish in small crustacean fisheries, or avoiding the capture of young fish[191].

Nearly all these studies on selectivity in the haul came to the same conclusion: the bigger the mesh size, the less young fish are caught (similar inter-species selectivity cannot always be achieved), but even with mesh openings larger than the legally stipulated ones, the stock cannot be protected.

Survival rates after escaping from the net or being discarded

We should not forget that the survival rate of specimens that manage to escape from the net thanks to improved technologies (grilles, larger mesh openings, etc.) differs according to the species[192], and in certain cases may only be 10%.

Studies carried out on haddock and whiting fishing confirm that young fish are more likely to die after having escaped from the net[193]. As with the case of studies on selectivity, the nets with smaller mesh openings or in a diamond shape increased mortality rates[194].

The survival rate differs considerably when we look at individual fish which have escaped from the net or fish discarded once they have reached the deck of the fishing boat. Likewise, the length of time that the fish remain on deck once they have been boarded is also an important factor, as is the duration of the trawl, the time the fish have been in the net or the weight and pressure suffered by the catch. In Norway lobster fisheries, the survival rate of specimens that escaped from the net was 67-95%, while for discarded fish this rate was only 33%[195]. In red shrimp fisheries, levels also varied between 90% and 6% respectively[196]. Meanwhile, in the fisheries of deep-sea species, the survival rate is nil given that all the fish die from the severe change in pressure they are subjected to on being brought to the surface.

Research carried out in the ICES area has identified considerable differences depending on both the season and the area or fishery. In multi-species fisheries, the survival rate varies between 10% and 90%[197]. Some observations of fisheries in the West Atlantic estimate this rate at just 9-12%[198]. Various evaluations of discards in the flatfish fisheries of the North Atlantic give figures that range from 50% for sole[199], to 35% for Greenland halibut[200] or almost 10% for flounder[201].

It has been proven that the air temperature and surface temperature of the water also have an influence when it comes to estimating the survival rates of fish discarded from the boats. Due to the high temperatures that are generally prevalent in Mediterranean areas, exposure of just half an hour on deck is enough to cause death in the majority of species caught[202].

The European Union has identified various areas and fisheries in which the discard levels are regarded as a serious problem. Nine of the ten main areas are fished by trawlers:

Table 12: European fishing grounds with the highest incidence of discards[203]

Area	Fishing method	Target Species	Landings	Discards
IVbc	Beam Trawl	Sole, dab, turbot, brill, plaice	120,000	270,000
IV	Bottom trawl	Haddock, Cod, Whiting	220,000	224,000
VII/VIII	Bottom trawl	Hake, megrim, monk	45,000	5,000
VII/VI /IV	Bottom trawl	Nephrops	50,000	13,500
IVb	Beam/bottom trawl	Crangon	14,000	9,350-35,750
VII Celtic Sea	Gill net	Hake	300	Harbour porpoises
NE Atlantic	Bottom trawl	Roundnose grenadier	13,352	11,921
NE Atlantic	Bottom trawl	Nephrops and shrimp	5,543	35,000

Greece	Bottom trawl	Hake, sea bream, flatfish, shrimp	20,000	8-10,000
Ionian Sea	Bottom trawl	Demersal species	¿	¿

Habitat and ecosystem damage

The impact of bottom trawling on ecosystems is believed to be very high. These fishing activities diminish the complexity of benthic communities[204]. All the components involved in trawling have the capability to affect the seabed[205]. The net, the chains, the weights and, especially, the doors, can go various centimetres into the seabed (up to 30 cm[206]) depending on the sediment and the technique used, destroying benthic ecosystems. The width of the scars left behind by trawling can measure between 0.5 and 6 m[207]. With the introduction of rollers or bobbins on the underside of the net, consisting of large discs in the shape of wheels, trawlers have extended their range of action and impact and are now able to work in rocky areas or reefs, causing their destruction. Despite the scarcity of research on the repercussions of these new devices, some studies have started to show their tremendous impact[208], their lesser selectivity[209], the serious damage they cause to the substrate and sessile species[210] and the damage to the ecosystem and its slow recuperation[211].

Deep-sea coral

Deep-sea coral are azooxanthellae polyps that live on sea mounts and mounds of calcium carbonate at depths of more than 200 metres (although in some Norwegian zones they can be found at just 40 metres, and in areas close to the Iberian Peninsula they can reach depths of 3,000 metros) and can form colonies more than 30 km long[212]. They are distributed throughout European waters from the Arctic to the islands of Madeira and the Canaries, and are even found in the Mediterranean[213]. Although their biodiversity does not reach the levels of tropical coral reefs, they can be the home to more than 800 species[214], including sponges, sea fans, hydroids, anemones, serpulids, barnacles, bivalves, bryozoans, brachiopods, crinoids, tunicates, nemertines, isopods, amphipods, brachyurans, eunicids, cirripeds, cidaroids, gastropods, echinoids, ophiuroids and asteroids[215].

These ecosystems are particularly vulnerable as certain species need one year to grow just 5-10 mm, while coral reefs barely manage to grow between 1.3 and 2.5 mm in this time[216]. Some studies have shown that certain structures can reach 35 metres in height[217]. This means that a coral reef needs thousands of years to build its structure in the Atlantic and in the event of physical destruction, its recovery will take a very long time indeed.

It has been demonstrated that these reefs are very important for a number of commercial species and are also home to very large concentrations of certain populations of saithe, redfish, ling and tusk (sometimes three times larger than those found in nearby ecosystems)[218].

The most common species of coral found on Atlantic reefs is the *Lophelia pertusa*, normally found alongside other species such as *Madrepora oculata*, *Desmophyllum cristagalli, Enallopsammia rostrata* and *Solenosmilia variabilis*[219].

A study carried out to calculate the age of five different coral reefs by means of samples brought up by trawlers off the west of Ireland concluded that some formations of *Lophelia Pertusa* are 450 years old, while those of *Desmophyllum cristagalli* reached 4,550 years[220]. On Sula Ridge (Norway), the age of coral reefs has been calculated at 8,500 years[221].

It is known that trawlers are one of the prime causes of the deterioration of these ecosystems in many parts of the world[222]. Scientists recognise that "generally speaking, wherever trawlers fish on waters above coral reefs there is the risk of causing serious damage"[223]. Various investigations have corroborated the damage inflicted on coral reefs by these fishing techniques in zones of the Atlantic between 200 and 1,200 metres in depth[224]. Trawlers are capable of destroying 33 square kilometres of habitat on the continental shelf in just 15 days[225]. The National Marine Fisheries Service (NMFS) of the United States has estimated that in the case of Alaska a single trawler can drag up 2,200 pounds of deep-sea coral in a single haul[226].

In Norwegian waters, trawling has already damaged 30%-50% of coral reefs[227]. Damage of this magnitude has also been confirmed in other parts of the North Atlantic, such as the Darwin Mounds to the north-east of Scotland, the south of Wyville Thomson Ridge and the Porcupine Seabight in Irish waters.

The coral reefs in Norwegian waters cover a surface area of some 1,500-2,000 square kilometres[228]: the government has protected three of the most important masses: Sula Ridge, Iverryggen and the recently discovered reef at Røst in the Lofoten Islands. In Swedish waters, two coral reefs in the Kosterfjord also enjoy government protection.

Nor should we forget the temporary trawling prohibitions established by the EU in the sea mounts of the Darwin Mounds (close to the Hebrides off Scotland)[229], in the Porcupine Seabight (to the west of Ireland)[230], and the proposal to establish a similar zone inside the 100 mile limit around the archipelagos of the Azores, Madeira and the Canaries[231].

The inadequacies of European legislation and the reticence of fisheries' administrations mean that other zones of enormous ecological value are not being protected, despite "reefs" are included in Annex I of the EU Habitats Directive 92/43/EEC (but there are not any specific mention about deep-sea corals), due to the fact that they fall outside the 12 mile limit of jurisdictional waters. These include the Rockall Bank, between Scotland and the Faeroes; Wyville Thomson Ridge, also off Scotland; Chapelle Bank in the Bay of Biscay; the Galician Bank to the north-west of Spain; Gorridge Bank to the south of Portugal; etc.

Different trawling methods all have an effect on the seabed[232]. While beam trawlers are designed to trawl over the surface of the seabed with raised weights and at great speed, the scars they leave behind are less than those made by stern trawlers.

Some studies have proved that the reduction in invertebrates (echinoderms, polychaetes and molluscs) in trawled zones reach figures up to 65% when compared with areas where this kind of fishing has not taken place[233]. However, there is very little information available on the true impact of trawling on the seabed as there are hardly any virgin areas that have not been affected by the repercussions of this fishing technique to serve as a point of reference. Furthermore, part of the information compiled comes from indirect sources (not from field samples), such as the comparison between the number and volume of accidental catches caught in the nets[234].

Research in various zones has confirmed that discards can give rise to episodes of anoxia on the seabed[235], increase the mortality of target species[236] and cause changes in the structure and composition of species[237], while at the same time attracting the presence of scavengers and altering the benthic structure[238]. Even discarding parts of these species—something that frequently happens in the Norway lobster fisheries of the North Atlantic, where just the tail is kept and the head is thrown overboard— can inhibit the movements of certain benthic species[239]. The estimate[240] of discards reaching the seabed in the southern sector of the North Sea is 0.6-0.4 g/m^2.

The concentrations of biomass in a particular area due to discards have resulted in changes in the behaviour of certain species[241], such as the seabirds and marine mammals that follow fishing boats as an easy source of food. There is no consensus as to whether the discards are positive or negative for seabirds. While on occasions they can represent an advantage by increasing available food during the breeding season[242], they can also generate a demographic explosion of the most opportunistic species to the detriment of other, more vulnerable, ones[243]. An increase in the availability of discards can also provoke more aggressive behaviour in certain species and greater kleptoparasitism[244]. In any event, the reproductive success of all species depends on the availability of food, and thus the real problem is not the reduction in the number of discards, but overfishing.

Seagrass meadows (phanerogams)

There are various species of marine seagrass growing in the shallow waters of Europe on top of sandy seabeds in depths ranging from the surface to 40-50 metres. They are widely distributed from the Mediterranean to the Arctic[245]. In the North Atlantic, the most common species are *Zostera marina*, *Zostera nolti* (and *Z. angustifolia*, which is sometimes regarded as a variety of *Z. marina*)[246], while the *Cymodocea nodosa* is more common in southern European waters (and *Halophila decipiens* also extends to the Canary Islands). In the Mediterranean, in addition to *Cymodocea* and *Zostera*, the endemic species is *Posidonia oceanica*.

Other European seagrasses include *Ruppia maritima* and *R. cirrhosa,* which do not form large marine meadows but tend to be found alongside *Zostera* communities[247].

One of the most important phanerogams is *Posidonia oceanica*, due to the size of the areas it covers, the high level of biodiversity it gives home to and its extremely important role in the ecosystem. Unfortunately, it is also one of the most threatened communities. Up to 1,400 different species[248] can be found in these meadows, and at the same time they can generate between 4 and 20 litres of oxygen per square metre each day and 38 tonnes of biomass per hectare per year[249]. These are important reproductive and spawning grounds for commercially valuable species which constitute the most important ichthyologic community in the infra-coastal Mediterranean environment[250]. The meadows of *Zostera* and *Cymodocea* are also highly important for anatids and marine reptiles, as well as hundreds of other organisms[251].

Some of these communities can be extremely long-lived. While their clones can reach thousands of years of age, the structures they form, together with some coral reefs, have been dated at millions of years old[252].

Despite the fact that *Posidonia* is protected by various laws (such as the EU Habitats Directive which includes it in Annex 1 as a priority habitat; or EC Regulation 1626/94 of the European Commission for the Conservation of Fisheries Resources of the Mediterranean), illegal trawling is decimating its populations and is regarded as one of the main causes of the deterioration of Mediterranean benthos[253]; between 40% and 50% of the meadows of Posidonia have been damaged by trawling[254].

Estimates of the impact of trawling on these meadows calculate that a trawler can drag up between 100,000 and 363,000 leaves of *Posidonia* per hour, depending on the time of year and the density of the meadow, seriously damaging the rhizome system[255]. Ten trawler hauls over one of these meadows are enough to cause the loss of 10% of its coverage[256].

The destruction of the meadows of *Posidonia* by trawlers affects the groupings and communities of many species of fish and invertebrates as well as epiphyte plants[257]. Amphipods seem to be a good indicator for confirming damage on these marine phanerogams[258].

European Union laws regard the meadows of *Posidonia* as a priority habitat, but they do not include other seagrasses such as *Zostera spp*. or *Cymodocea Nodosa*, of incalculable ecological value.

Coralligenous beds

This biotope is characterised by the predominance of animal species with a calcareous structure such as sea fans, corals and false corals, as well as encrusting bryozoans and arborescent sponges. They live on hard substrates such as rocky seabeds and underwater caves, canyons or cliffs. Coralligenous beds can be found in shallow waters and up to depths of more than 100 metres[259].

There are very few studies on the impact of fishing on coralligenous beds in Europe. In other areas, such as Australia and Alaska, it has been confirmed that many of them are long-lived species that are very vulnerable to disturbances and have serious difficulties in recuperating[260]. Trawling over these ecosystems can reduce biomass, which can be up to 106% higher than the biomass in zones where trawling is a regular occurrence, and are home to a number of species 46% higher[261].

The sea fans and soft corals are particularly vulnerable to physical destruction. Depending on the damage inflicted and the species affected, the recovery of these ecosystems can take between 10 and 125 years[262].

In the Mediterranean, the main components of coralligenous beds are sea fans *(Paramuricea clavat*a, *Eunicella verrucosa, E. filiformis, Elisella paraplexauroides* and *Lophogorgia ceratophyta*), large bryozoans and false corals *(Pentapora fascialis, Myriapora truncate and Sertella beaniana*), arborescent and other sponges (*Axinella damicornis, Axinella cannabina, Axinella polypoides, Haliclona mediterranea*, *Verongia aerophoba, Spirastrella cunctatri* and *Petrosia ficiformis*), polychaetes (*Salmacina dysteri* and *Serpula vermicularis)*, ascids (*Polyclinidae spp.*, *Didemnidae spp.* and *Halocynthia papillosa*), cnidarians such as red coral *(Corallium rubrum*) and other corals (*Alcyonum acaule, A. Palmatum, Parazoanthus axinellae*, *Leptosammia pruvoti*) and some red seaweeds (*Neogoniolithon mamillosum, Mesophyllum lichenoides, Peyssonnelia squamaria, Pseudolithophyllum expansum)*. This ecosystem is home to considerable biodiversity which includes echinoderms (*Sphaerechinus granularis, Centrostephanus longispinus, Marthasterias glacialis*, *Antedon mediterranea* and *Hacelia attenuata)*, molluscs, crustaceans (*Stenopus spinosus, Palinurus elephas)* etc., and different species of fish, such as moray eels (*Muraena helena*), congers (*Conger conger*), grouper (*Epinephelus marginatus*), salemas (*Salpa salpa*), seabream (*Oblada melanura*, *Diplodus annularis* and *Diplodus vulgaris*), numerous chromis (*Chromis chromis)* and swallow-tailed seaperch (*Anthias anthias).*

These communities are regarded as particularly vulnerable and sensitive to large-scale damage[263]. European Union legislation only makes note of red coral in Annex V of the Habitats Directive.

It is calculated that in certain zones, 57% of discards are consumed by seabirds, 3% by animals in the water column and 49% by scavengers on the seabed[264] (crabs, starfish, ophiuroids, etc.). Other estimates bring seabird consumption down to 20% or 25%[265]. It would appear that fish hardly get any

benefit from discards apart from a few species (such as capelin) and then only occasionally[266].

Ross Reefs (Polychaete communities)

Some of the polychaetes in European waters also form reefs, notable amongst which are those created by *Sabellaria spinulosa* and *S. alveolata*.

Both species are more common in central and southern European waters, but they can also be found in the North Sea in sub-tidal and inter-tidal zones. *S. spinulosa* is more common in the sub-tidal zones of the Mediterranean and the Atlantic coast of the Iberian peninsula[267] , extending as far as the Wadden Sea and the Shetland Islands[268], while *S. alveolata* extends to the inter-tidal waters of the Mediterranean and North Africa[269].

Various studies suggest that the depletion of these species is due to fishing activities[270], mainly trawling and dredging. Many scientists use these species as bio-indicators to evaluate the intensity of the fishing effort[271].

Fishing destroys these reefs in a variety of ways: sometimes by dragging fishing gear along the sea bed but also intentionally by using huge weights to damage the reefs and create a gap through which to fish[272].

Many polychaete communities have disappeared completely in wide stretches of the Wadden Sea and other spots in the North-East Atlantic[273], as well as around the Isle of Sylt, the Norderau area, the Jade Bay (Germany) and Morecambe Bay (United Kingdom). In this last case, the entire two square kilometre stretch of reef was lost in the Eighties[274].

Sometimes the destruction of reefs of *Sabellaria* has given rise to the expansion of opportunist communities of mussels and underwater amphipods[275]. Shrimp trawling has been one of the most destructive activities for these reefs[276].

Damaging these polychaete communities can give rise to changes in the substrate and biological communities, causing the most sensitive species to move away, generating changes in the benthos and altering the quality of the water[277].

The EU Habitats Directive protects “reefs”, although it does not specify which communities it regards as such, so it is unclear whether the *Sabellaria* reefs (or other reefs formed by mollusca –i.e vermetidae or mytillidae-) are included under this reference.

Studies[278]carried out in the eastern Mediterranean show that trawling can create similar effects to eutrophication, increasing the probability that opportunist species will increase. This can be caused by stirring up the seabed (in muddy sediments, trawling can induce resuspension of some 112 kilos of

particles per second)[279], displacing the substrate and suspending nutrients and dead organisms. Although this activity can benefit certain species (mainly scavengers such as starfish and crabs) it has a negative effect on others, including many species of commercial interest and species that are vulnerable to the suspension of sediments (such as *Acanthocardia echinata*), eutrophication and turbidity. As a result, this can give rise to a temporary increase in biodiversity in terms of species taking advantage of the "new" conditions created. However, the reduction in biomass in these zones, when compared with an area where trawling has not taken place, can be 10 times greater, especially with regard to fish species.

Trawling also has other effects on the seabed, the water column and the ecosystem in general, such as changes in biogeochemistry and the nutrient effluent caused by the resuspension of sediments, nutrients and pollutants, as well as damage to the invertebrates that are responsible for irrigating, compacting and oxygenating the seabed[280]. The increase in turbidity can also affect the photosynthetic capacity of plants, with the resultant decrease in their distribution and productivity in the photic zone[281].

The resuspension of pollutants can increase their accumulation in the bodies of certain sea creatures, especially those that live closer to the seabed and species responsible for filtering. They can also induce a rise in the toxic activity of pollutants in the ecosystem and their bioaccumulation[282].

Various studies have confirmed these results[283] and also confirm fears of the longevity of the damage caused by trawlers which, in muddy seabeds, can still be identified visually up to 18 months later. It can be assumed that the scars left by trawlers will generally last for between a few months and a year[284]. Meanwhile, constant fishing by trawlers in the same zone can cause changes in the granulometry[285] and, as a result, affect the ability of certain species to survive, as well as strongly affect benthic groupings[286].

The species most greatly affected by the continuous trawling of the seabed are the most long-living epibenthic ones and, to a lesser degree, infaunal species, bivalves that live shallowly buried, anemones and echinoids[287]. Consequently, the oldest and longest-living species are the scarcest in trawled areas, while younger, more short-lived species occupy this ecological niche[288] (for example, various polychaetes). Research carried out on seabeds in the Barents Sea where trawling has taken place, show that of the 163 species under study, polychaetes, some scavenger crabs, various bivalves, ophiurids and anthozoa increased their populations following trawling, while larger-sized species, many of which are decapods, porifers, cirripeds and amphipods, drastically decreased[289].

It is believed that in deep-sea zones the effects of trawling on species groupings could be even greater because in these areas the creatures are not regularly subjected to natural changes as frequently as those in shallower waters and are thus more vulnerable to artificially induced changes[290].

The Maërl beds

The maërl beds are communities where coralline algae predominate, accumulating calcium carbonate and sediments to build their structures, and have similar shapes to corals. *Lithothamnion corallioides and Phymatolithon calcareum* are the most characteristic rhodophyceae algae of this biotype which extends from the Mediterranean to Norway. But there are many other red algae that can be found forming rhodolites, such as *Lithothamnion lemoineae, Lithothamnion sonderi, Lithophyllum dentatum*, *Lithophyllum fasciculatum, Lithophyllum hibernicum, Lithophyllum racemes, Lithophyllum hibernicum, Lithophyllum tortuosum, Lithophyllum expansum, Halcampa chrysanthellum, Neopentadactyla mixta, Edwardsia timida, Corallina officinalis, Phymatolithon purpureum, Mesophyllum lichenoides* and other rhodophytes such as *Lithothamnion glaciale* that extend as far as the Arctic[291].

The maërl beds are regarded as communities with a high biodiversity that provide a habitat for hundreds of species. Some maërl beds can reach the age of 8,000 years[292]. The species that create the maërl beds tend to have a slow growth cycle, accumulating on average some 200-400 g of $CaCO_3$ m^2 per year[293], with a stem growth of 0.10-0.96 mm per year[294]. Their reproduction can be very late, as can be observed in the case of *L. corallioides* off the coast of Brittany in France, where the reproductive cycle takes place once every 6-8 years[295]. This makes the maërl beds very sensitive to fishing activities, such as trawling or dragging for mussels, which can destroy extensive areas of maërl. In some of these depleted communities, not a single sign of recuperation has been observed four years after the damage was caused[296].

The deepest maërl banks, about 90 metres down, are subject to greater incursions than the ones in shallower waters as they lie outside the regular exclusion zones for trawlers, which tend to reach a depth of 50 metres.

The European Union has established different levels of protection for the species that create the maërl beds. While *Lithothamnion corallioides* and *Phymatolithon calcareum* are included in Annex V (b) of the EU Habitats Directive, many rhodophyceae do not even appear on any list.

Because pelagic trawlers do not need to drag their gear along the bottom, they have a lesser impact on the benthic ecosystem (apart from the effects observed as a result of discards), but depending on the depth at which they operate, the weights, doors (when used) and other parts of the gear can touch the seabed and produce adverse effects that are similar to those described for bottom trawlers.

Kelp forests

Brown algae can create formations with a high ecological value, such as kelp or large *laminaria* forests. Although the largest of these, giant kelp (*Macrocystis pyrifera)* is found in Tasmania and the North Pacific, where some of these algae can exceed 30 metres in height[297], they are also common in wide tracts of European waters.

In zones of the Mediterranean and Atlantic, the species *Saccorhiza polyschides* forms dense meadows of 5-6 feet/m^2 in areas of between 15 m and 35 m, reaching heights of 2 and 2.5 m. Alongside them, and sometimes up to 50 metres depth, are *S. bulbosa, Laminaria hyperborea, L. digitata*, *L. saccharina*, *Alaria esculenta, Desmarestia dresnayi, D. ligulata, Phyllariopsis purpurascens* and *Ph. brevipes[298] or Laminaria ochroleuca*, with specimens that can reach 4 metres long, giving home to and sheltering coral, numerous algae, molluscs and echinoderms and sessile species such as sponges, cnidarians, bryozoans and ascids[299]. Amongst their stems and leaves we can find a multitude of epiphyte plants and epibiont species that are very sensitive to the loss of foliage cover[300].

The kelp forests extend to the Arctic, providing a habitat of particular interest to commercial species of fish and many other marine organisms[301], and are regarded as important spawning grounds in various parts of the North Atlantic, which has enabled them to be declared as protected zones[302].

These ecosystems are also known for their high productivity, which can reach levels of 40,000 kJ m^2/year, of which 90% is exported[303].

As with the case of other photophilous plants, the resuspension of sediments by trawlers and other human activities can limit and reduce their growth and their spread due to the increase in turbidity[304]. For example, in the case of *Laminaria saccharina,* the increase in suspended sediments can diminish its growth rate by 20%[305].

The physical impact of trawlers and dredgers on these communities can be considerable, which are also recognised for their importance to numerous commercial species such as cod[306].

Kelp forests also have to contend with mass harvesting for various uses such as alginate production[xi], and the threat of the introduction of exotic species such as *Undaria Pinnatifida*, an Asian water kelp that has extended across wide tracts of European waters and which could diminish the biomass of other indigenous species[307].

Unfortunately, none of these species of kelp, which are the creators of important habitats, are recognised in the European Directive.

Impact on threatened species

[xi] Alginates are the biopolymers present in all brown algae which are used as thickeners for food and pharmaceutical products, for manufacturing surgical bandages or dental resins and as texturisers for fabric printing or paints, amongst other uses.

The impact of trawlers on species such as seabirds, cetaceans, pinnipeds and sea turtles is not particularly high in European waters except in certain specific cases. It is known that other fishing techniques have a greater impact on these animals, such as accidental catches of cetaceans in both fixed[308] and drift nets[309] or seabirds[310] and sea turtles[311] by longliners.

The most worrying effect of trawlers on these species is the interaction and competitiveness they generate with humans for marine resources and the overexploitation of the hunted species. Nevertheless, examples do exist of accidental catches of sea turtles and cetaceans in trawl nets.

Pelagic trawlers cause the greatest direct impact on the populations of marine mammals. Various studies on these fisheries in the North-East Atlantic[312] have confirmed the accidental capture of cetaceans in pelagic trawl nets while fishing for anchovy, sardine, mackerel, tuna, seabass, etc. In the fisheries of the Bay of Biscay and the English Channel, operated by French, Dutch and British boats, the rate of accidental catches of cetaceans was put at 3.8 dolphins per 100 hauls[313].

Recently, another report[314] concluded that in the Celtic Sea the levels of catches of marine mammals –including seals- were higher (4.8 dolphins per 100 hauls). However, it is believed that the true number of by-catches must be much higher, as new pelagic fishing techniques use suction hoses to bring their catches on board without the need to remove the nets from the water, so some discards go unnoticed.

Bottom trawlers can also generate accidental catches of marine mammals, but their impact seems to be lower. There are some studies which detail the catching of dolphins, whales and even killer whales in demersal trawling[315], and a new study carried out in the easternmost part of the Mediterranean (close to the coast of Israel) discovered a high and unprecedented number of dolphin caught by these trawlers[316].

There is very little available information on accidental catches of turtles and seabirds by trawlers operating in European waters. Some data from the North-East Atlantic suggests that the populations of these reptiles are small and thus they do not frequently appear amongst the statistics on accidental catches. In the Mediterranean, on the other hand, catches appear to be common off the African coast of Tunisia (Gulf of Gabes), where it is estimated that numbers could reach some 5,000 specimens caught per year[317]. There are no estimates on seabirds, but studies in other areas (e.g. the Bering Sea[318] and New Zealand[319]) allow us to consider the possibility that this also happens in European waters.

In the last meeting of the Barcelona Convention, a Plan of Action was agreed upon to prevent the threats that endanger the populations of sea turtles, such as pollution, the destruction of their habitat and accidental caches. So far, the Plan has only been ratified by Morocco, Monaco and Spain.

Energy efficiency

A major problem in fisheries, and particularly in trawling, is the high consumption of energy. Bottom trawling is seen as the fishing technique that uses up the most energy. Analyses of the Norwegian fleet demonstrated that trawlers need twice the volume of fuel of other fleets to catch the same amount of fish. In Iceland, the consumption of fuel by the fishing fleet is greater than that of industry or air traffic, and is comparable to that of all the motor vehicles on the island[320].

When comparing the energy consumption of different fleets in the north of Europe, the results are similar[321]:

Table 13: Fuel consumption by fishing boats

Fishing gear	Kg. fuel/Kg fish			
	Denmark	Iceland	Norway	Sweden
Trawlers	1,44	0.6-1,0	0.4-1.0	1.5
Longliners	---	0.2-0.3	0.1-0.4	---
Coastal	0,33	0.1	0.1-0.4	0.41

Some estimates[322] on trawlers in the North-East Atlantic throw up figures close to 0.50 kg of fuel per kilo of fish caught. One of the fisheries that is most dependent on energy consumption is Norwegian lobster, requiring some 0.85 kg of fuel per kilo caught, followed by shrimp trawling, with 0.75 kg per kilo caught, and that of cod, with 0.44 kg per kilo caught. There are other fisheries around the world that also require very high fuel consumption, even several times higher than in European waters, such as crustacean trawling in the United States which reaches levels of 6.21-8.23 kilos of fuel per kilo caught[323].

NEW FISHERIES: THE SEARCH AT GREATER DEPTHS

At the same time as much of the stock in traditional fisheries was declining, some countries decided to invest in developing new fisheries or commercialising species that up to then had often been discarded. During the Eighties, new surveys were carried out to identify exploitable banks in deeper waters. These investigations led to the development of new fisheries focused on deep-sea species. The trawling vessels of today can lay their nets at increasingly greater depths. The scars that these fishing techniques leave on the seabed can now be detected at 1,400 metres below sea level[324].

In the last two decades, deep-sea fishing has developed very quickly: smooth grenadiers, tusks, orange roughy, silver scabbardfish, lings and other species are now frequently targeted by these fleets. By the year 2000, catches had already reached 133,773 tonnes[325].

Many of these species have a slow growth cycle and live to a great age so there are serious doubts as to whether economically viable sustainable exploitation can be maintained[326]. The blue ling and the sand smelt can live for 30 to 35

years; redfish for up to 45; grenadiers for up to 60 and orange roughy or slimeheads for up to 125-150 years[327].

The International Council for the Exploration of the Sea (ICES) has recommended introducing trawling prohibitions in deep-water zones[328] because of the fragility of these communities. Numerous studies have highlighted the particular sensitivity of these ecosystems as well as the serious damage that trawling can inflict on benthic communities[329], with the risk of even causing the extinction of certain species, given that these fisheries are found in the most biodiverse zones with the greatest number of endemic species[330].

Both the ICES[331] and different scientists have condemned the fact that many of these fisheries, which have only been operating for one or two decades, have already overfished or depleted certain stocks. In the case of Rockall (to the north of Scotland), it is estimated that in just five years the mass of these species has been reduced by half[332].

An example of how deep-sea stocks can collapse is the red crab fishery *(Chaceon affinis)*, which began in 1988 on the Galicia Bank (some 200 miles to the west of Galicia). In just five years, catches rose from 0.9 tonnes to 11.5 tonnes in 1994. By 1997 there were no catches and the fishery ceased to exist[333]. In addition, deep sea fisheries are also subject to a high number of accidental catches and it is believed that the impact of this on the ecosystem is much more worrying than in shallower waters.

At Rockall, an experimental survey on trawling in these seamounts, saw that they caught 60 different species in 10 days of fishing at depths ranging between 500 and 1,300, including 15 chondrichtyans, 42 teleosts and 3 cephalopods[334]. Off the West of Ireland, in just a three-hour haul, a trawler working at a depth of between 840 and 1,300 metres caught 14 different commercial species and an unknown number of other species, including corals and sponges[335].

The volume of by-catches in these fisheries can be very high, as only a few of the species caught have any commercial value. On the Galicia Bank, 106 species were caught from 309 trawler hauls[336], and in the French grenadier fisheries 48.5% of catches are discarded[337].

Some of the species most commonly caught accidentally in these fisheries are rabbitfish (*Chimaera monstrosa*), piper gurnard (*Helicolenus dactylopterus*), roughhead grenadier (*Macrourus berglax*), common mora (*Mora moro*), cardinal fish (*Epigonus telescopus*), wreckfish (*Polyprion americanus*), goldeneye perch (*Beryx splendens*), alfonsino (*Beryx decadactylus*), red crab (*Chaceon affinis*), forkbeard *(Phycis phycis),* blackmouthed dogfish (*Galeus melastomus*), kitefin shark (*Dalatias licha*), gulper shark (*Centrophorus squamosus*) and Portuguese shark (*Centroscymnus coelolepis*)[338]. In the case of deep sea sharks, which are occasionally caught as a target fish, but on many more occasions as a by-catch, it is believed that their populations in the North-East Atlantic have been diminishing faster than those of other species[339].

Although the size of trawlers in the Mediterranean is smaller than those of the North Atlantic, and thus they cannot use the same techniques, there are already several fisheries of deep-sea species and others are being developed in the search for new stocks to exploit. Technology is advancing and deep-sea trawling in the Mediterranean is already exceeding depths of 800 metres. In the Ionian Sea[340], the deepest part of the Mediterranean, there are plans to implement a deep-sea fishery for catching hake, blue whiting and piper gurnard. There is also an interest in extending the fisheries of giant red shrimp and red shrimp, where accidental catches of hake, small-scaled scorpionfish, Norway lobster and crustaceans of the *Plesionika* type occur. Other target species of these fisheries are sparidae, wreckfish (although in this case fixed nets are more often used) and various species of deep-sea sharks. The deep sea crustacean fisheries in the Mediterranean are already giving rise to discards of more than 100 different species[341], which on occasions add up to more than 50% of unloaded catches[342].

Some key stocks in deep-sea fisheries[343]

The speed with which deep-sea fisheries have been developed has put many fish populations at serious risk.

Some of the most sought-after species include **orange roughy** *(Hoplostethus atlanticus).* The majority of its populations have been overfished. In sub-area VI the stock has been depleted and it is feared that the same thing will happen elsewhere if fishing is not drastically cut back. Having gone from 8 to 3,800 tonnes in just three years, catches have dropped recently to barely 200 tonnes. There is a fear that sub-area VII will follow a similar trend[344].

The French trawlers are the main fleet operating in sub-areas VI and VII (the latter zone shared with the Irish), while areas Vb and Va are dominated by the Faeroes and Iceland respectively. All of them have significantly increased their catches.

The **roundnose grenadier** (*Coryphaenoides rupestris*) is another of the most sought-after species. In the last 12 years, catches have gone from 11,305 tonnes in 1988 to 24,683 in 2001, which has led to recommendations to reduce the heavy fishing pressure, especially in sub-areas VI and VII and divisions Vb and IIIa. It is estimated that this reduction should be fixed at least 50% in order to give this species the chance to recover.

Despite the fact that it is believed that neither the **greater forkbeard** (*Phycis blennoides*) nor the **great silver said smelt** (*Argentina silus*) can withstand high levels of exploitation, catches of the latter have increased rapidly, particularly in sub-areas II, VI and VII (in addition to it being caught accidentally in the factory fisheries of VI), which has led to the unloading of more than 45,000 tonnes in 2001[345].

The case of the **black scabbard fish** *(Aphanophus carbo)* is similar, and catches have multiplied in just 12 years, going from 2,604 tonnes in 1988 to 8,166 in 2001. There are two active fisheries, to the north and west of the British

Isles, where French trawlers catch this species along with grenadiers and deep-sea sharks, and where the ICES has recommended significant reductions. However, the stock in the Portuguese zone seems to be in a more favourable situation[346].

The **ling** populations, both common ling (*Molva molva*) –which lives in the shallower waters (200-600 metres), where it can be found alongside tusks, megrim and monkfish – and the **blue ling** (*Molva dypterygia*), which is found at a greater depth, are outside safety limits. In the case of the common ling, the ICES has called for a reduction in catches of 30%, particularly relating to trawlers operating in sub-areas Va, VI and VII. As far as the blue ling is concerned, an immediate cessation of fishing has been recommended.

In the case of the **tusk** (*Brosme brosme*), which is usually caught accidentally in other fisheries, its status is not known for certain, although it is feared that the safety limits of this species have also been exceeded and that its biomass has dropped by more than 80%, which is why there has also been a recommendation to reduce its catches by 30%.

A special mention needs to be made of redfish, which, although not regarded as true deep-water species, swims in both shallow pelagic waters and others of very great depth, normally depending on its age[347]. Its behaviour and biological cycle are also similar to other deep-water species. The **oceanic redfish** *(Sebastes mentella)* is caught by Norwegian and Russian trawlers in sub-areas I and II, while in sub-area XIV (which is believed to be a reproducing and spawning ground that also sustains other areas[348]) German freezer trawlers operate, and sub-areas Va and Vb are fished by the Icelanders and the Faeroe Islanders[349].

As all the redfish stocks are either depleted or heavily overfished, the ICES has called for the cessation of the direct fishing of this species in various sub-areas, significant reductions in others, the creation of protection zones and the reduction of by-catches of this species in other fisheries.

It is also possible that the pelagic fishing of this species carried out in the Irminger Sea has also exceeded the species' safety limits. In 2001, catches of this stock reached 117,000 tonnes, from some 70 factory trawlers coming from Iceland (26), Russia (25), Germany (8), Spain (6), the Faeroes (2), Norway (2) and Greenland (1)[350].

The **giant redfish** *(Sebastes marinus)* is also going through a bad time. The stock in sub-area XIV is depleted and in V, VI and XII, where the main fishing fleets are trawlers from Iceland and France, the stock is heavily overfished. For this reason, the ICES has recommended the closure of the first zone and a 30% reduction of the fishing effort in the others, despite the fact that current landings barely reach 28% of what they were 12 years ago[351]. In sub-areas I and II, where Norway is the leading fishing country, the status of the stock is unknown[352].

THE EUROPEAN FLEET IN NON-EUROPEAN WATERS

Large deep-sea fleets from the European Union operate in the waters of third countries and on the high seas. These vessels can be found on every ocean in the world, catching all kinds of fishery resources including tuna, crustaceans, cod, hake, squid, mackerel, sardines, etc.

The main areas in which the European fishing fleets operate are the North Atlantic, Central Eastern Atlantic, South Atlantic, Indian Ocean, the Antarctic and, more recently, the Pacific islands.

Table 14: Catches by European outside Europe

EUROPEAN FLEETS' CATCHES IN NON EUROPEAN WATERS OR OWN EEZ[xii]									
	ATLÁNTIC					PACÍFIC			ÍNDIAN
	Central East 34	Northwest 21	Southeast 47	Southwest 41	Central West 31	Northeast 67	Central East 77	Southeast 87	All 51
Denmark	0	359	0	0	0	0	0	0	0
Estonia	4	15,022	0	777	0	0	0	0	0
Faroes	0	9,149	0	0	0	0	0	0	0
France	53,782	0	0	0	0	0	0	0	101,002
Germany	5,178	2,861	0	0	0	0	0	0	0
Greece	5,983	0	0	0	0	0	0	0	0
Iceland	0	6,877	0	0	0	0	0	0	0
Ireland	39,588	0	0	0	0	0	0	0	0
Italy	6,202	0	0	0	0	0	0	0	4,760
Latvia	30,491	2,742	0	0	0	0	0	0	0
Lithuania	0	10,948	0	0	0	0	0	0	0
Netherlands	161,143	0	0	0	0	0	0	0	0
Norway	0	14,536	0	0	0	0	0	0	0
Poland	28,712	428	21,038	2,754	0	0	0	0	0
Portugal	11,484	18,526	1,552	3,853	49	0	0	0	2,177
Russia	121,505	34,686	10,297	8,286	0	109	0	0	123
Spain	123,183	34,092	7,805	39,307	2,535	0	20,503	26,662	177,535
U. Kingdom	0	0	2,149	5,262	0	0	0	0	0
Ukraine	91,334	0	32,015	0	0	0	0	58,773	0
Total	***678,589***	***150,226***	***74,856***	***60,239***	***2,584***	***109***	***20,503***	***85,435***	***285,597***

A recent report[353] commissioned by the European Union concluded that "the agreements are generally signed with no guarantee that they will be implemented in the context of sustainable fishing" and that "under current conditions, fisheries' agreements and the activities related to them are not sustainable"**.**

The first agreement signed by the EU was with the United States in 1977, while the most recent was signed with the Solomon Islands in 2004, and conversations are currently taking place with Tanzania for European boats to fish in its waters. Other countries in which the EU has an interest are Brazil (currently in negotiations with the EU), Colombia, Chile, Djibouti, Ecuador, Kenya, Liberia, the Maldives, Namibia, Nigeria, Peru, Sierra Leone, Somalia, South Africa, Sri Lanka, Tunisia, Uruguay and Venezuela. Today, the EU has 26 agreements in force with foreign governments, 17 of which are with ACP countries (Africa, Caribbean and Pacific).

Some of the agreements that the EU has established with other European countries will soon disappear once these nations join the EU (Estonia, Latvia,

xii Information from 2002. Sources Fishstat, NAFO, ICES, CECAF & FAO databases.

Lithuania and Poland). Others, such as those with the EFTA, the CIS and other non-aligned countries, will depend on future discussions.

These agreements are of vital importance because the consumption of marine resources in the EU is higher than what it can produce from its own waters. At present, 20% of its catches are the result of agreements with other countries, while the global average of catches by domestic fleets in the waters of other countries is 5%[354]. In Spain, which has the second largest distant-water fleet in the world, this amounts 47% of its total marine catches (some 596,000 tonnes per year[355]), and in France 23%. Another country that is heavily dependent on these agreements is Portugal[356].

The European Union exports 1.6 million tonnes of fish a year and imports 4.3 million tonnes (at a cost approaching 4,000 million euros); meaning there is a deficit of 2.7 million tonnes. This is covered by imports from ACP countries (1,400 million), Latin America (1,400 million) and Asia (1,200 million). In other words, 58% of the marine resources consumed in the EU are imported[357].

The EU earmarks huge sums of money to fishing agreements. Between 1993 and 2000, these amounted to 28.5% of the total budget of the Common Fisheries Policy (CFP)[358]. In 2002, the sums allocated for this purpose came to some 190 million euros.

However, to get an overview of the total cost of these fisheries agreements, we would have to add another 20%, which corresponds to the taxes and licences that boat owners have to pay to gain access to quotas.

Table 15: EU DWF in Fisheries agreements

Approx. EU Fleet fishing under agreements 1990-2000		
Area	**Fleet**	**Main Countries**
ACP	200 Shrimp trawlers	Spain, Portugal, Italy & Greece
	100 Cephalopod trawlers	Spain & Italy
	120 Bottom long liners	Spain & Portugal
	60 Small pelagic purse seiners	Spain
	12 Pelagic trawlers	Holland, UK & Ireland
	70 Demersal trawlers	Spain & Greece
	30 Polyvalent	Spain
	80 Tuna purse seiners	Spain & France
	60 long liners	Spain, Portugal & Italy
	80 pole and line	Spain, Italy & Portugal
North Atlantic	1,200 Demersal trawlers	Denmark, UK, Holland, Germany & France
	200 Industrial trawlers	Denmark & Holland
	150 purse seiners	Denmark
	250 gill-netters	Denmark & UK
	100 multipurpose	Sweden & Finland

The European Union trawler fleet is the largest fleet in terms of its number of boats and the second largest in terms of its volume of catches after the

European tuna fleet that operates in the waters of other countries. In total, some 1,800 trawlers.

An assessment of the fisheries agreements made between 1993 and 1997, which was completed in 1999[359], showed that there were 2,800 vessels in the EU either partially or totally dependent on agreements with other countries. In order to ensure that its boats had access to other waters, the EU had to pay 1,053 million euros, receiving in exchange catches of some 2.9 million tonnes of fish (around 590,000 tonnes per year on average). Looking at it from an economic perspective, this represents 2.75 euros per kilo of fish coming from non-Community waters. This means that during this period of time, each European citizen had to pay almost three euros to have access to non-Community fish.

Catches by the EU fleet in ACP country waters come to 240,000 tonnes per year, while those made in other European zones of the North Atlantic come to 300,000 tonnes.

Table 16: Comparison between fisheries agreements with ACP countries

Comparison of EU-ACP FA's in force during 1993-1997 and 2000-2003[360]		
Country/Area	**Agreements 1993-97**	**Agreements 2000-2003**
Angola (1996-1999) (2000-2002)	9 tuna purse seiners 12 tuna longliners 22 shrimp trawler (6,550 GRT/m) Demersal trawler (2,000 GRT/m) Bottom longliners-gillnetter (1,750 GRT/m)	18 tuna purse seiners 25 tuna longliners 22 shrimp trawlers (6,550 GRT/m) Demersal trawlers (3,750 GRT/m) Bottom longliners (1,750 GRT/m) 2 pelagic trawlers
Cape Verde (1994-1997) (2001-2004)	23 tuna purse seiners 17 tuna long liners 3 bottom longliners (630 GRT/m)	37 tuna purse seiners 62 tuna longliners 18 tuna pole and line 4 bottom longliners (630 GRT/m)
Comores (1994-1997) (2001-2004)	37 tuna purse seiners	40 tuna purse seiners 25 tuna longliners
Equatorial Guinea (1994-1997) (2000-2001)	47 tuna purse seiners 2 tuna longliners 4 tuna pole and line	30 tuna purse seiners 30 tuna longliners 8 tuna pole and line
Gabon (2001-2005)		38 tuna purse seiners 26 tuna longliners Shrimp and cephalopod trawlers (1,200 GRT/m)
Gambia (1993-1996)	23 tuna purse seiners 7 tuna pole and line Shrimp trawlers (2,000 GRT) Demersal trawlers (410 GRT/y) Freezer finfish trawlers (750 GRT)	
Guinea Bissau (1995-1997) (2001-2006)	26 tuna purse seiners 16 tuna longliners/pool and line Demersal trawlers (12,800 GRT/m)	40 tuna purse seiners 36 tuna longliners/pole and line Shrimp trawlers (9,600 GRT/y) Cephalopods and finfish (2,800 GRT/y)
Guinea Conakry (1996-1997) (200-2001)	28 tuna purse seiners 7 tuna longliners 7 tuna pole and line Demersal trawler (5,000 GRT/m)	38 tuna purse seiners 16 tuna longliners 14 tuna pole and line Shrimp trawlers (1,500 GRT/m) Cephalopods and finfish (2,500 GRT/y)
Ivory Coast (1994-1997) (2000-2003)	47 tuna purse seiners 2 tuna longliners 4 tuna pole and line	39 tuna purse seiners 20 tuna longliners 12 tuna pole and line Demersal trawlers (600 GRT)
Madagascar (1995-1998) (2001-2004)	42 tuna purse seiners 16 tuna longliner/pole and line	40 tuna purse seiners 40 tuna longliners
Mauritania (1996-2001)	40 tuna purse seiners 17 tuna longliners/pole and line	36 tuna purse seiners 31 tuna longliners/pole and line

(2001-2006)	Shrimp trawlers (5,500 GRT) Hake trawlers/longliner (8,500 GRT) Non hake (9,700 GRT) Cephalopods trawlers (15,000 GRT) Crawfish (300 GRT) 22 pelagic trawler	Shrimp trawlers (6,200 GRT/y) Demersal trawlers/longliners/gillnetters (16,800 GRT/y) 55 cephalopods trawlers (16,500 GRT/y) 15 pelagic trawlers
Mauritius (1993-1996) (1999-2002)	6,000 tonnes of tuna	43 tuna purse seiners 40 tuna longliners pole and line (25 GRT/m)
Morocco (1996-1999)	37 tuna purse seiners (6,100 GRT) 27 tuna pole and line 630 surface and bottom longliners Shrimp trawlers (38,400 GRT) Hake trawlers (3,000 GRT) small pelagics (1,200 GRT) Cephalopods trawlers (100,596 GRT)	
Mozambique (1992-1993) (2003-2006)	42 tuna purse seiners	35 tuna purse seiner 14 tuna longliners 10 shrimp trawlers
Sao Tome and Principe (1996-1999) (1999-2002)	9,000 tons of tuna	36 tuna purse seiners 33 tuna longliners 7 tuna pole and line
Senegal (1993-1996) (1997-2001)	47 tuna purse seiners 6 tuna longliners 11 tuna pole and line Trawlers (7,000 GRT)	41 tuna purse seiners 23 tuna longliners 12 tuna pole and line 3 Coastal demersal trawlers (481 GRT) 11 Oceanic demersal trawlers (3,750 GRT) 22 pelagic trawlers (6 at once) 7 Coastal freezer trawlers (1,800 GRT) 29 Ocean freezer trawlers (4,119 GRT)
Seychelles (1996-1999) (2002-2005)	42 tuna purse seiners 15 tuna longliners	40 tuna purse seiners 27 tuna longliners
Kiribati (2003-2004)		6 tuna purse seiners 12 tuna longliners
Salomon Islands (2005-2007)		4 tuna purse seiners 10 tuna long liners

As we can see in Table 16, trawlers feature in 9 of the 17 fisheries agreements currently in force with ACP countries, as well as in all of the agreements with countries in the North Atlantic zone.

Before the agreement with Morocco expired in 1999 due to the failure to reach an agreement between the EU and the African country (Europe was offering 170 million euros for a three-year period while Morocco was demanding 270 million), this country was the main source of catches for the EU fleet in ACP country waters, producing some 180,000-200,000 tonnes per year. Since then, Mauritania has held this position, but the main agreement, in terms of volume of catches, continues to be the agreement with Norway, in whose waters the EU fishing fleets catch some 200,000-240,000 tonnes per year.

Fishing on the high seas

Apart from agreements with third countries, there are European fleets operating in international waters, such as the boats fishing in the Antarctic or the waters of the North-East Atlantic. In some cases these fleets, despite being backed by European capital, do not sail under the flags of their country of origin but use flags of convenience or operate as joint venture companies, which allows them to fly the flag of other countries.

In the NAFO area, there are still some 130 European vessels from operating from 10 different nations[361] (some of which are not EU members but are

authorised to work in Canadian and US waters). Spain and Russia are the countries with the largest fleets, apart from Greenland, which has an EEZ in the North-East Atlantic.

Both Spain and Russia have some 30 freezer trawlers each in the NAFO area (including two Spanish pair trawlers) catching halibut, shrimp, ray and redfish. These boats work at depths of between 200 and 600 metres[362] and their main accidental catches are American flounder, yellowtail flounder, grenadiers and rays.

Table 17: TACs for European fleets in the NAFO area

TAC's (tonnes) in NAFO area for European Fleets in 2003[363]									
Country	**Cod**	**Redfish**	**American plaice**	**Yellowtail**	**Witch**	**Capelin**	**Greenland halibut**	**Squid**	**Shrimp**
Denmark [xiii]	0	69	0	0	0	0	0	0	144
EU	0	3,100	0	290	0	0	17,226	Ns	144
France[xiv]	0	69	0	0	0	0	0	453	144
Iceland	0	0	0	0	0	0	0	0	144
Norway	0	0	0	0	0	0	0	0	144
Poland	0	0	0	0	0	0	0	227	144
Estonia Latvia Lithuania Russia	0	13,850	0	0	0	0	0	1.133	144
Ukraine	0	0	0	0	0	0	0	0	144
Total	***0***	***17,088***	***0***	***290***	***0***	***0***	***17,226***	***1,813***	***1,152***

The EU fleet fishing in Argentine waters is a case apart. It consists of 29 vessels that "technically" are not part of the European fleet, as they fly under the flag of the South American country, although they are part of the "second-generation EU agreements", and it is the EU that has to pay Argentina for the right for them to fish in its waters.

The Antarctic

European fleets also have interests in the Antarctic, where longliners and trawlers specialise in catching krill, deep-water cod, Antarctic icefish, rock cod, grenadiers and squid, amongst others.

Some of them are members of the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), such as the Ukraine, Norway, Poland, Russia and the EU as a whole, as well as some of its member states as individuals (Spain, Sweden, Belgium, the United Kingdom, France, Germany and Italy), while others have applied for membership: Bulgaria, Greece, Holland and Finland.

Table 18: European catches in the Antarctic

[xiii] Faroes and Greenland
[xiv] St. Pierre et Miquelon

Catches (tonnes) in CCAMLR area by European fleets (season 2001-2002)[364]						
Species	**France**	**Poland**	**Russia**	**Spain**	**UK**	**Ukraine**
Antarctic krill (Euphasia superba)		16,365				32,015
Argentine shortfin squid (Illex argentinus)		49				
Bigeye grenadiers (Macrourus spp.)	372					
Blackfin icefish (Chaenocephalus aceratus)					4	
Humped rockcod (Notothenia gibberifrons)					1	
Mackerel icefish (champsocephalus gunnari)		296	1,373		396	
Marbled rockcod (Notothenia rossi)					5	
Patagonian toothfish (Dissostichus eleginoides)	3,569		313	832	1,728	
Rockcods (Nototheniidae)					10	
Roundnose grenadier (Coryphaenoides rupestris)		9				
Skates and Rays (Rajiformes)	342					
South Georgia icefish (Pseudochaenichthys georgianus)					5	
Unidentified bony fish (Osteichthyes)		1				
Total	4,283	16,720	1,686	832	2,149	32,015

The main fishery in these waters in terms of volume of catch is krill, which is carried out by big freezer trawlers, reaching 4 million tonnes of fish a year and amounting to 99% of quotas, although one of the most lucrative catches is deep-water cod. Both trawlers and longliners specialise in fishing the latter, but catches have decreased significantly due to overfishing and the encroachment of numerous pirate fleets, many of which are funded by European capital.

Joint ventures

For more than 30 years, European companies have been signing agreements with other countries to be able to send their vessels to fish in other waters by means of joint venture enterprises. These agreements give a false impression of fleet reduction, as the boats simply cease to appear in the European fishing registers and go on to join the ranks of the host countries. In other words, it is simply a change of flags.

Between 1992 and 2000, European Union companies constituted 152 joint ventures for exporting 241 vessels, with a GRT of 88,319 tonnes, thanks to the contribution of 281 million euros in subsidies. Half of them were Spanish firms and the rest were made up of Portuguese, Italian, Greek, French and Danish companies. These vessels are currently operating in the waters of some 28 different countries: 77% in Africa, 22% in Central and South America and 1% in Europe[365].

However, despite the fact that subsidies for exporting the fleet were proffered as measures to reduce the fishing pressure and overcapacity in European waters, only 34 of the 241 boats exported by means of joint ventures were actually fishing in European waters. The majority of these were small boats with a lower horsepower (on average with 163.5 GRT), while the remaining 207 exported vessels had up to 400 GRT and were not working in European waters.

Table 19: Joint ventures with participation from EU companies

European boats under joint ventures						
Country	**Denmark**	**France**	**Greece**	**Italy**	**Portugal**	**Spain**
Albania				2		
Algeria						3
Angola				2	15	19
Argentina	1					30
Cameroon			3		1	5
Cape Verde					4	
Falklands[xv]					3	10
Gabon					2	7
G. Bissau					5	1
G. Conakry		5	1			1
Ivory Coast						1
Kenya				3		
Madagascar			1			
Mauritania					7	2
Mexico						2
Morocco					3	11
Mozambique						11
Namibia	4					8
Peru		3				
Sao Tomé					1	
Senegal			7	17	1	16
Sierra Leone			3			
South Africa						2
Tanzania			3			
Togo			2	2		4
Tunisia				2		
Uruguay						2
Venezuela						3
Total	**5**	**8**	**20**	**28**	**42**	**138**

The export of vessels has dramatically increased the fishing capacity in some of the host countries. This is particularly worrying in certain areas of Africa, such as Kenya, which has experienced an increase of 110% in the GRT of its fleet, in Guinea Conakry, with an increase of 96%, and in Angola, with an increase of 85%[366].

This big fleet of exported vessels is mainly made up of trawlers. Specifically, 204 are bottom trawlers (80% of which are factory ships) and the rest are made up of longliners, seiners and multi-purpose trawlers. Their catches reach 150,000 tonnes per year, the main target species being hake (50%) other demersal fish (16%), cephalopods (14%), pelagic fish (9%), crustaceans (8%)

[xv] Falklands Islands, despite being British, has different fisheries legislation, as it happen to Greenland and Faroes respect to Denmark.

and others (2%). Despite their dispersal, 75% of catches are made in the vicinity of Argentina and the Falkland Islands.

Nor should we ignore the fact that more than 100 of these vessels are operating in the waters of countries with which the EU has agreements, which represents heavy competition for the boats flying under European flags and seeking the same resources.

Today, there are more than 20 similar projects in place to achieve European Union funding and subsidies with the aim of creating new joint ventures.

This was an habitual practice in certain European countries before forming part of the EU. Between 1977 and 1990, in view of the cuts that the EU was calling for in order for countries to become a member, Spain fostered the creation of 132 joint ventures which served to export 245 boats with a capacity of 124,018 GRT[367].

The new agreement with Argentina, signed in 1998, has meant that this kind of export of overcapacity now has an official EU tag and has revived this form of "reducing" the fleet in Europe by increasing it in other parts of the world. Spain is the country that most benefits from the agreement with Argentina, but new countries have also managed to share in these benefits. Of the 29 exported vessels, 24 are Spanish, 2 are British, 2 are German and 1 is Italian[368].

However, if it is difficult to find out about the activities of these boats, and even more complicated in the case of "leasing" or experimental fishing agreements, such as those signed by European companies with the Government of India[369]. Nor should we forget the European companies who have their own private agreements with governments without the intervention of the European Commission. Since this involves boats that do not sail under European flags, the fleets are very difficult to track, as responsibility for their control lies with the Government with which the vessel is registered.

Situation for fishing grounds in key countries in European fisheries agreements

The situation of much of the stock in the fisheries in which EU deep-sea fleets operate is unknown due to the lack of reliable and historical information. Despite this, the information that is available on these fishing grounds gives cause for concern.

Various FAO reports[370] show that 82% of all the commercial species in the Central Eastern Atlantic (CEA) –an area that includes Mauritania and Senegal, two of the main destinations for European vessels- are either depleted, overfished, at their maximum possible output or undergoing recovery. This makes this zone the second worst in the world in terms of overfishing. The percentages are even more worrying in the case of demersal and pelagic species and crustaceans and molluscs, estimated at 90%.

Two new reports analysing the evolution of fishing in the CEA in the last 50 years indicate a dramatic change in the status of stocks during this time. According to their content, this area has gone from "a situation where 90% of resources were classified as underexploited to one where 68% are totally exploited or in decline[371]". Studies have also discovered that the biomass of fish (excluding small pelagic species) has dropped to less than a fourth of what it used to be 50 years ago, while catches have multiplied 20-fold in the last two decades[372].

A large proportion of the Mauritanian industrial fleet, made up of 120 vessels (most of which are trawlers), is actually maintained by charters from European countries such as Spain, Greece, Russia or the Ukraine[373]. Other European countries involved in fishing in this country are Norway, Latvia, Lithuania and Estonia, as well as around fifteen boats under flags of convenience (Belize, Panama, Cyprus or St. Vincent) backed by various sources of capital[374].

Together with catches of small pelagic fish, which represent 86% of the total volume[375] (mackerel, anchovy, sardine, sardinella and horse mackerel), other common species in European fishing in Mauritanian waters are hake, octopus, silver scabbardfish, squid, shrimp, lobster and monkfish. The FAO[376] has repeatedly asked for a reduction in fishing pressure on the regular trawling stocks such as shrimp, hake, small pelagic fish, cephalopods and coastal demersal species, as well as greater cooperation from the EU towards improving management and information from European vessels.

A little further south, in Namibia, some species have been showing a clear decline since the Seventies. This is the case of the rock lobster, due to a combination of factors that include overfishing and environmental changes in its habitat[377].

In Senegalese waters, the evolution of the red pandora *(Pagellus bellottii)* has been followed with particular interest. The level of catches of this stock, which makes up 14% of total landings, is of great concern as it is being overexploited. The yield numbers of red pandora have fallen dramatically in less than ten years, going from 25,000 tonnes in 1990 to some 10,000 tonnes in 1998; while the status of the reproductive biomass is estimated at only 4.1% of the virgin biomass[378].

Other Senegalese stocks, such as white grouper (*Epinephelus aeneus*)[379], have also been dramatically depleted. In Guinea Conakry, these two species (red pandora and white grouper) are both overexploited, although it is believed the situation is not as bad as in Senegal. Meanwhile, in Cape Verde, the Cape Verde lobster (*Palinurus charlestoni*) and the 'garoupa' (*Cephalopholis taeniops*) are reaching, if they have not already reached, the status of overexploitation[380].

The decline in the biomass of demersal species in Sierra Leone over recent years has been linked to the significant presence of foreign boats (mainly from the countries of the former USSR and Spain), which has caused fluctuations in the trophic structure[381].

In general, it is believed that the biomass of demersal species off the coasts of North Africa has diminished by 75% since the Fifties[382].

Super-trawlers

For decades, the biggest fleets involved in catching small pelagic fish in the waters off West Africa were the countries of the former USSR and Eastern Europe. Due to the economic and political collapse of these governments, some African countries, such as Mauritania, sought out new countries wishing to exploit their bountiful waters. The European Union took advantage of this opportunity and introduced to the CECAF a group of super-trawlers under the flags of Holland, Germany, the United Kingdom, France and the United States, although the vast majority belonged to Dutch companies.

A little later, more super-trawlers joined this fleet, including the Irish vessel "Atlantic Dawn", the largest fishing boat in the world, capable of combining pelagic trawling with seining.

In 1998, this fleet was already catching some 180,000 tonnes, mainly sardinella, but also mackerel, sardines, hardtail and Atlantic bonito.

There are very few studies on the limited information available on these vessels due in part to the fact that it is almost impossible to put any kind of EU/Mauritania inspection programme into practice. Mauritanian inspectors have little experience and in any case the majority of catches by the super-trawlers are unloaded in the Canary Islands port of Las Palmas de Gran Canaria.

A study carried out on board one of these boats estimated that discarded fish amounted to 4.7% of the total weight caught, including various species with no commercial value. The target species were various types of small pelagic fish such as sardinella, sardine, horse mackerel, etc. However, another investigation confirmed that 34 of the 60 species identified as part of the catches of this boat were discarded[383].

A supervisory programme, carried out in coordination with an on-board observers' programme on the accidental catching of dolphins and other large marine mammals, has started produce preliminary data. What emerges from this data, is that the marine macrofauna most commonly caught by accident, consists of common dolphins (*Delphinus delphis*), moon fish (*Mola mola*), hammerhead sharks *(Sphyrna spp.)*, other non-identified sharks and marlins (*Tetrapterus spp.)*.

Accidental and discarded catches

Estimates on discarded catches in African waters are based on various partial studies on the deep-sea fleets operating in these waters. Information from the

FAO on the discards of trawlers in this zone range from 1.48 kg per kilo of fish unloaded to 2.72 kg in the case of the shrimp fisheries in the ACO area[384]. Another study, which focused specifically on Senegal, showed extremely disturbing figures, as discarded catches from shrimp trawlers were ranging from 1.5 kg to 9.0 kg per kilo unloaded[385].

The FAO has also shown its concern for the high number of by-catches in cephalopods fisheries during pelagic trawling for horse mackerel and other small pelagic species, as well as in fixed nets and longlining for pandora, shark or tuna[386].

Generally speaking, it is believed that the stocks off West Africa fished by trawlers are decreasing because of the fishing pressure[387].

In Senegal, some 11,000 tonnes of fish are discarded annually by EU trawlers, which has been valued at a loss of 5.6 million ecus[388]. In Mauritania, estimates give even higher figures, reaching some 24,000 tonnes of discarded catches from shrimp and hake trawlers alone, at a cost approaching 21.3 million dollars[389].

Studies on Spanish cephalopod trawlers in Morocco show that there are very high levels of accidental catches. During the Seventies, these were reaching 66% of catches, a percentage that during the Eighties fell to 44%[390]. Other estimates on shrimp trawlers off Senegal and Guinea show figures for discarded catches of around 38.5% in the Eighties. In the case of cephalopod trawlers, these percentages could increase to up to 72% and in Senegal up to 75%[391].

Illegal fishing and competition from local fishermen

Air surveillance carried out by Megapesca[392] off West Africa found various foreign boats involved in illegal activities in these waters. Unfortunately, this kind of activity tends to go undetected and unpunished. Half the boats detected were working illegally; almost 95% of the infractions related to their penetration of the Exclusion Zone which different African governments have established to protect their artisanal fisheries and prevent overfishing and vessel collisions. Half the vessels working illegally had no visible name or registration number.

In 2001, a regional survey of the Madagascar Exclusive Economic Zone concluded that illegal, uncontrolled fishing was much higher than what had previously been thought. Total catches were estimated as being 31% higher than those declared, and 50% of the reports that were supposed to be provided by boats working in the zone were submitted late.

Illegal fishing does not only affect ecosystems. Dozens of fishermen have died, been injured or lost their fishing gear when industrial trawlers have entered fishing zones reserved for artisanal fishermen and have ransacked the zone or collided with their fragile canoes. In Senegal, 50 fishermen died in this kind of collision in just two years. In 2000, almost 450 illegal incursions were recorded in the area of Bongolón in Guinea Conakry, causing the deaths of 12 fishermen

and considerable economic losses[393]. The Mauritanian fishermen have also been the victims of collisions with foreign ocean-going vessels. It has been proved that these confrontations tend to occur more often with charter boats. These boats have also been reported for robbing octopus caught in the nets of artisanal fishermen, as the catches are of better quality than those caught by the trawlers and thus achieve higher prices on the market.

In Angola, there have also been reports denouncing the involvement of the European fleet in violating the 12-mile restriction zone (reserved for artisanal fishing) and confrontations with local fishermen[394].

In response to the continuous reports condemning the actions of European vessels and authorities, the most recent fishing agreements signed by the EU have increased the funds earmarked to support local industries and fishermen and improve surveillance, training, port facilities and other activities relating to fishing. In spite of this, the percentage allotted for this purpose continues to be very disparate, ranging between 2% and 60%[395]. While the European Union has reiterated time and again its commitment to supporting and developing local fisheries, the fact is that only 1% of the total compensation fund is allocated to this activity and only 9 of the 17 agreements in force with ACP countries in 2000 even mentioned small-scale fisheries. Only in a few of these agreements does the volume of financing directed at artisanal fishing reach significant levels. This is the case of the agreements with Equatorial Guinea, the Comoros Islands and the Seychelles, where between 18% and 36% of the total compensation is geared towards these ends[396].

OCEANA'S PROPOSALS

For a reduction in the fishing effort and protection of fishing stocks:

- A plan to progressively eliminate bottom trawling in the European Union's fleet to achieve a reduction of at least 40% in the fishing effort by 2007.
- Prohibiting the use of "rockhopper" gear and similar fishing tackle which allow bottom trawling in rocky zones or coral reefs, and passing a law that prevents the spread of bottom trawling to new zones.
- Creation of zones that are closed off to fishing or particular fishing techniques, either temporarily or permanently, with the aim of protecting stocks and the concentration of young fish, as well as spawning, breeding, feeding and growth areas.
- Increase in minimum sizes for marine species, taking as a point of reference scientific knowledge on the earliest age of maturity, preventing the commercialisation of specimens from any kind of species that are under the minimum size required, so that at least 50% of specimens can reproduce.
- Plans to recuperate all stocks with the aim of ensuring, in a worst-case scenario, that the biomass reaches at least 50% of its original size by 2010.
- Implementation of a special management plan for deep-sea species that includes the prohibition of bottom trawling recommended by the ICES, the reduction in catches by longliners and other fishing techniques and

the establishment of a management system that takes into account the biological peculiarities of these species and their relationship with the ecosystem.

- Replacement of pelagic trawling in places where there are already alternative fishing techniques in place that entail lower impact and wastage, as well as its restriction to areas where it has been scientifically proven that its use is ecologically and socially respectful, as well as viable, and where it is not possible to use alternative methods with less impact on stocks, traditional fisheries or accidental catches.
- Making any increase in fishing effort or the opening of new fisheries conditional upon the availability of scientific data that proves, from a precautionary standpoint, that their development is ecologically and socially viable.
- Counting accidental catches and discards as part of TACs and undertaking studies that enable an estimation to be made of creatures damaged after escaping from nets so they can also be included in the TAC.

For an increase in selectivity and on-board observers:

- A shift in the subsidies granted to bottom trawling and fuel consumption towards developing less damaging fishing techniques as well as towards research dedicated to increasing selectivity and minimising accidental catches.
- Passing of a law that envisages the closure of fisheries in certain areas or for certain periods of time when the high level of accidental catches or protected species makes it necessary.
- Creation of a programme to reduce the number of multi-species fisheries to only those where the characteristics of the species make it technically impossible otherwise, so long as measures are adopted to reduce accidental catches and discards to a minimum. The EU should not be committing to opening up new markets to accidental catches.
- Creation of a European coastguard service that works both in North Atlantic waters and in collaboration with the countries with which fishing agreements have been established.
- Increase in investment in and coverage of on-board observers to encompass 100% of the fishing boats working on the high seas or in third-country waters, as well as on-board observation programmes that allow sufficiently representative and reliable data to be obtained on the coastal fisheries where it is known or suspected that high levels of accidental catches and discards occur, such as by pelagic trawling and bottom trawling.
- A programme to eliminate accidental catches and discards to ensure that these do not exceed one million tonnes from European vessels by 2007.

For fishing agreements:

- Elimination of bottom trawling as a fishing technique for European vessels in new fishing agreements signed with third countries.

- Termination of fishing agreements that do not fulfil the requirements laid down by the FAO Code of Conduct and the United Nations Law of the Sea, as well as those in which the agreed methods of conservation are based on lower standards than those in place in the country of origin.
- Elimination of subsidies aimed at exporting overcapacity by means of creating joint ventures.
- Passing of laws that allow any member country of the EU to prosecute any European company or individual involved in illegal, uncontrolled or unregulated fishing (IUU fisheries) and the withdrawal of economic aid or any other kind of material or tax benefit.

For the protection of benthos and areas of special interest

- Legal protection for the benthonic ecosystems of greatest ecological value, including deep-sea corals and sponges, maërl beds and coralligenous formations, kelp forests, marine seagrass meadows, polychaete communities, vermetid reefs, and other biogenic reefs.
- Prohibition of trawling over these sea beds by 2005.
- Creation of at least 100 new protected marine areas by 2007, to include coastal and deep sea ecosystems.
- A moratorium on bottom trawling over seamounts, carbonate mounds, submarine canyons and hydrothermal terms both in European EEZ and on the high seas and in the waters of third countries.
- Inclusion on the lists of EU protected species and habitats of all the species that create coral reefs and habitats of marine interest (maërl, coralligenous formations, kelp forests, coral reefs, sponges, seagrass, etc.).
- Basing the Common Fisheries Policy on fishing systems and techniques that take into consideration environmental, social, economic and cultural benefits.
- Creation of a "Zone of Special Fishing Interest" chart to include key spawning, breeding and feeding areas for species of commercial interest, with a specific management system that regulates which activities can be carried out in them and when these may be carried out.

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