DEEPFISHMAN
Management And Monitoring Of Deep-sea Fisheries And Stocks

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1 Introduction

The Deepfishman project includes five types of case studies which have been selected to illustrate the diversity of deep-water fisheries. The first category addresses directed single species fisheries and focuses on two highly vulnerable orange roughy fisheries; the orange roughy in Namibian waters and the orange roughy in ICES areas VI & VII, as well as the less vulnerable blue ling fishery in ICES areas Vb, VI & VII. The second category looks at a mixed demersal fishery, i.e. the French trawl fishery for roundnose grenadier, black scabbardfish and deep-water sharks in ICES areas Vb, VI & VII. The thrid category deals with three artisanal fisheries: The red (blackspot) seabream fishery in the Gibraltar Strait; the red (blackspot) seabream fishery in the eastern Mediterranean, both of which are vulnerable; and the Portuguese fishery for black scabbardfish in ICES subarea IX which is less vulnerable. Two case studies were chosen because of especially rich data, the northeast Atlantic redfish fishery and the Greenland halibut fishery in the NAFO area. The redfish fishery was later split into two sub-cases, the pelagic beaked redfish in the Irminger Sea and adjacent waters (ICES areas V, XII & XIV and NAFO Areas 1 & 2), and the beaked redfish in ICES Subareas I & II.

In this report we first discuss how these stocks have been managed, and then analyse the socio-economic impact of the fisheries. All nine case studies are analysed in this report, not just a selection as specified in the DEEPFISHMAN DOW.

2 Management

2.1 Orange roughy in Namibian waters

The first orange roughy aggregation of Namibia was discovered in 1995 at Hotspot, the second ground, Rix, was discovered later that year, followed shortly by the discovery of the thrid, Johnies. In early 1996, the last ground, Frankies, was discovered. By 1997 three companies had been awarded quotas allowing them to fish in the four Quota Management Areas (QMA's). A total of five demersal trawlers belonging to the three companies were licensed to fish orange roughy in 1997 (Boyer et al., 2001). By 2007 the number of vessels had dropped to only one and total catches declined from around 18,500 tonnes in the fishing year 1996/1997 to only 270 tonnes in the year 2006/2007. A joint decision was made by management officials and the fishing industry to put a three year moratorium on the orange roughy fisheries (2008-2010).

The management system of the Namibian fisheries involves setting an annual total allowable catch (TAC) for each QMA and then allocating individual non-transferable vessel quotas. The TACs are based on survey biomass results and catch per unit effort (CPUE). Entry to the industry is contingent on obtaining a fishing right from the Ministry of Fisheries. The Ministry calls for applications which are then screened according to certain criteria. Effort and capacity limitations have also been used to manage the orange roughy fishery, as well as temporal closures. Rotational closures of grounds have also been attempted. Thus, Frankies was closed for a few years and only opened once fish had re-aggregated on that ground. Once Frankies was opened, Rix was closed.

2.2 Deep-water fisheries in the NE-Atlantic

Until 2003, most fisheries in the NE-Atlantic were unregulated, despite concerns regarding declining deep-water stocks (ICES, 1994; 1996). These concerns coupled with pressure from Non-Governmental Organisations (NGOs) resulted in 2002 in the introduction of specific European Union measures for deep-water fisheries management (The European Commission Council Regulation No 2347/2002 introduced the following measures:

- Deep-sea fishing permits: Required for vessels catching more than 10 tonnes year calendar year of deep-water species. Permits were only issued to vessels that were able to demonstrate catches of deep-water species of more than 10 tonnes in any of the years 1998-2000. Vessels not holding such permits were not allowed to catch more than 100 kg of deep-water species in each trip.
- Effort restrictions: Permits could only be issued to vessels that demonstrated that the aggregate power and/or volume of the vessels had not changed since the years 1998-2000.
- Reporting of fishing gear characteristics and fishing operations in log book.
- Vessel monitoring system.
- Designated ports: Vessels were prohibited to land any quantity of any mixture of deep-water species in excess of 100 kg at any place other than ports that had been designated for landing deep-water species.
- On-board observers.

In January 2003, the EU introduced biennial TACs for deepwater species, which together with the effort system intrdouced by Council Regulation no 2347/2002 formed the cornerstone of the deep-water fishery management policy of the EU. In addition, temporal and spatial closuers and technical measures, e.g. mesh size, have been used to manage the various fisheries.

2.2.1 Orange roughy fishery

The orange roughy fishery in ICES areas VI & VII started in the early 1990s, with French vessels dominating the fishery at first. Ireland entered the fishery a decade later (Foley et al., 2010).

Fishing for orange roughy in the northeast Atlantic is managed by Iceland, Norway, the Faroe Islands and Greenland, the European Commission (EC) and the North-East Atlantic Fisheries Commission (NEAFC).

At first the fishery was not subject to any restrictions, but in 2002 the EC isssued Council Regulation No 2347/2002 which introduced a total allowable catch (TAC), as well as the other measured discussed aobve. Since 2003, the fishery has been managed by a combination of TAC, licensing and spatial closures. The quotas were exclusively for by-catches but since 2010 the TAC for EC vessels has been set at zero.

2.2.2 Blue ling fishery

Fishing effort was regulated from 1995 (Council regulation (EC) No 2027/95), and in 2003 the EC licensing system was introduced and a TAC set for the fishery. (Lorance et al., 2010).

Since then the fishery has been managed by TAC, licensing, capacity limits, effort restrictions, spatial and temporal closures and technical measures (mesh size) at national level. The fishing companies themselves have also set some rules for their vessels in order to comply with annual quotas. Thus, while landings by EU vessels have been limited to 25 tonnes per fishing trip (Council regulation (EC) No 2015/2006), one of the harvesting companies reduced their landings to 20 tonnes in 2006 and 2007, and even further to 15 tonnes in 2008 to avoid quota overrun (Lorance et al. 2010).

2.2.3 Roundnose granadier, black scabbardfish and deep-water sharks

The French fleet fishing in ICES areas Vb, VI & VII has primarily targeted two species, roundnose grenadier and black scabbardfish, but also deep-water sharks. The fisheries have been managed by TACs, licensing, effort and capacity limitation, spatial closures and technical measures. For roundnose grenadier and black scabbardfish, ICES recommends that catches should be constrained to 50% of the level before the respective expansions of the fisheries. The fisheries should be allowed to expand unless it can be demonstrated that they are sustainable. There is no managment objectve for roundnose grenadier and black scabbardfish.

No assessment has been performed for deepwater sharks in recent years. In 2006, ICES advised that no target fisheries should be permitted, unless there were reliable estimates of current exploitation rates and stock producitivity. Accordingly TAC should bet set to zero. Further, additional measures should be taken to prevent by catch of poruguese dogfish and leafscale gulper shark in other fisheries. In 2008, ICES considered these two shark species to be depleted, despite the fact that the rates of exploitation and stock sizes could not be quantified.

Table 2-1 ICES advice for the year 2011.
Source: ICES advice (http://ices.dk/advice/icesadvice.asp).

	Vb	VI	VII
Black scabbardfish	2,500 t TAC for areas V, VI, VII and XII		
Blue ling	No direct fishery. Limit bycatch. Reduction in catches		
Deep-water sharks (Portuguese dogfish and Lefascale gulper shark)	Zero catch		
Greater forkbeard	Fishery should not be allowed to expand and a reduction in catches considered		
Orange roughy	No directed fisheries and measures to minimize bycatch		
Roundnose grenadier	Catches less than 6,000 t and a further reduction should be considered		

2.3 Artisianal fisheries

2.3.1 Red (black-spot) seabream in the Gibraltar Strait

The red (black-spot) seabream fishery in the Strait of Gibraltar was managed as a regulated open-access fishery from its initial exploitation in 1983 until 1998. Since 1999, a local fishing plan came into operation which only allowed vessels to use *voracera*, a mechanised hook line. Consequently, a provisional list of authorised vessels was established. The recovery plan set a maximum of 160 fishing days per boat, a maximum of five fishing days per week, and a ban on fishing during the months of February and March. However, the days-at-sea cap was not binding. Thus, a study by Espino, del Hoyo & Sharp (2005), reveals that no vessel in their sample made more than 103 trips per year during the years of the first recovery plan (1999-2001). Landings for sale were only allowed in the ports of Algeciras and Tarifa. A new recovery plan was implemented by the Regional Government of Andalucía for the years 2003-2008. This plan includes such technical measures as closure of the fishing season during two and half months (15th January–31st March), minimum size of fish retained or landed (33 cm total length), authorised vessels list, hook size, maximum hooks per line (100), maximum number of lines per boat (30), and maximum number of automatic machines for hauling per boat (3). As before catches may only be landed in Algeciras and Tarifa. These kinds of measures are still currently in force in the 2010-2011 fishing plan.

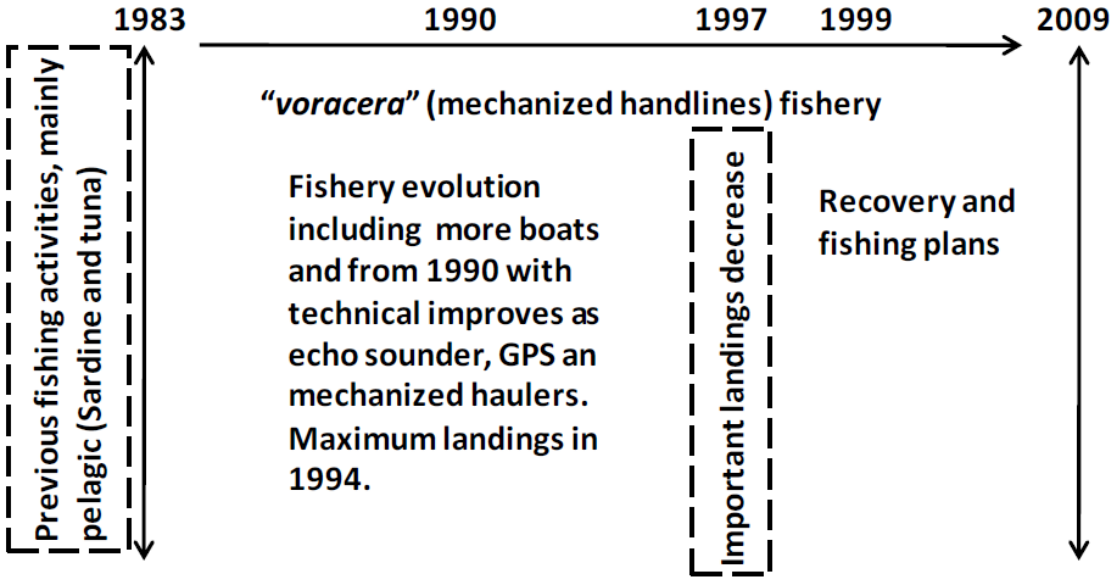

Figure 2-1 Management of the red seabream *voracera* fishery. Source: Deepfishman Case Study 3 A Report (2010).

ICES recommends that catches in Subareas IX and X should be contrained to recent average catches (2003-2007) of 500 tonnes in Subarea IX and 1,050 tonnes in Subarea X, and that information should be collected for evaluation of long-term sustainable level of exploitation. These recommendations have though not been completely followed, as the EU has set a higher total allowable catch (TAC). Landings in ICES Subarea IX have in recent years been far smaller than TAC, but in 2009 the difference between the two was smaller.

2.3.2 Red (black-spot) seabream in the eastern Mediterranean

Entry into the red seabream fishery in the eatern Mediterranean (Ionic Sea) is controlled by licenses, but the fishery is otherwise not regulated. No new licenses are now issued, irrepspective of vessel type, and new boats can only enter the fishery through replacement of older vessel. The old boat must then be decommissioned and destoyed or exported. There is no TAC for this fishery, as the species is not currently assessed since it is not not among the target species list of EU-DCR (National Data Collection Program applying to EU Data Collection Regulation COM 1543/2000). Scientific advice has mostly taken the form of technical measures such as minimum landing sizes or legal mesh sizes. Recently, recreational fishing was limited to the use of hooks and lines only, and all kind of net fishing was banned.
The Greek fleet is comprised of circa 20,000 boats, which corresponds to about 20 per cent of all the EU fleet. Around 70 per cent of the boats have engines with less than 25 kW engine power. These vessels do not bear VMS devices and do not market their catches through official markets. As a result, monitoring is very difficult and data gathered in the EU-DCR framework concern just a small portion of the fleet, around 2 per cent, from which the total Effort/Landings is estimated by applying some raising algorithms (extrapolation).
As red seabream is not amongst the 27 target species of the EU-DCR framework for Greek fishery data, data gathering and estimation of total fleet, effort and production is a huge obstacle to confront. In addition, an unknown number of Italian trawlers are exerting their effort in the deep waters of the area. Information on their catches has not yet been available

2.3.3 Portuguese fishery for black scabbardfish in ICES IX

The Portuguese fishery for black scabbardfish is managed by a combination of TACs, effort limitations and licensing. Effort regulations were introduced in 1995, the EU regulation No 2347/2002 and TAC in 2003 and in 2004 the Portuguese administration set up a new licensing scheme. (DIÁRIO DA REPÚBLICA/ I SÉRIE-B No 200/25-08-2004).

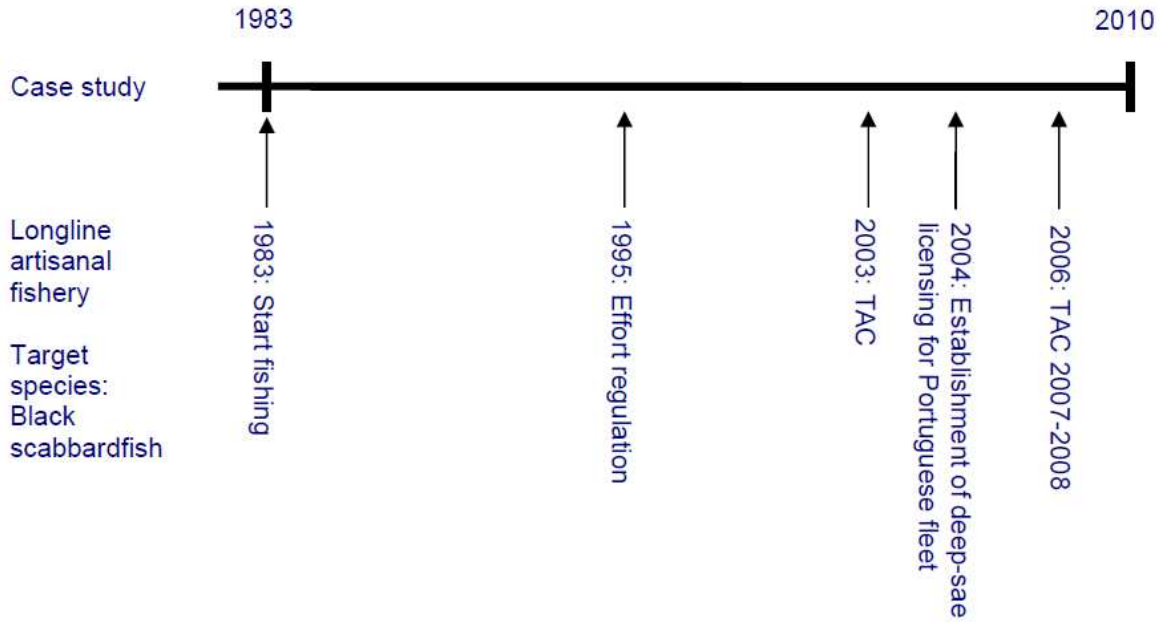

Figure 2-2 Management of the Portuguese red seabream fishery.

2.4 Northeast Atlantic redfish

2.4.1 Beaked redfish in the Irminger Sea and adjacent waters

North East Atlantic Fisheries Commission (NEAFC) has managed pelagic *S. mentella* in the Irminger Sea and adjacent waters through TAC system since 1996, but Iceland is responsible for management of the Icelandic fishery within the Icelandic Economic Zone. The fisheries are managed by a combination of TACs and licensing, but Iceland utilises an individual transferable quota management system.

There is however no consensus on the management among contracting parties of NEAFC; the EU, Denmark, Iceland, Norway and the Russian Federation, with the parties disagreeing both on the stock structure, TACs and allocation keys. No management objectives have been agreed upon and no harvest control rules are in effect.

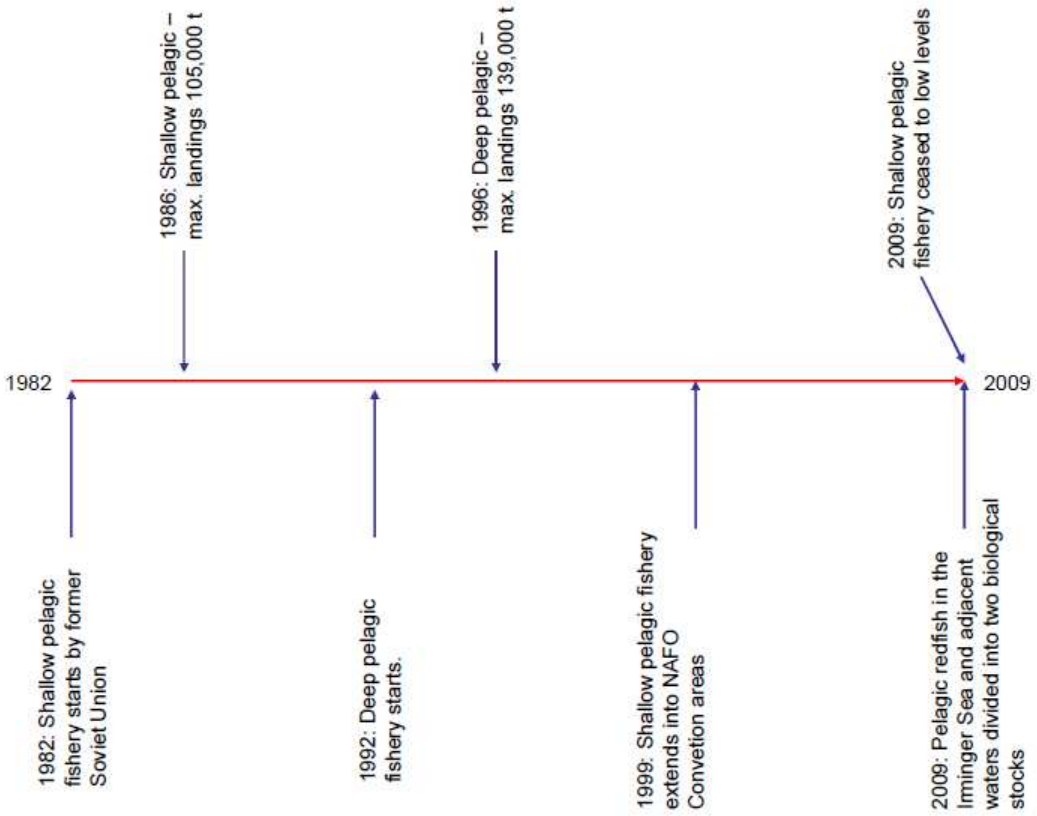

Figure 2-3 Management of beaked redfish in the Irminger Sea and adjacant waters.

2.5 Beaked redfish in ICES Subareas I & II

The beaked redfish in ICES areas I & II is managed by a combination of TACs, licensing, technical measures and spatial and temporal closures. The management directly depends on management procedures used in other fisheries, where redfish is caught as bycatch (Steinshamn, 2010). Consequently, it is tightly linked to the management of other demersal fish species and the shrimp fishery in the area. Fish management in the Norwegian and Barents Sea is also part of integrated management systems which also cover environment, oil extraction and maritime traffic.

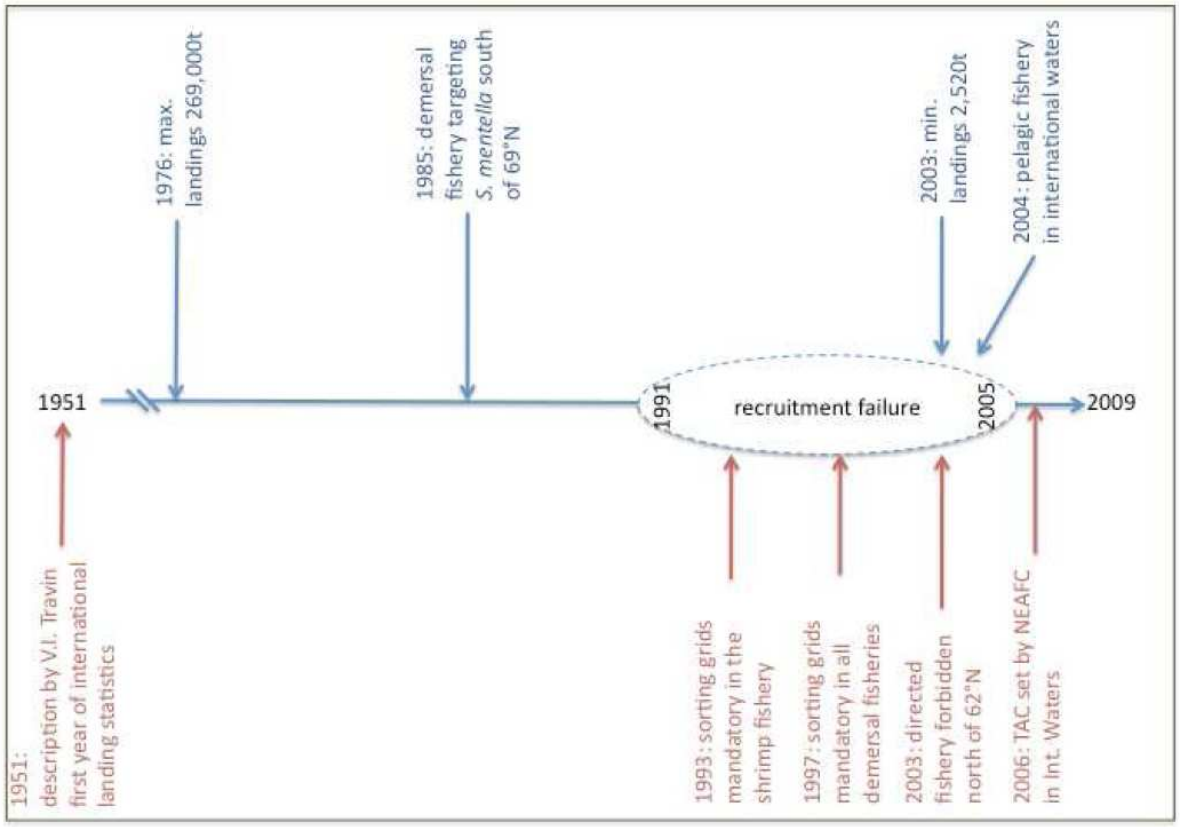

Figure 2-4 Management of beaked redfish in ICES areas I & II.

The Norwegian licensing system dates back to 1938 (Flaaten and Heen, 2004) and currently all commercial fishing by trawlers requires a license. The Norwegian fishereis are regulated through annual regulations on the sharing of TACs for all regulated stocks amongst the different groups and amongst the participating vessels (OECD, 2005). The individuals vessel quotas can not be sold or bought, but owners of more than one vessel may merge the quotas on to one vessel and then decommission the other vessels. However, it is possible to buy vessels with quotas, and in this way quotas may be said to be semi-transferable.

2.6 Greenland halibut fishery in the NAFO area

Management of Greenland halibut in subarea 2 and divisions 3KLMNO became the responsibility of the NAFO Fisheries Commission in 1995, which imposed a TAC of 27,000 tonnes for that year. In 2003, the Fisheries Commission established a fifteen year rebuilding plan for this stock, with TACs set at 20, 19, 18.5, 16 ('000 tonnes), respectively, for the years 2004-07. The TAC for subsequent years shall be established taking into account the progress made in the rebuilding of the stock. Variations in TAC between years may though not exceed 15%.

The Greenland halibut fishery is currently managed by a combination of TACs, licensing, effort limitation, technical measures and spatial closures. Spanish and Portuguese vessels fishing in the area are registered, and new vessels can not enter the fishery without another vessel exiting. In Spain, the country's TAC is allocated to individual vessels, but these vessel quotas are non-transferable. The fishery is regulated by the NAFO Conservation and Enforcement Measures (2009).

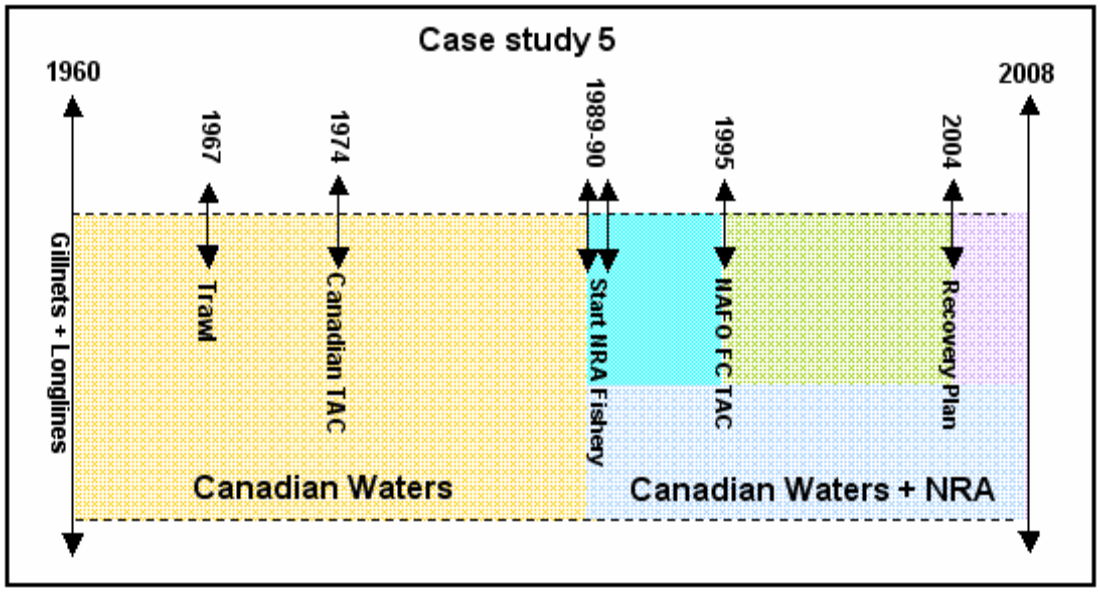

Figure 2-5 Management of the Greenland halibut in NAFO area.

2.7 Conclusion

The deep-water fisheries analysed in DEEPFISHMAN are managed primarily by TACs, licenses, effort restrictions, technical restrictions and spatial and temporal closures. The Greek red seabream fishery is though in effect an open access fishery. The only cases of market based management are found in Norway and Iceland. Norwegian vessels taking part in beaked redfish fishery in the Barents Sea and Norwegian Sea are subject to individual vessel quota regime, and although the quotas as such may be non-transferable, it is possible to transfer quotas between vessels owned by the same entity. Furthermore, vessels with quotas can be bought and sold on the market. In Iceland, an ITQ system has been in effect in almost all fisheries since 1990. There are two kinds of quotas, permanent and annual catch entitlements. No restrictions apply to transfers of permanent quotas, but transfers of annual catch entitlements are subject to considerable restrictions.

3 Catches and fleets

In this and the following three sections we focus on four major aspects of the fisheries; catches and fleets, labour utilisation in the fisheries and associated sectors, processing and marketing, and economic performance. The case studies differ considerably in their data richness. Whereas information on catches and fleets is generally available, information on other aspects is often scarce or missing.

3.1 Deep-water fisheries in ICES Vb, VI, VII & XIIb

The deep-water fisheries in ICES Vb, VI, VII & XIIb constitute three case studies; case study 1b – orange roughy in ICES VI & VII, case study 1c – southern blue ling in ICES Vb, VI, VII & XIIB and case study 2 – demersal mixed fishery in ICES Vb, VI & VII.

Catches of orange roughy in ICES areas VI and VII are reported in Tables 3-1 and 3-2 respectively. After peaking in the early 1990s, catches in area VI have dwindled to a few

tonnes in recent years. The development of catches in area VII is similar. French catches peaked in the early 1990s and Irish catches a decade later.

Table 3-1 Estimates of landings by orange roughy by nations in ICES area VI 1988-2009. Source: ICES WGDEEP Report 2010.

	Faroes	France	E & W	Scotland	Ireland	Spain	Total
2000		136			2		138
2001		159		11	110		280
2002		152		41	130		323
2003		79			2		81
2004		54			2		56
2005		41			6		47
2006		32			1		33
2007		12					12
2008		5					5
2009		2					2
Total	0	672	0	52	253	0	977

Table 3-2 Estimates of landings by orange roughy by nations in ICES area VII 1988-2009. Source: ICES WGDEEP Report 2010.

	France	Spain	E & W	Ireland	Scotland	Faroes	Total
2000	1019			1			1020
2001	1022		1	2367	22		3412
2002	300		14	5114	33	4	5465
2003	369			172			541
2004	279			188			467
2005	165			90			255
2006	451			37			488
2007	145			28			173
2008	118						118
2009	15						15
Total	3883	0	15	7997	55	4	11954

Although catches of blue ling have remained more stable than catches of orange roughy in area Vb2, they have declined in other areas.

Table 3-3 Catches of blue ling in ICES area Vb1 by country. Tonnes.
Source: ICES WGDEEP report 2010.

	Faroe	France	Germany	Norway	E & W	Ireland	Russia	Total
2000	1677	575	1	163	33		1	2450
2001	1407	439	4	130	11	2		1993
2002	1003	578		274	8			1863
2003	2465	1133		12	1			3611
2004	751	1132		20			13	1916
2005	1028	781		15	1			1825
2006	1276	839		21	1		16	2153
2007	1220	1167		212	8		36	2643
2008	642	865		35			110	1652
2009*	523	188		13			15	739

* Preliminary figures.

Table 3-4 Catches of blue ling in ICES area Vb2 by country. Tonnes.
Source: ICES WGDEEP report 2010.

	Faroe	Norway	Scotland	Total
2000		37	37	74
2001		69	63	132
2002		21	140	161
2003		84	120	204
2004	710	6	68	784
2005	609	14	68	691
2006	647	34	16	697
2007	632	6	16	654
2008	317		91	408
2009*	444	8	160	612

* Preliminary figures.

Table 3-5 Catches of blue ling in ICES area VIa by country. Tonnes.
Source: ICES WGDEEP report 2010.

	Faroe	France	Germany	Ireland	Norway	Spain	E & W	Scotland	Lithuania	Total
2000		4,544	94	9	102	108	24	1,300		6,181
2001		2,869	6	52	117	797	116	2,136		6,093
2002		2,177		62	61	285	16	2,027		4,628
2003	7	2,010		2	106	195	3	428		2,751
2004	10	2,264		1	24	24	1	482		2,806
2005	17	2,032		2	33	210		390	29	2,713
2006	13	1,794		1	49	27	3	433		2,320
2007	13	1,814			31	49		113	1	2,021
2008	14	1,574			73	10		112		1,783
2009*	11	1,028			74	31		178		1,322

* Preliminary figures.

Table 3-6 Catches of blue ling in ICES area VIb by country. Tonnes. Source: ICES WGDEEP report 2010.

	Poland	Russia	Faroe	France	Germany	Norway	E & W	Scotland	Ireland	Estonia	Total
2000				514		184	500	966	7		2,171
2001			238	210	1	256	337	1,803	4	85	2,934
2002		3	79	345		273	141	497	1		1,339
2003	4	2		510		102	14	113		5	750
2004	1	5	4	514		2	10	96		3	635
2005		15	1	235		1	9	80			341
2006			3	313		2	4	29			351
2007		1	15	109		4	7	30			166
2008		12	2	29		2	2	9			56
2009*		1		10		1		7			19

* Preliminary figures.

3.1.1 French fleet

The French fleet is involved in all three fisheries under consideration here. The bulk of the French deep-water fishery is carried out by two companies, which together operate five large trawlers. Two other companies though participate on a smaller scale, each operating a single vessel. It should be noted that some 50 vessels, including smaller skipper-owned artisanal vessels, applied for a deep-water fishing license under EU regulation 2347/2002, but either did not use it or only used it to legalize by-catch landings of greater forkbeard caught in significant amount in some areas of the Celtic sea shelf. As shown in Table 3-7, the size of smaller vessels in the deep-water fleet is around 180 gross registered tonnes (GRT), but the largest trawlers register on average 880 GRT.

Table 3-7 Number and characteristics of French vessels licensed for deep-water fishing.

	2003	2004	2005	2006	2007	2008	2009
20-24 m							
Number of vessels	4	5	8	11	12	15	15
Mean power (kW)	450	450	440	450	440	470	470
Mean GRT	130	140	170	170	170	180	180
24-40 m							
Number of vessels	32	32	34	28	24	25	25
Mean power (kW)	710	710	680	660	660	670	670
Mean GRT	320	320	300	300	310	310	310
>40 m							
Number of vessels	18	18	16	13	13	10	10
Mean power (kW)	1600	1600	1700	1800	1800	1700	1700
Mean GRT	920	920	950	975	975	880	880

Vessels in the French fleet primarily use single bottom otter trawls, but vessels that have entered into the fishery in later years are though equipped for twin bottom trawl and for deep-water fishing.

In 2008, only six vessels landed about 75% of the total deep-water species landings. These six vessels are, not surprisingly, more powerful than the average vessel licensed for the deep-water fishery.

3.1.2 Irish fleet

In 2000, a programme to develop an Irish deep-water fishery was initiated with 10 vessels commencing exploratory deep-water fishing in ICES areas VI and VII (Shephard, 2006), mainly in the slopes of the Porcupine Bank. Grant funding was organised through the Irish Sea Fishereis Board (BIM), and in that first year five trawlers were built (Foyle et al., 2010). A slightly older trawler entered the fishery in 2003. Table 3-8 presents statistics for Irish trawlers participating in deep-water fisheries for the years 2001 to 2007.

Table 3-8 Characteristics of the Irish deep-water fleet engaged in deep-water fishing. Source: Deepfishman, Case study 1 B report.

		2001	2002	2003	2004	2005	2006	2007
Number of veels		4	5	6	6	4	3	2
Age	Mean	1	2	3.5	2.3	4.3	5	7
	Max	1	2	6	7	5	6	7
	Min	1	2	3	1	2	3	7
	Std	0	0	1.2	1.9	1.5	1.7	0
Length	Mean	32.5	33	33.1	32.5	33.6	33.1	31.2
	Max	40.7	40.7	40.7	38.3	38.3	38.3	38.3
	Min	24	24	24	24	24	24	24
	Std	8.2	7.2	6.5	5.7	6.5	7.9	10.1
GRT	Mean	483	460	491	468	458	488	478
	Max	637	637	637	507	507	507	507
	Min	340	340	340	340	340	346	346
	Std	162	150	154	135	124	133	187
kW	Mean	1454	1646	1542	1717	1987	1844	1691
	Max	1900	2414	2414	2950	2950	2950	1521
	Min	1242	1242	1022	1022	1242	1242	1341
	Std	301	502	516	775	833	959	494

3.1.3 Spanish fleet

The Spanish Basque country fleet has in recent years comprised 4-8 vessels, around 250 GRT in size. The fleet consists of gill netters, bottom long liners and otter trawlers, but in 2004 and 2005 only four trawlers took part in these deep-water fisheries.

Table 3-9 Descriptive statistics for the Spanish Basque country fleet. Source: Diez (2009).

Averages	2001	2002	2003	2004	2005
Number of vessels	8	6	6	4	4
Length overall	37	38	36	39	39
Gross tonnage	249	257	239	261	264
Engine power, hp	871	913	900	827	918

3.1.4 UK fleet

During the period 2005-2008, 19, 21, 19 and 17 vessels, respectively, of the English, Welsh and Scottish fleet caught blue ling as by-catch in ICES areas Vb1, Vb2, VIa and VIb. There are also foreign owned vessels registered in the UK, mostly Anglo-Dutch, Anglo-Icelandic or Anglo-Spanish. Table 3-10 presents average vessels size, gross tonnage and engine power of these vessels broken into passive gears, trawlers and whitefish vessels.

Table 3-10 Descriptive statistics for the UK vessels. Source: AER (2009).

Vessel type	Averages	2005	2006	2007	2008
Number of vessels		19	21	19	17
Passive gears	Length	27.3	34	29.6	
	Gross	184	271.3	228.7	
	Engine	550.3	527.7	330	
Trawlers (mainly nephrops)	Length	30.4	40.4	24.1	28.8
	Gross	204.8	361.5	264	220.3
	Engine	553.8	1066.5	638	609
Whitefish	Length	32.6	31.5	31.2	31.7
	Gross	437.5	431.3	422.7	428.5
	Engine	1017	1019.7	969.6	973.5

3.1.5 Norwegian fleet

In 2006, 16 Norwegian vessels registered catches of blue ling in ICES areas Vb1, Vb2, VIa and VIb. The next year the vessels numbered 16 and 13 in 2008. The Norwegian fleet used automatic long lines in all these areas, except for except for ICES area Vb1 where they also used seine nets. Table 3-1 presents the average number of trips per year for the Norwegian fleet, split by ICES area for blue ling and all species. Blue ling is a by-catch for this fleet, as the Norwegian vessels target ling and tusks.

Table 3-11 Number of trips per year for the Norwegian fleet. Source: Correia daSilva (2009).

ICES area	Vb1			Vb2			VIa			VIb		
Year	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
All species	14	22	11	7	6	1	48	63	71	54	55	30
Blue ling	8	7	4	2	2	1	8	9	8	5	6	3

3.2 Namibian orange roughy

The origin of the Namibian orange roughy fisheries traces back to 1994 when an exploratory fishing license was given to a Namibian fishing company to search for commercial deep-water fish species. In 1997, five trawlers belonging to three companies were awarded quotas allowing them to fish in the four Quota Management Areas (QMA's) (Boyer et al. 2001). By 2007 the number of vessels had dropped to only one and total catches declined from around 18,500 tonnes in the fishing year 1996/1997 to only 270 tonnes in the year 2006/2007. A joint decision was made by management officials and the fishing industry to put a three year moratorium on orange roughy fisheries (2008-2010).

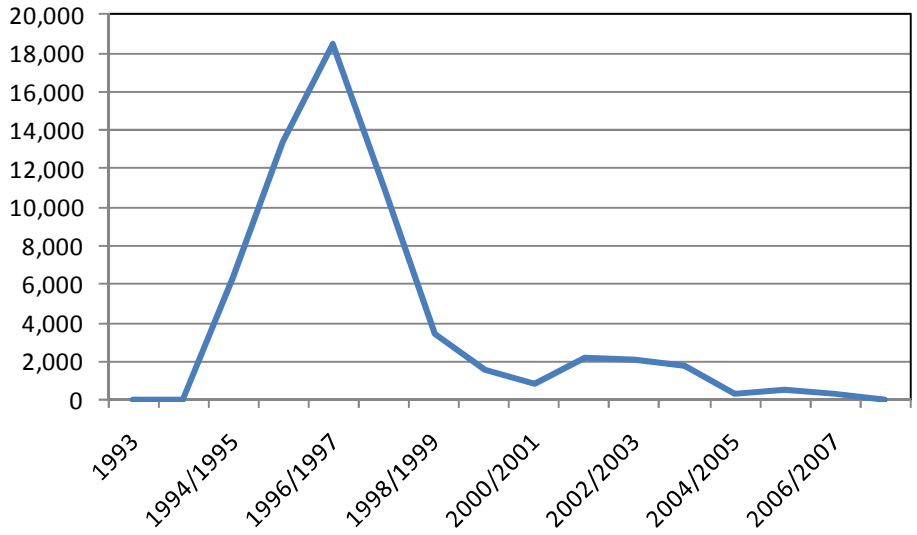

Figure 3-1 Orange roughy catches in Namibia 1993-2008. Tonnes. Source: FAO.

All six vessels taking part in the Namibian orange roughy fishery were trawlers, ranging in size from 192 to 1,269 GRT. The oldest vessel was built in 1974, the newest in 1990. The vessels are owned by three fishing companies.

Table 3-12 Descriptive statistics for the Namibian fleet
Source: Deepfisman Case Study Report 1 A (2010).

Vessel	Length	GRT	Year built	HP
Conbaroyo Quarto	57	1,269	1988	3,300
Southern Aquarius	54	690	1974	3,000
Whitby	27	192	1977	800
Emanguluko	31	483	1990	1,850
Ulzama	33	264		1,100
Congasa	40	513	1981	1,200

3.3 Beaked redfish

3.3.1 Irminger Sea

Recent results have shown that the pelagic beaked redfish, *Sebastes mentella*, in the Irminger Sea forms two stocks: deep pelagic stock and shallow pelagic stock (Cadrin et al., 2009). Trawlers from the former USSR started fishing shallow pelagic *S. mentella* in 1982 in the Irminger Sea and in the late 1980´s and early 1990´s trawlers from the Faroe Islands, Iceland, and Norway joined the fishery. Catches have decreased fast in recent years. In 2003 they totaled 55,700 tonnes, but were down to 2,000 tonnes in 2008.

Table 3-13 Catches of the shallow pelagic *S. mentella.*
Source: Deepfishman. Case Study Report 4 – Part II (2010).

	2003	2004	2005	2006	2007	2008
Faroes	1.955	777	210	334	98	298
Germany	3.579	1.126	1.152	994		
Iceland	4.306	5.714	3.086	1.287	77	64
Latvia	1.269	1.114	919	1.803	186	
Lithuania	21.629	3.698	1.169	466	467	8
Norway	3.214	2.721	624	280		
Poland	917	1.018	1.17	663	189	
Portugal	1.926	2.133	2.78	1.372	529	
Russia	15.418	13.208	15.562	4.953	4.037	1.597
Spain	1.461	1.679	1.557	3.576	339	36
Total	55.674	33.188	28.229	15.728	5.922	2.003

Fishing of the deep pelagic stock started a decade later than for the shallow pelagic stock started, i.e. in 1992. Although catches there have also dwindled in recent years, total catches in 2008 still amounted to 30,000 tonnes.

Table 3-14 Catches of the deep pelagic *S. mentella.*
Source: Deepfishman. Case Study Report 4 – Part II (2010).

	2003	2004	2005	2006	2007	2008
Faroes	3.938	4.67	1.8	3.498	2.902	2.653
Germany	7.028	2.251	1.836	1.83	1.11	
Greenland	3.403	2.419	1.431	744	1.961	1.17
Iceland	44.588	31.112	12.919	20.948	18.091	6.721
Lithuania			1.027	1.294	1.394	749
Norway	5.185	6.277	3.95	5.968	4.628	571
Poland		1.889	1.24	1.356	636	219
Portugal	2.109	2.286	1.088	1.313	2.067	1.733
Russia	28.638	31.067	16.323	23.67	21.337	15.106
Spain	9.374	9.996	3.871	6.673	3.81	1.179
Total	104.263	91.967	45.485	67.294	57.936	30.101

The Russian fleet has traditionally been the largest player in the redfish fishery, but a substantial number of Icelandic vessels have also taken part in the fishery and have even outnumbered the Russian vessels in some years. The number of vessels engaged in the fishery has though fallen by a half in recent years.

Table 3-15 Number of vessels by country (not separated by stock).
Source: Deepfishman. Case Study Report 4 – Part II (2010).

	Faroes	Germany	Greenland	Iceland	Norway	Poland	Portugal	Russia	Spain	Total
1995	3	9	NA	28	3		NA	41	4	88
1996	7	8	NA	32	3		NA	30	3	83
1997	7	10	NA	27	3	1	NA	40	4	92
1998	7	9	1	27	2		NA	25	6	77
1999	7	9	1	26	2		NA	20	6	71
2000	2	8	1	26	2		NA	25	6	70
2001	3	7	1	26	4		NA	28	6	75
2002	3	7	1	27	5	1	6	29	6	85
2003	4	6	1	22	5	1	5	27	6	77
2004	4	3	1	22	5	1	5	34	10	85
2005	4	4	1	18	3	1	5	35	11	82
2006	2	3	1	16	5	1	7	28	11	74
2007	3	1	1	15	5	1	6	26	9	67
2008	3		1	12	1	1	6	17	6	47

3.3.2 Icelandic fleet

Table 4 presents an overview of the characteristics of the Icelandic fleet participating in the fisheries for the years 2003-2008. The vessels are relative old; the mean age of the fleet has increased from 20 years in 2003 to 25 years in 2008, and large. In 2003, the average vessel registered 1585 tonnes, with the largest vessel mesuring 3,239 GRT.

Table 3-16
Characteristics of the Icelandic fleet.
Source: Directorate of Fisheries in Iceland and the Icelandic Maritime Administration.

		2003	2004	2005	2006	2007	2008
Number of vessels		23	22	17	18	16	13
Age	Mean	20	20	23	22	23	25
	Max	29	32	33	34	35	36
	Min	3	4	7	6	7	10
	Std	9	9	9	10	10	9
Length	Mean	65	66	65	68	69	66
	Max	86	86	79	86	86	79
	Min	51	51	51	57	57	57
	Std	10	9	8	8	9	7
GRT	Mean	1585	1679	1502	1769	1792	1591
	Max	3239	3239	2157	3239	3239	1999
	Min	745	924	924	932	1141	1141
	Std	630	596	384	611	601	314
kW	Mean	2638	2750	2458	2902	2884	2529
	Max	5520	5520	3680	5520	5520	3680
	Min	1619	1691	1691	1691	2060	2060
	Std	944	907	511	1012	955	478

3.3.3 ICES areas I & II

Traditionally, the fishery for *S. mentella* was conducted by Russia and other East European countries on grounds located south of Bear Island towards Spitsbergen, but since 1991 the fishery has been dominated by Norway and Russia.

A directed pelagic fishery for *S. mentella* in international waters of the Norwegian Sea outside the Norwegian EEZ has developed since 2004. Landings of *S. mentella* taken in the pelagic fishery for blue whiting and herring in the Norwegian Sea have been reported in 2004 and 2005. Since 2006 this fishery developed further to become a directed fishery with 31 trawlers from seven countries taking part in the fishery in 2008.

3.3.4 Norwegian fleet

Only few Norwegian vessels have taken part in the for *S. mentella* fishery in recent years. In 2000, there were three trawlers engaged in the fishery, but the number had doubled in 2003, only to decline again in the ensuing years.

Catches of the Norwegian fleet amounted to around 5,000 tonnes, except in 2003 and 2004 when they were 8,000-9,000 tonnes.

Table 1 Number of Norwegian vessels and catch (in tonnes)
Source: Kaspersen 2008.

	Number of vessels	Catch (tons)
2000	3	5,232
2001	4	5,222
2002	4	5,291
2003	8	8,399
2004	6	8,998
2005	4	4,574

3.4 Greenland halibut in NAFO areas

The target fishery for Greenland halibut in this management area began in the early 1960's in the deep-water bays of eastern Newfoundland, particularly Trinity Bay. As catches declined there, fishing effort increased in the other bays along the east and northeast coast of Newfoundland. Subsequently, vessels moved further offshore to the deep channels running between the shallow fishing banks. In 1990, an intense fishery for Greenland halibut developed in the NAFO Regulatory Area (NRA), of Div 3L and 3M, in the deep-water areas known as Sackville Spur and Flemish Pass.

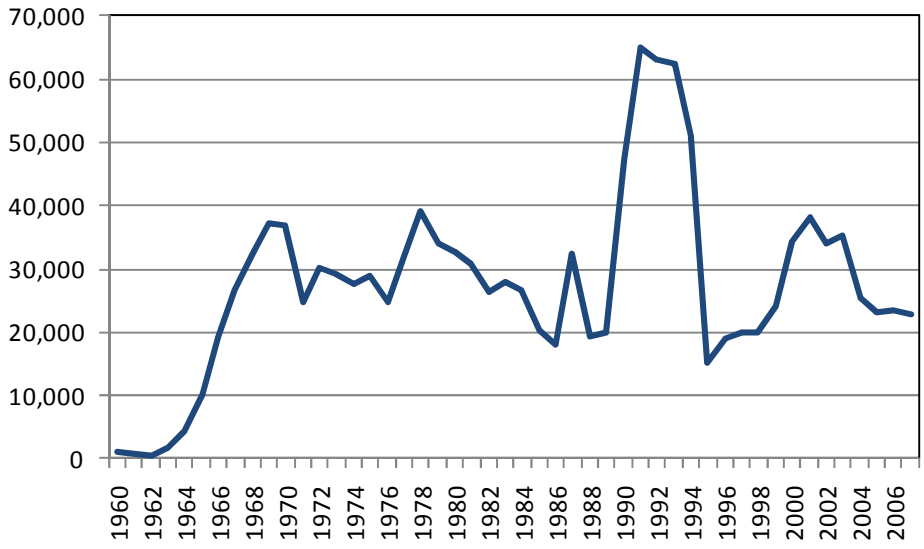

Figure 3-2 Catches of Greenland halibut in NAFO subarea 2 and divisions 3KLMNO 1960-2007.
Source: Deepfishman Case Study 5 Report (2010).

3.4.1 Spanish fleet

Apart from Greenland halibut, the Spanish fleet also catches other incidental species, mainly redfish, skate, roughhead grenadier and prawn, both in NAFO waters as well as in other fishing zones, such as Hatton Bank, Irminger, Svalbard, Reykjanes, Greenland, southwest Atlantic and the Falkland Islands.

Only four vessels took part in the Greenland halibut fishery when Spain entered the fishery in 1990. The number of freezer trawlers though grew fast in the ensuing years – not least because of the extraordinary catches – and by 1994 the fleet counted 33 ships. The number of trawlers engaged in the fishery then remained much the same for the next decade and in 2005 there were still 35 vessels active in the fishery. However, since the introduction of a recovery plan in 2004, the number of vessels has shrunk and in 2008 there were only 14 Spanish trawlers engaged in the Greenland halibut fishery.
The average trawler active in the period 1992-2008 registered 762 GRT, had a carrying capacity of 1111 tonnes and was able to process (freeze) up to 29 tonnes per day.
During the period 2001-2005, 43.6 per cent of this fleet's landings came from NAFO zones and the remaining 56.4 per cent came from the other fishing grounds. Of these 43.6 per cent, 32.8 per cent correspond to Greenland halibut landings (Garza-Gil and Varela-Lafuente, 2009).

3.4.2 Portuguese fleet

First records of Greenland halibut catches of Portuguese vessels in the NAFO area date from 1973, but until 1981 there were only incidental catch records in all divisions. Since 1995, the Greenland halibut fishery, along with the red fish fishery, has been the mainstay of long-distance Portuguese fleet operating in NAFO. In recent years the Greenland halibut catches have remained stable in all divisions with the exception of division 3M where catches have increased.
In 2007, the Portuguese fleet consisted of 13 freezing trawlers which registered on average 1,650 tonnes. The trawlers were owned by five companies, which were also engaged in processing and preserving of fish products. The trawlers typically have a crew of around 35 members and the average fishing trip lasts 4-5 months. The crew usually remains unchanged throughout the trip. Most of the vessels have their home port in Aveiro or Lisboa.

3.5 Artisanal fleets

3.5.1 Tarifa fleet

The beginning of the seabream fishery in the Strait of Gibraltar can be traced back to the 1970s when vessels from Ceuta began to explore its potential. Vessels from Tarifa began to exploit the fisheries in the 1980s, and the fishery quickly grew in importance. Thus, whereas the proportion of red bream in captures in Tarifa amounted to only 10% in 1980, it had grown to 50% in 1990, and 93% of total landings in 1994. Spanish landings from this fishery cover almost the 70 % of the landings for the species in the ICES subarea IX.
In 2007, there were 103 authoritized vessels in the *voracera* fleet, which utilises mechanised hook line baited with sardine. The boats are small, on average 10 metres long and just over 6 GRT. The fleet has increased considerably since the beginning of the fishery in the early 1980s. In 1984, it included 55 vessels, but in 2001 their number had increaed to 108 vessels.. Not all vessels in the *voracera* fleet report catches of red seabream, and there are also some unautorisized vessels that land red seabream.

Table 3-17 Summary statistics for the *voracera* fleet in 2007. Source: Deepfishman Case Study 3 A Report (2010).

	Average	Min	Max	St. dev.
Length	9.8	5.5	15.0	2.1
Size (GRT)	6.4	1.1	19.0	4.2
Horse power (kW)	47.5	5.2	132.5	28.7

3.5.2 Greek fleet

The Greek fleet taking part in the red black-spot seabream fishery in the eastern Mediterranean can be divided into four segments; gillneters, trammel netters, longliners and trawlers. The trammel net fleet is by far the most numerous, counting over 1,400 vessels in 2009. The fleet also included 263 gillnetters, 78 longliners and 20 trawlers. It should be noted that these vessels catch other species apart from red black-spot seabream. Gillnetters, trammel netters and longliners are on average smaller than trawlers.

Table 3-18 Descriptive statistics for the Greek gillnet fleet. Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008
Vessels	535	113	172	150	225	263
Average Length (m)	10	10	10	9	10	10
Average Age (years)	24	25	26	23	22	23
Average Engine Power (KW)	13.8	13.8	13.6	13.7	14.8	15.4
Average size (GRT)	1.4	1.4	1.4	1.4	1.6	1.7

Table 3-19 Descriptive statistics for the Greek trammel net fleet. Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008
Vessels	835	1,091	1,041	1,105	1,163	1,409
Average Length (m)	10	10	10	9	10	10
Average Age (years)	24	25	26	23	22	23
Average Engine Power (KW)	13.8	13.8	13.6	13.7	14.8	15.4
Average size (GRT)	1.4	1.4	1.4	1.4	1.6	1.7

Boats practicing gillnet and trammel net fisheries are categorized as “coastal boats bearing nets” and are indistinguishable in terms of capacity, size, age. As a result, figures in Tables 3-8 and 3-9 above are similar.

Table 3-20 Descriptive statistics for the Greek longline fleet. Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008
Vessels	10	18	43	37	40	78
Average Length (m)	9.6	10.0	9.9	9.7	9.7	9.4
Average Age (years)	25.4	21.1	21.9	21.3	20.8	19.8
Average Engine Power (KW)	17.4	17.1	17.0	16.7	17.2	17.2
Average size (GRT)	1.9	1.9	1.9	1.9	2.0	1.9

Table 3-21 Descriptive statistics for the Greek trawl fleet. Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008
Vessels	30	20	20	21	20	20
Average Length (m)	23	23	23	23	23	23
Average Age (years)	23	24	24	26	24	25
Average Engine Power (KW)	284	282	276	279	270	272
Average size (GRT)	73	70	72	73	77	77

3.5.3 Portuguese fleet

The Portuguese black scabbardfish fishery began in 1983 on the continental slopes off the coast within the Portuguese Exclusive Economic Zone. The Portuguese Fisheries Research Institute (IPIMAR) had previously conducted exploratory surveys in collaboration with the harvesting sector. These surveys involved searching for the fishing grounds and conducting preliminary biological studies on the stock, as well as experimenting with longline fishing (Bordalo-Machado and Figueiredo, 2009). Fishermen from the island of Madeira (Portugal) had extensive experience fishing with deep-sea longline gear (Leite, 1988) and took part in developing the fishery.

Most of the black scabbardfish catches in ICES area IX are taken by Portuguese vessels. Total harvests have fluctuated between 2,500 and 4,500 tonnes in the last 20 years, but have risen somewhat in recent years.

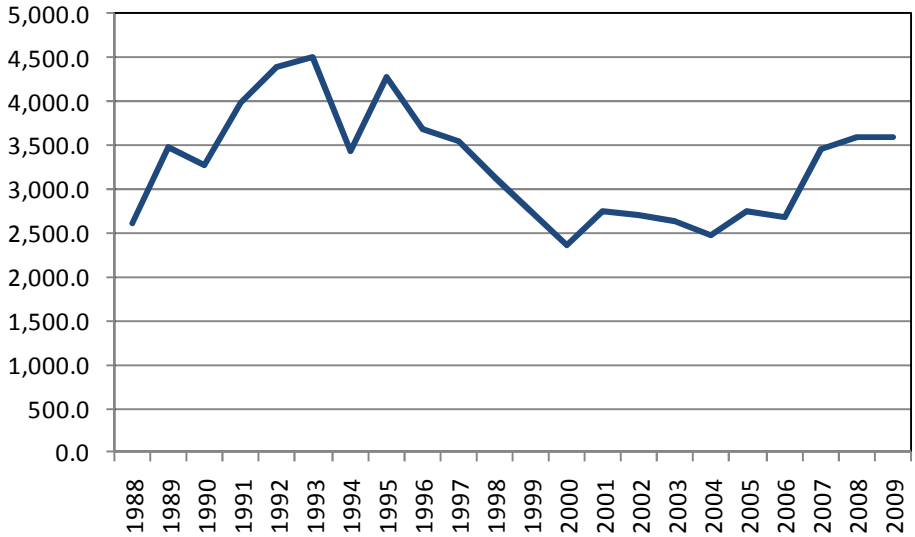

Figure 3-3 **Black scabbardfish catches of the Portuguese fleet in ICES area IX during 1988-2009. Preliminary figures for the last year.**
Source: Deepfishman Case Study 3 C Report (2010).

When the black scabbardfish fishery started the fleet comprised small artisanal vessels which were on average 11 meters long, had a GRT of 17 tonnes and an engine power of 100 kW. In the early 1990s, the vessels became larger and more powerful, and in 2002 and 2003 still larger boats entered the fleet. By then the average vessel was 17 meters long, had a GRT of 45 tonnes and engine power of 310 kW. At present the fleet comprises 17 vessels, most of which have their home port in Sesimbra. The vessels are on average 17.5 meters long, a GRT of 43.3 tonnes and engine power of 237 kW.

Table 3-22 Summary statistics of the 17 vessels in the fleet in 2009.
Source: Deepfishman Case Study 3 C Report (2010).

	Mean	Min	Max	St. dev
Length M)	17.5	12.8	24.5	3.8
GRT	43.3	-	-	26.5
Engine power (kW)	236.8	106.0	445.0	114.6

Although investments have been made in fishing vessels, the gear used has not changed much since 1984. The vessels use a horizontal bottom longline as their main fishing gear with alternating floats and weights at constant intervals along the main line. The number of hooks used on the fishing gear has increased from about 4,000 at the beginning of the fisheries to about 4,000-10,000 in 2004. Automatic line devices have not been introduced and little changes have been made to the fishing operations as such (Bordalo-Machado and Figueiredo, 2009).

3.6 Ownership

As a general rule, larger vessels are owned by harvesting companies, while smaller boats are most often skipper-owned. Thus vessels in the Spanish Basque country fleet are usually company-owned, as are trawlers in the Spanish and Portuguese NAFO-fleet, and the French, Icelandic, Norwegian and Namibian deep-water fleet. However, all the Irish vessels were owned by skippers and in the UK, vessels are either owned by companies or skippes, or under joint ownership. Boats belonging to the artisanal fisheries in Greece, Portugal and Spain are most frequently owned by the skippers, and in many cases run as family businesses.

3.7 Length of trip and distance to port

The largest trawlers in the French fleet can be away from homeport for up to 29 days, but land in Scotland or Ireland every 9 days where part of the crew is relieved and the catch transported to France by lorry. Trawlers ranging from 30-38 meters carry out trips of 24 days and land their catches in Ireland or France every six or seven days.

Home ports of French vessels engaged in the demersal deep-water mixed fishery are Boulogne-sur-mer and Lorient in France. A few years ago a third port, Concarneau, hosted a significant part of the fleet but is now marginal as most vessels were moved to Lorient. The bulk of the catches are not landed in these French ports but in Scottish, e.g. Lochinver and Ullapool, and Irish ports, e.g. Killybegs.

The fishing grounds for orange roughy are about 120 nautical miles away from the main Irish ports Fenit, Killybegs, Galway, Dingle and Ros a'mhil. Home ports and landing ports are mostly the same. The average fishing trip for Irish vessels lasts 10 days.

Hull, Ullapool, Aberdeen and Fraserburgh used to be the most important ports for the UK deep-water fleet, but now all the vessels are freezer-trawlers which can land anywhere they choose. Nevertheless, if they land blue ling or other deep-water species, they are subject to regulation 2347/2002 which requires these species to be landed in designated harbours. Scottish trawlers though still have homeports were they tend to land.

The Spanish Basque country fleet has its home port in Ondarroa, approximately 1800 km from its main fishing grounds for blue ling but its main landing ports are in Ireland, only 35 km from the fleet's main fishing grounds.

Vigo in Galicia is the home port for the Spanish NAFO fleet. The distance from the fishing grounds in the Flemish Pass (divisions 3L-3M) is approximately 1675 nautical miles. Although trips take on average 3-4 months, the crew will in most cases remain unchanged through the duration of the whole trip. The trawlers, which are equpped with on-board freezing facilities, have a crew of about 24 persons, but the number of seamen can be considerably higher as the same members do not always make up the crew.

As the fishing grounds of the Portuguese fleet are the same as for the Spanish fleet, the distance between the fishing grounds and home and landings ports of the fleet is similar. Aveiro on the north coast of Portugal is the most important home port for the Portuguese fleet. The average fishing trip lasts 4-5 months, with the crew usually remaining unchanged throughout the trip.

For all the fishing grounds the home port is the same as the landing port, with Walvis Bay and Luderitz the most important ports. The four fishing areas for orange roughy are 100-320 nautical miles from home port.

The most important home ports of the Icelandic fleet are Reykjavik and Hafnarfjordur in the southwest and Akureyri, Olafsfjordur and Saudarkrokur in the north. The distance from home port to the main fishing ground of deep pelagic redfish is 100-200 nautical miles. The distance from home port to the main fishing ground of shallow pelagic redfish is 500-600 nautical miles.
Gillnetters and longliners engaged in the blackspot seabream in the Ionian Sea usually go on one day trips, while trawl vessels may stay out a day longer.
The distance from the homeports to the fishing grounds is about 105 km (57 nm). The main landing port is Sesimbra which is about 31 km, (17 nm), from the main fishing grounds. Fishing trips usually last 2-3 days, with vessels usually departing at dusk and steaming for 1-6 hours. Once they have reached the fishing grounds the fishermen deploy the prepared baited longline gear into the sea and mechanically haul in the longline gear set in the previous 24-48 hours. Deploying the baited longline usually takes about 2 hours while hauling the previous longline takes about 8-15 hours (Bordalo-Machado et al, 2008).
Most of the seabream fishing takes place very close to the home ports of the *voracera* fleet, Algeciras and Tarifa, especially the latter. The two ports are the only two authorized landing ports in the Strait of Gibraltar fishing plan regulatory area. Trip lengths are no longer than a day.

3.8 Conclusion

The fleets taking part in the fisheries in the nine cases highlighted in DEEPFISHMAN vary considerably in size and scope. In essence the fleets can be categroised as artisanal fleets, industrial fleets, consisting of only a handful of vessels, and large industrial fleets, primarily the Spanish, Icelandic and Portuguese fleets.
The Greek artisanal fleet is the most numerous, comprising close to 1,800 vessels, ranging from 10 meter long gillnetters and trammel netters to 23 meter long trawlers. The fleet has numerous home ports and catches are landed in more than 1,200 ports. The socio-economic effects of the seabream fisheries are therefore not limited to a few communities, but are felt in a considerable part of the country. Reliable information on total catches is scant.
The red seabream fishery in the Strait of Gibraltar and the black scabbardfish fishery off Portugal are by contrast very local. In Spain, most of the catches are landed in the port of Tarifa and in Portugal in the port of Sesimbra. The Spanish *voracera* fleet numbers 100 boats, whereas the Portuguese fleet counted 17 vessels in 2009. The local effects of the fishery are quite profound.
In France, Ireland, the UK and Spanish Basque country there are only a handful of vessels, mostly trawlers, taking part in the deep-water fisheries in the waters around the British Isles and west of Ireland. Catches of the fleets have fallen drastically in the last decade; the orange roughy stock and deep-water shark stocks have been depleted, and although the blue ling is less vulnerable catches in most ICES areas have declined.
Catches of shallow pelagic beaked redfish in the Irminger Sea and adjacant waters have fallen from 55,700 tonnes in 2003 to 2,000 tonnes in 2008, and catches of deep redfish from 100,300 tonnes to 30,100 tonnes over the same period. The number of Icelandic vessesl taking part in the fishery has dropped from 26-27 to 12 in less than a decade.Norwegian catches in the redfish fishery in the Barents Sea and the Norwegian Sea have remained fairly stable in

recent years, hovering between 4,500 and 9,000 tonnes, but only a handful of Norwegian vessels have taken part in the fishery.
The Greenland halibut NAFO fishery has also declined. In 2008, only 14 Spanish trawlers took part in the fishery, whereas in 2005 the fleet counted 35 ships. In 2007, there were 13 Portuguese trawlers taking part in the fishery.
The orange roughy stock in Namibian waters has been depleted and a moratorioum on fishing has been in effect the last few years.
Most of the NE-Atlantic and Namibian deep-water fisheries tell a similar story of good harvests in the beginning of the fishery and then a farily steep decline, resulting in small or even zero TACs. In general, there are only a few vessels from each country taking part in the fisheries, except in the case of Iceland, Spain and Portugal where the deep-water fleets have until quite recently each consisted of more than 20 vessels, usually large freezer-trawlers.

4 Utilisation of labour

4.1 Namibia

In 2006/2007 there were just two vessels engaged in the orange roughy fishery, the Southern Aquarius and Emanguluk. Each vessel has an average crew of 35 on board. The catch of both these vessels was processed on land by Deep Ocean Processors (DOP). However, information is unavailable on the number of employyes engaged in the processing of orange roughy. A third harvester, Atlantic Sea Products, operated a freezer trawler which processed all catches on-board.
According the FAO, the fishery sector including aquaculture is estimated to have employed 5,775 persons in 2003, while the secondary sector, i.e. processing and marketing, is estimated tohave employed 7,925. The total population of the country was then close to 2 million. The fisheries sector and deep-water fisheries in particular, thus only played a minor role in the country's labour market.

4.2 Irish fisheries

On average, there were 10 persons fully employed per Irish vessel taking part in the orange roughy fishery. Of these, approximately 7.3 were at sea while 2.7 crew members were employed in various on-shore activities. All the crew members were men. In the Irish deep-water fleet, 76 per cent of the crew was Irish when the fishery started in 2001. Gradually, however, foreigners became a larger proportion of the crews and in 2005 68 per cent of the crew was foreign. The foreigners, mostlyy east Europeans, were mainly working as deckhands. The engineers and the skippers and mates were usually Irish with a few exceptions. Only one of the vessels used Irish crew only, but this vessel left the fishery in 2005. Only one Irish long-liner took part in the blue ling fishery in 2000, but two larger vessels joined the fishery the following year. The smaller vessel had a crew of 9, with additional 3 men employed onshore. The larger long-liners also had crews of 9. All the workers are male. In 2001, half the crews were Irish, but this gradually changed in the next few years and by 2004 80 per cent of the crews came either from Portugal or Eastern Europe. Irish vessel owners are members of producer organizations but crew members are not members of any union.

At the beginning of the fishery, wages were good and thereby attractive for Irish labour. However, declining catches lead to decreasing wages and that made the fishery less competitive. Decreasing profits lead vessel operators to look elsewhere for suitable labour, and thus the share of foreigners increased. Good economic conditions facilitated exit from the industry and into other branches of economic activity. The boom years also attracted foreign labour to the country, which competed with local fishermen for crew places. Irish crew members have, however, claimed that the ship owners preferred foreign crew not only because of lower wages, but also because foreigners did not demand the same level of social security as Irish fishermen. It seems that the change from peak fishery for orange roughy to mixed deep-water demersal fishery had considerable effect on the employment structure, as the fishery on the flats was fuel intensive and yielded low price catches. This in turn forced labour costs down.

Table 4-1 Composition of crew and total number of fishermen employed by Irish vessels engaged in deep-water fishing.
Source: Deepfishman, Case study 1 B report.

	Number of vessels	Irish crew	Foreign crew	Total crew	Mean crew (n)	% Foreign
2001	4	39	12	51	12.8	23.5
2002	5	35	14	49	9.8	28.6
2003	6	28	20	48	8	41.7
2004	6	23	25	48	8	52.1
2005	4	12	26	38	9.5	68.4

All vessels used to have a share system where the catch was devided by the number of shares. However, a system of fixed payments became dominant when it became more common to use East European crew.

Table 4-2 The Irish fleet. Total employment, earnings and gender distribution for 2002-2003.
Source: Deepfishman, Case study 1 B report.

	Whole economy	Fishing	Deepwater trawlers
Employment	1.764 million	10,584	80
% male	58%	99%	100%
Average	€ 35,411	€ 9,500	€ 40,000

In 2002-2003 there were about 1.7 million individuals employed in Ireland, whereof just 10,600 engaged in fishing, and just 80 in deep-water fisheries. Average wages in Irish fisheries were then only €9,500, but wages in the deep-water fisheries were four times higher, and considerably higher than average wages in the economy as a whole. No females were

then employed by the deep-water trawlers, and women made up only 1% of those engaged in the fisheries as a whole.

4.3 French fisheries

In 2005 there were 1,077 fishermen (full time equivalent) employed by the two French fleet segments partly engaged in deep-water fisheries. Two years later, the number of fishermen had declined to 905. In 2006, total employment in the French fisheries amounted to 13,400 FTE, and 13,155 in 2007. Hence, the two fleet segments represent less than 7% of the total employment at sea. It is estimated that in 2006, the harvesting sector employed around 19,900 people and the processing sector 18,500. Total employment in the economy then amounted to 27.6 million people. The share of the fisheries sectors in total employment was thus only 0.14%. It is therefore safe to say that deep-water fisheries contribute very little to the national employment.

Table 4-3 Number of fishermen (full time equivalent) employed by French vessels engaged in deep-water fishing. Source: AER (2009).

	2005	2006	2007
24-40 m	746	657	641
> 40 m	331	264	264
Total	1077	921	905

In a recent survey, it was found that the fisheries employed 818 women, whereof the shellfish culture segment employed 616 and 182 were employed by vessels in the *Petite pêche (costal fisheries)* category. Trips made by vessels in that category usually last less than 24 hours. There was no indication that any women were taking part in the deep-water fisheries.
Crew size is governed by local agreements between ship-owning companies and crew unions. A vessel over 45 meters usually has 14 or 15 crewmen depending on the conventions between crew unions and the ship owning companies. The 30-38 meter longs vessels usually have a crew of nine and the 25 meter trawlers a crew of six or seven. These figures represent the number of crewmen on-board during fishing trips, but the total number of crewmen for each vessel is higher due to the turn-over of crew between fishing trips. This enables the vessels to stay longer out at sea than would be possible with a single crew. Trawlers with 14 or 15 crewmen on-board have an additional crew of six and five crewmen respectively and trawlers with sex or seven crewmen on board have an additional crew of two or three. This system of crew turn-over is not implemented on 30-38 meter trawlers.
Even though shortage of crew can be a problem at times, employment of foreign crew is very limited. First, employing non-EU citizens is requires obtaining residential permit for them. There may also be few trained crewmen available among the immigrants. Second, even for EU citizens, employing foreigners may imply some additional administrative work to the employer. It is therefore likely that only serious shortage of able seamen would make harvesting companies willing to recruit foreigners on a substantial scale. Lastly, foreign crews

command the same wages and social security contributions as locals, so there is no cost incentive to employ foreigners instead of French seamen.
The four companies active in the deep-water fishery are all member of the same union, *Union des Armateurs á la Pêche de France*, which typically represents fishing companies, including the tropical tuna fleet segment. Historically, this union has been very influential in key negotiations, notably for the CFP in the 1970-1980s and in the Law of the Sea Conferences. Some unions are established with fishing as their unique scope but others are more general in the sense that they represent workers from all sectors, even though they may have a specific section for seamen or fishers. Strangely enough, skippers and crews can be members of the same section in some of these unions. Usually skippers speak louder than the crews and the positions claimed by these unions, e.g. on social issues, may at times be a bit ambiguous. By law there is a strong presence of unions in many institutions overseeing fisheries, their management and social structures etc. The number of seats taken by each union in boards and general assemblies etc. depends on the results of elections, where only registered unions approved by government may present candidates. In addition, there is often a specified allocation of seats for crews and employees, ship owners, processing industries, cooperatives, and mariculture etc.
The five (>40 meter) big trawlers all operate under a regime of a fixed minimum wage plus a proportion of the sales, excluding such costs as fuel and gear, etc. The two smaller vessels also have a minimum wage and a share regime but fuel costs are deducted before sharing.
There is no data available on unemployment in the fishing sector but indications suggest it is not a major problem. On the contrary, there rather appears to be a shortage of the number of men willing to stay in fishing. This shortage affects both small and large vessels alike.

4.4 UK fisheries

The English, Welsh and Scottish fleet employed 93 workers in 2007. Of those, 72 were employed in the North Sea (NS) and West of Scotland (WoS) demersal single rig fleet and 21 in the West of Scotland single rig nephrops trawl fleet. Vessels in single rig fleet had an average crew of 8, while the single rig trawlers had an average crew of 3
The main wage structure within the English, Welsh and Scottish fleet is crew share. Average crew share per vessel, in pounds sterling, by fleet are shown in Table 4-4.

Table 4-4 UK fleet. Average crew share per vessel. Pounds sterling
Source: Deepfishman Case study 1 C.

	2005	2006	2007
NS & WoS demersal single rig	230,300	367,100	284,300
WoS single rig nephrops trawl	32,900	30,200	48,900

4.5 Spanish Basque country fisheries

In 2001, the Spanish Basque country fleet employed 112 seamen, but in 2005 the total crew size had dwindled by a half. However, the average crew size has remained much the same, 13-16 seamen per ship, but the number of vessels taking part in the fishery has fallen from 8 to 4. Some of the workers in the Spanish Basque Country fleet are emigrants from Africa. An

association of producers acts as a fishermen's association in the Basque country fleet. The main wage structure within the Basque country fleet is crew share.

Table 4-5: Employment and average crew share (Euros) in the Spanish Basque country fleet.
Source: Diez (2009).

	2001	2002	2003	2004	2005
Number of seamen	112	78	96	56	52
Average crew share	588	247	323	402	463

4.6 Artisanal fisheries

4.6.1 Spanish seabream fishery

In 1986 there were 55 vessels in the *voracera* fleet with a total of 185 crew members, whereas in 2001 the 108 vessels taking part in the fishery had a combined crew of 356 members. Since the crew of anverage numbers 3-5 members, it is therefore likely that the current fleet of 103 boats employs 350-400 fishermen.

Most fishermen in Tarifa belong to the Brotherhood of Fishermen (*Cofradia de Pescadores*) which carries out several functions related to the fisheries, such as where, how and when partners can fish, safety issues at sea, fish sales and resolves conflicts between fishermen. The Brotherhood also defends the interests of the fishing community. Wages are usually based on some kind of share system

4.6.2 Greek seabream fishery

In 2008, the total number of fishermen employed by vessels taking part in the target red black-spot seabream fishery (gillnets & longlines) amounted to approximately 1,000 individuals. This number decreased to 555 fishermen on average, during the period 2003-2008. However, the vessels engaged in the red seabream fishery also take part in other fisheries and these figures therefore overestimate the local importance of the red seabrem fishery. Trammel net vessels employ the greatest number of fishermen which is not surprising considering the fact that those vessels are the most numerous. Gillnetters, trammel netters and longliners usually have a crew of 1-3, while trawl vessels have a crew of 5-6 members.

Table 4-6 Number of fishermen employed in the fishery by fishing gear type. Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008
Trawl	165	110	110	116	100	100
Gillnet	802	169	343	270	450	789
Trammelnets	1,253	1,636	2,083	1,989	2,326	4,226
Longline	15	27	86	66	80	233
Total	2,235	1,942	2,622	2,440	2,956	5,348

4.6.3 Portuguese scabbardfish fishery

Individuals taking part in the black scabbardfish fishery can broadly speaking be divided into three categories; crew, land-based employees and processing works. The crews are responsible for all the operations at sea and sometimes the preparation of fishing gear, but preparing the longline is otherwise in the hands of land-based employees. Sesimbra, the main port, has one processing firm where the catches are processed and packaged.

Table 4-7 Composition of workers in the black scabbardfish sector in 2009. Source: Deepfishman Case Study 3 C Report (2010).

			Processing		
	Crew	Land-based	Males	Females	Total
Employees	121.0	112.0	25.0	16.0	274.0
Average age	48.0	51.0		42.0	
Average work experienc	13.0	12.0		9.0	
Average experience in fisheries	32.0	51.0		9.0	

In 2009, there were 274 individuals employed by the fishery. The 17 vessels engaged in the fishery had a combined crew of 121, while further 112 employees were land-based. The crew of a typical vessel thus numbered seven, but the largest vessels had a crew of up to 10. The processing plant employed 25 men and 16 women. The overall share of women in the black scabbardfish workforce thus amounts to 6%.

The composition of sea and land crew for 15 out of the 17 total vessels in the fleet is presented in Table 4-8. Land-based employees tend to be as many as those employed on-board as it is possible for some of the on-board crew to prepare the fishing gear and hence reduce the need for land-based staff. The average number of workers per vessel is 16, but crew sizes differ somewhat between vessels with one vessel only having a cew of six. All of those directly involved in the fishery are men (Bordalo-Machado and Figueiredo, 2009) Wages are based on a share system, with approximately 40% of the sale of black scabbardfish shared amongst the crew.

Table 4-8 Number of workers for 15 out of the 17 vessels in the fleet in 2009. Source: Deepfishman Case Study 3 C Report (2010).

Vessel	Crew	Land-based	Total
1	7	9	16
2	8	7	15
3	8	6	14
4	8	9	17
5	8	10	18
6	9	6	15
7	6	0	6
8	9	6	15
9	9	11	20
10	10	9	19
11	7	6	13
12	8	10	18
13	6	9	15
14	7	8	15
15	8	9	17
Total	118	115	233
Average	7.9	7.7	

Most of those directly involved in the fishery were married and had children and even grandchildren. Taking into account the number of these dependencies, it can be estimated that around 1,100 individuals in Sesimbra depended on the fisheries for the livelihood. As Sesimbra had a total population of close to 38,000 in 2009, the black scabbardfishery can be estimated to have been the mainstay of around 2.6% of the population. These figures do not take into account the number of individuals indirectly linked to the fishery.

Table 4-9 Overview of workers and family dependent on the black scabbardfish sector in 2009. Source: Deepfishman Case Study 3 C Report (2010).

	Processing	Crew	Land-based	Total
Workers	41	121	112	274
Wives and husbands	25	99	90	214
Children	58	279	278	615
Total	124	499	480	1,103

4.7 Beaked redfish fisheries

4.7.1 Icelandic fishery

As Icelandic freezer trawlers have an average crew of 26, it can be estimated that the fleet of 13 trawlers taking part in the redfish fishery in 2007 employed 350 individual. However, this fleet is not only engaged in this particular fishery, but also fishes for other demersal species. Limitedinformation is available on the number of others directly or indirectly involved in the fishery.

In the Icelandic pelagic redfish fisheries, as in other Icelandic fisheries, wages take the form of share wages. Icelandic fishermen are members of The Fishermen's Association of Iceland (*Sjómannafélag Íslands*) and skippers are members of The Association of Ship Captains (*Félag Skipstjórnarmanna*).

4.7.2 Norwegian fishery

In recent years, the number of vessels engaged in the beaked redfish fishery has fluctuated between 4 and 8. Assuming a crew of around 25, it can be estimated that the fishery has employed 100-200 seamen.

4.8 NAFO Greenland halibut fishery

4.8.1 Spanish fishery

The freezer-trawlers have a crew of about 24 persons, but the number of seamen can be considerably higher as the same members do not always make up the crew. As mentioned above, 14 Spanish trawlers took part in the Greenland halibut fishery in 2008. Assuming an average on-board crew of 24 and a partial second shift of 12 it can be estimated that there were about 500 individuals employed by the halibut fleet. The crews were all-males.

In recent years an increasing number of the crew, mostly deckhands, has been made up of immigrants from Africa and Latin America. However, no information is available on the share of these immigrants in the workforce at sea.

A share system with a fixed minimum wage is the most common form of wage agreement in both the Spanish and Portuguese NAFO fleets.

The trawlers process their catches at sea but some further processing may also take place on land. No information is available on the number of persons engaged in land-based processing or marketing. The majority of workers in the Spanish fish processing plants are women. Information is unavailable on unionization of the Spanish fleet.

4.8.2 Portuguese fishery

The Portuguese vessels are generally larger with an average crew of 35 full time persons, all males. Assuming some level of crew rotation it can be estimated that 50 persons make up the crew of each vessel. Since there are 13 vessels currently in the Portuguese NAFO fleet, it can therefore be estimated that 650 individuals are engaged in the Greenland halibut fishery.

Althoug the main crew members are Portuguese, the crew is also made up of immigrants from Africa, Eastern Europe and even Indonesia. The share of these foreigners in the workforce is though small, probably no larger than 10-15%. There are at least two unions present and active in the Portuguese work collective agreement.

4.9 Conclusion

As noted in Section 3, most of the industrial fleets engaged in the deep-water fisheries analysed here have in recent years only contained few vessels. The number of individuals employed by the harvesting is, consequently, small. In 2006/2007, there were probably around 70 employed by the two vessels taking part in the Namibian orange roughy fishery. The Irish long-liners and trawlers had on average a crew of 8-10, and the fleet in 2005 probably only employed around 50 seamen. The largest Fench trawlers usually command a crew of 14-15, whith smaller vessels employing 7-9. The seven vessels active in the deep-water fisheries in recent years have thus probably employed around 100 individuals. The UK fleet employed 93 workers in 2007 and the Spanish Basque country fleet around 50 in 2005. Employement in The Icelandic fleet engaged in the redfish fishery probably totalled around 350 seamen in 2007, while the Norwegian fleet probably employed a third of that. The combined crew of the large Portuguese and Spanish off-shore fleets can be estimated at 500 and 650 members respectively. Taken together all the industrial fleets can thus be estimated to have directly employed around 2,000 individuals in recent years, all males.

The total employment of the artisanal fleets of the Mediterranean countries can be estimated at 1,150-1,200. The Greek fleet is estimated to have engaged around 550 individuals in recent years, the *voracera* fleet 350-400 and the Sesimbra fleet 230.

Some kind of a share system is the most common renumeration method in all fisheries. In boom times when catches are good and/or prices high, wages will therefore be high and the fishery an attractive way of living. In other times, when catches and/or prices are low the fishery may find it difficult to man the vessels taking part in the fishery.

5 Processing and markets

5.1 Orange roughy in Namibia

Orange roughy catches were processed into fillets which were land or sea frozen, fully interleaved and sold in shatter packs weighing between 6 and 10 kilograms per carton. The smaller and skinless fillets were sold in re-sealable retail packages. All catches were exported to makets in the United States.

Table 5-1 Landings and value of production by fishing season. Source: Source: Deepfisman Case Study Report 1 A (2010).

Season	Landings (tons)	Value (N$ million)
2004/2005	1188	N$3.6
2005/2006	267	N$8.2
2006/2007	487	N$3.8

In 2006/2007 total orange rougy landings amounted to N$3.8 In value added terms, fishing and fish processing represented 4.9 per cent of the Namibian gross domestic production

(GDP) in 2007. However, the decline of orange roughy catches has lowered the fishery‘s contribution to GDP to a minimum.

5.2 France

Almost all of the deep-water fish landings in France are bought by processing factories and filleted. The bulk of the deep-water landings are found on the domestic market as fresh fish fillet in retail shops and supermarkets. Catches of the French fleet are sold in auctions in Boulogne-Sur-Mer, Lorient and Concarneau

5.2.1 Orange roughy

France is the most important market for orange roughy in Europe and catches of both French and Irish vessels are transported from the ports of landing in Ireland and Scotland to the mainland where they are sold in auctions. There is no tradition and market for deep-water fish in Ireland. Transport and logistics facilities have been developed for catches from all the west coast of the British Isles, and the Irish industry has taken advantage of this infrastructure to transport catches of deep-water species to mainland markets.

Irish landings are either sold in auctions or to single buyers or coops. In the latter two cases prices are to a large extent determined by auction prices. Most of the orange roughy catches are bought by processing firms, which fillet the fish and sell it fresh in the domestic market. Prices are to a large extent determined by demand and supply, but it is possible for buyers to keep the fish for a few days withouth the quality deteriorating. This gives buyers some possibilities to adapt to market conditions.

Table 5-2 reveals the development of prices of Irish catches in French auction in recent years. Although there has been some year-to-year variation, prices have generally been rising in nominal terms.

Table 5-2 Average prices in (€ per kg) for Irish catches of orange roughy in French auction markets.

	Bologne	Le Guilbinec	Concarneau	Lorient
2000	4.4	4.3	2.2	4.0
2001	3.8	3.5		3.6
2002	4.6	4.5		4.6
2003	5.7	5.5	4.6	5.3
2004	5.9	5.4	5.1	5.1
2005	5.9	6.5	6.5	5.4
2006	6.3	5.9	6.0	5.3
2007	6.1	6.3	6.8	6.7
2008	5.7	5.7	7.9	6.5

Landings of French vessels are also sold in auctions. Even though one of the companies operating a trawler is a subsidiary of a supermarket business, which also owns processing plants, it has no preferential arrangement for the sale of the vessel’s catches, which all end up in auctions. As revealed in Figure 5-1, the amount sold in auctions has been declining in the last few years, but prices have risen almost continuously.

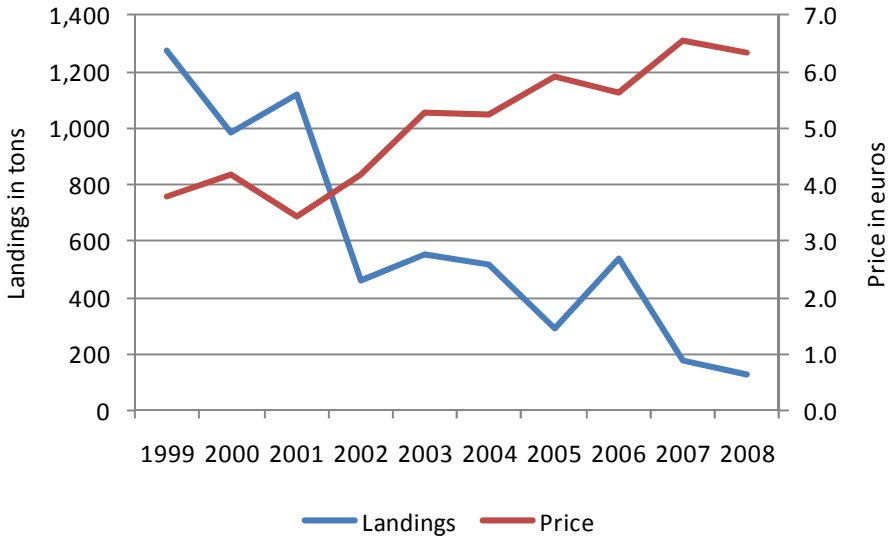

Figure 5-1 Landings and prices (€ per kg) for French catches of orange roughy at French auctions. Source: Deepfishman Case Study 2 report.

As Figure 5-2 clearly reveals, the development of prices in open auctions in France has been very similar for catches of French and Irish vessels.

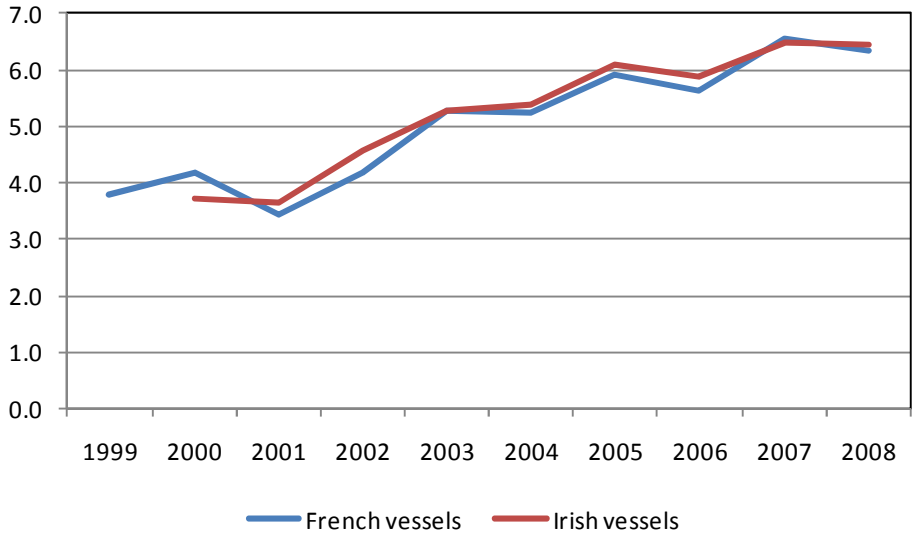

Figure 5-2 Comparison of average prices (€ per kg) of landings from French and Irish vessels.
Source: Deepfishman Case Study 1 B report and Deepfishman Case Study 2 report.

In 2006, there were 324 companies active in the whole sector, 287 in processing and 50 in mixed wholesale-processing. Annual turnover for these sectors were 1703, 3753 and 522 million Euros respectively. A total of 5,500 persons were employed by wholesale firms and 13,000 by processing plants. The vast majority of the processing plants is located in coastal regions; in the North, Normandy, Brittany, along the Atlantic coast and in the Mediterranean

area. The processing plants can be described as fishmonger workshops that typically employ 50-500 workers.

5.2.2 Blue ling

Although landed in UK and Irish ports, deep-water fish caught by the French fleet is sold in French auction markets in Boulogne-Sur-Mer, Lorient and Concarneau. All the catches from French vessels are landed fresh and sold on the domestic market with the exception of some deep-water sharks that have in recent years been exported to Spain and Italy. Up to the 1980's blue ling was fished by French freezer trawlers but these vessels abandoned that fishery in the late 1980's or early 1990's. The product of these vessels was processed further in land-based factories and sold as frozen fillets or ready-cook dishes

There has been some marketing of blue ling roe, but little information is available on how successful the marketing has been. Average prices in France have remained stable in recent years, averaging at € 2.0-2.4 per years during the period 2006-2008. As revealed in Figure 2, there are though considerable season price fluctuations with lower prices during the months May-July than other months of the year.

5.2.3 Other species

Greater forkbeard are landed gutted, roundnose grenadier is either gutted and tailed or only tailed and black scabbardfish is gutted and headed. Deep-water sharks were sold as *saumonette*, i.e. not filleted but headed, tailed and skinned whole fish. All deep-water species are sold on domestic markets with the exception of some deep-water sharks exported to Spain and Italy. This export is though too limited to appear in official statistics.

Figure 5-3 shows landings for the period 1999−2008 for the species under question. With the exception of the greater forkbeard and the black scabbardfish, landings for all species have dropped. Orange roughy has the largest relative drop in landings, with a decline of 90 per cent, landings deep-water (siki) sharks and roundnose grenadier have diminished by 75 per cent, and landings of blue ling have been halved. Greater forkbeard and black scabbardfish landings have increased by half over the period. EU TACs for siki sharks and orange roughy were set at 0 in 2010, and since allowance is only made for a small bycatch only, these species will almost disappear from the landing. It is therefore likely that landings will be limited to small catches in Faeroese waters, where EU TACs do not apply.

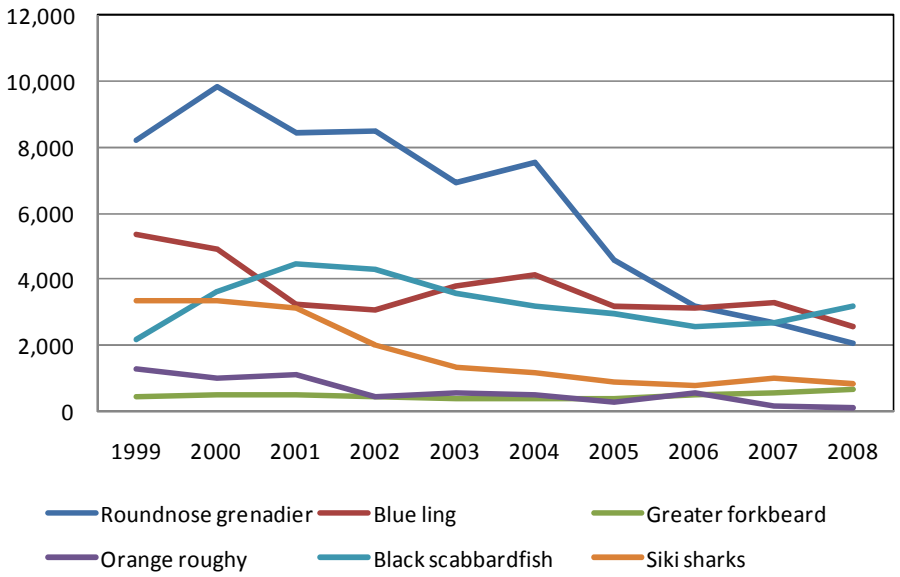

Figure 5-3 Landings of the French deep-water fleet by years. Tonnes.
Source: Deepfishman Case Study 2 Report (2010).

Auction prices vary greatly by species. In addition, prices differ between ports and seasons, and have been changing over time. As shown in Figure 5-4 orange roughy fetched the highest price, which in 1999 amounted to €3.8 per kg but had increased to €6 per kg in 2008. The price of other species also rose over the period but not to the same extent as the price for orange roughy. To a large extent, the price development in Figure 5-4 can be traced to changes in supply. Landings of orange roughy, for instance, decreased by 90 per cent over the period and this development had understandably a considerable impact on prices.

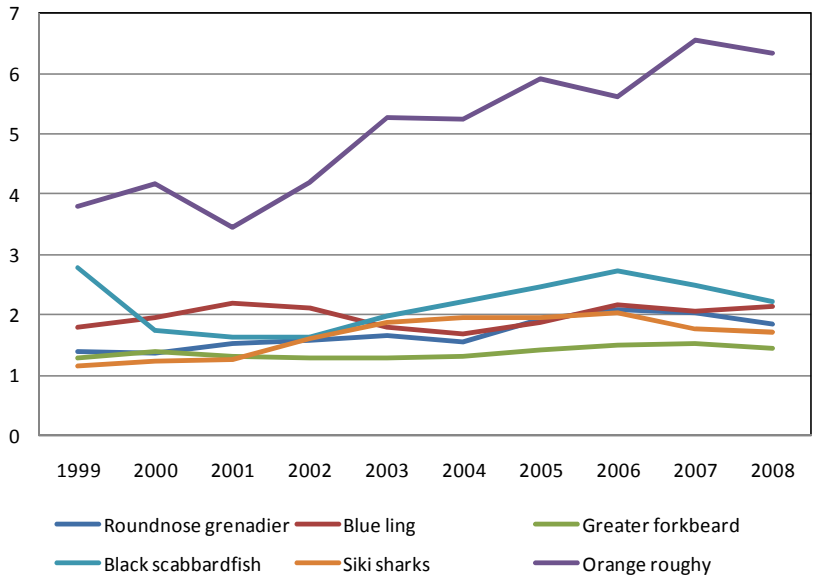

Figure 5-4 Average prices of catches of deep-water species at French auctions. € per kg.
Source: Deepfishman Case Study 2 Report (2010).

As a result of the decrease in catches, the value of landings has fallen, with the exception of greater forkbeard and black scabbardfish which saw an increase in landings over the period.

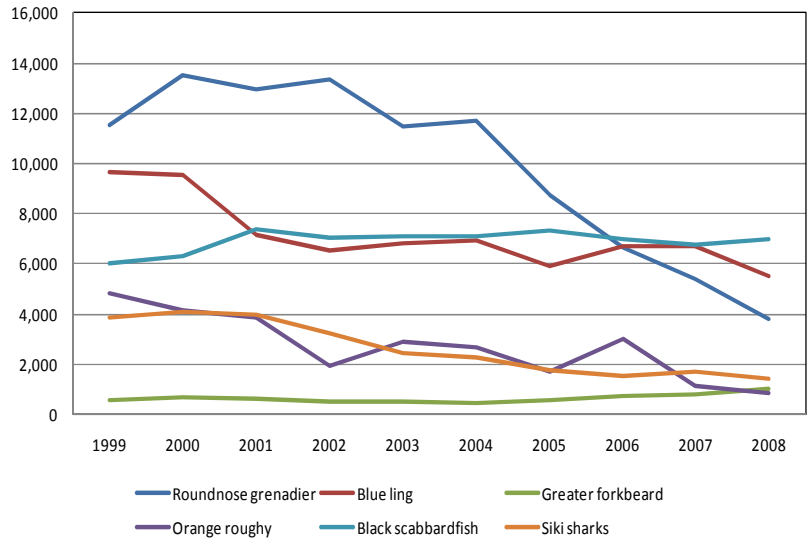

Figure 5-5 Value of deep-water catches per year: € '000.
Source: Deepfishman Case Study 2 Report (2010).

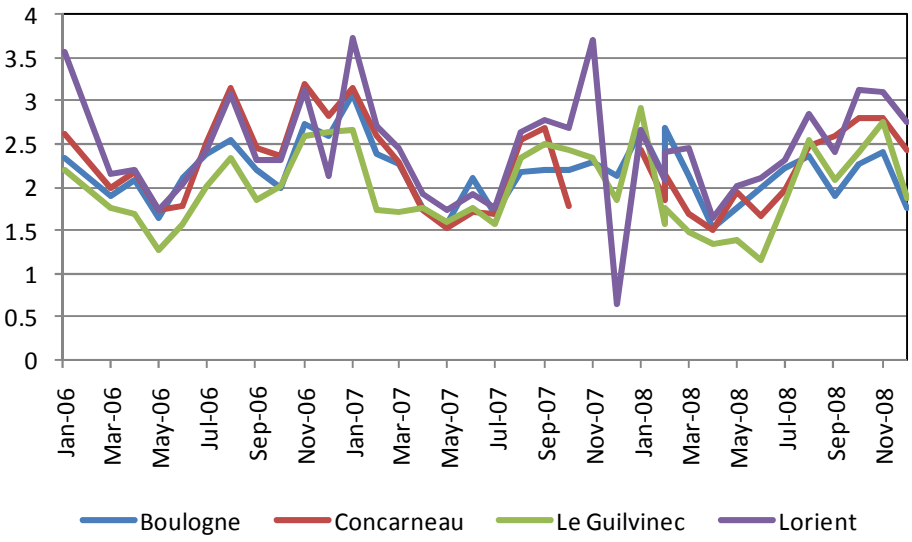

Figure 5-6 Average price by port for the French market in. € per kilo.
Source: Lorance, 2009

5.3 UK

The English, Welsh and Scottish market for southern blue ling is characterized by open auctions in Scotland whilst the landings are mainly exported to France. Blue ling is mainly either fillet or whole fish. As shown in Table 5-3, prices have fluctuated between € 1.1 and €2 in recent years. In 2008, UK vessels were on average receiving lower prices than French vessels.

Table 5-3 Average prices in the English, Welsh and Scottish market. € per kg. Source: Metz (2009).

	2005	2006	2007	2008
Passive	2.02	1.14	1.5	N/K
Trawlers (mainly nephrops)	1.87	1.8	1.78	1.38
Whitefish	1.5	1.47	1.78	1.68

5.4 Spanish Basque country

The Basque country market for southern blue ling is characterized by open auction with landings predominantly sold in non-local markets. Table 5-4 presents the average price of blue ling, as determined by auction, in € per kg. Prices in 2005 were comparable to those fetched by UK vessels. Only a very small quantity of blue ling is sold in the Basque country as fresh fish for consumption, but most is processed outside the Basque country.

Table 5-4 Average price and value of landings by the Basque country fleet. € per kg. Source: Diez, 2009.

	2001	2002	2003	2004	2005
Average price	1.8	2.3	1.7	2.4	1.8

5.5 Spanish seabream

Catches of red seabream of the *voracera* fleet are sold fresh in open auctions, organised by the Brotherhood of Fishermen. The largest share of the catches are then transported mainly to the northern and central Spain and sold there. Important markets are also found in other parts of Spain, as well as some other EU countries, i.e. Italy and Portugal.

Quantity sold has more than doubled from 2006 to 2009. The total value of the catch has also been rising steadily over the years, with average prices increasing slightly during 2006-2008 before declining again in 2009.

Table 5-5 Red seabream landings in Tarifa. Quantity sold and values. Source: Deepfishman Case Study 3 A Report (2010).

	2006	2007	2008	2009
Quantity sold, tons	161.8	278.2	291.0	432.4
Value. € '000	2,546.3	4,432.6	4,876.8	5,777.1
Average price, € per kg	15.73	15.94	16.76	13.36

Catches are classified into four categories after size, with the largest fish generally fetching the highest auction prices. However, catches in the second largest category are usually more expensive than the largest individuals. This is clearly revealed in Figure 5-7, which shows development of prices of the four catch categories during the period 2007-2009. The strong

seasonality of prices is also evident from the figure, with prices for the smallest fish usually higher during the summer, for example due to increased demand from restaurants. The largest two categories also show price fluctuations during Christmas time because the red seabream is a traditional Christmas dish in several regions of Spain. During this time the largest category of catches becomes the most valuable category.

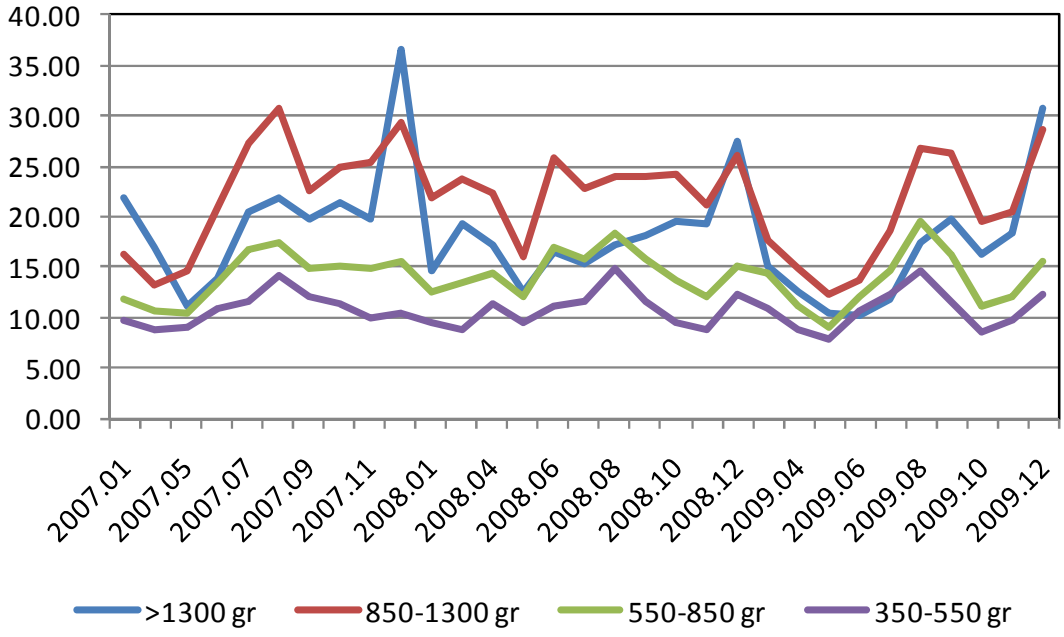

Figure 5-7 Average price of catch landed in Tarifa. € per kg.
Source: Source: Deepfishman Case Study 3 A Report (2010).

5.6 Greek seabream

Landings of red seabream are sold on local markets for direct consumption, or transported to non-local markets of metropolitan areas such as Patra, Preveza, Mesolonghi and Athens. Cathces of the trawlers are sold in open auctions, while landings by netters and long-liners are usually sold to a single buyer such as fish merchants, restaurants, hotels or individuals. In all cases the market demand is for fresh fish. Estimated landings by fishing gear for the years 2003 to 2008 are presented in Table 5-6 and revenue in Table 5-7.

Table 5-6 Estimated landings by fishing gear type.
Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008
Trawl	1.3	1.5	1.5	1.3	1.0	1.0
Gillnets	95.3	91.1	147.2	106.6	144.0	82.6
Trammelnets	13.6	24.4	1.3	17.5	20.0	24.3
Longline	2.0	3.6	24.1	42.9	33.0	19.0
Total	112.2	120.6	174.2	168.3	198.0	126.9

Table 5-7 Revenue figures by fishing gear type.
Deepfishman Case Study 3 b Report (2010).

	2003	2004	2005	2006	2007	2008	2009
Trawl	219	414	270	212	196	200	252
Gillnet	881	4,468	3,092	2,436	2,515	1,256	2,441
Trammelnets	80	123	4	54	68	69	67
Long lines	1,010	1,101	2,028	4,020	3,242	982	2,064
Total	2,190	6,107	5,394	6,723	6,020	2,507	4,824

5.7 Portuguese scabbardfish

Catches of black scabbardfish are landed fresh and gutted inport at Sesimbra. In recent years, the majorityof catches have been bought by a single buyer, *ArtesanalPesca*, the local association of producers and ship owners, which is responsible for the processing and commercialization of the fish. The price of fish is set according to a pre-established contract between the buyer and fishermen. During the last decade black scabbardfish has developed into one of the main commercial deep-water species caught in Europe. The black scabbardfish caught and processed in Portugal is regarded as a higher quality fish than landings by French and Spanish trawlers because the fish is landed whole with the skin still on. French and Spanish vessels use trawls and this fishing method rips the skin of the fish. In addition, these vessels freeze their catches aboard.

Black scabbard fish is sold as fresh wholefish, fresh and frozen fillets, and frozen fish steaks. The fish is mainly sold in the domestic market, with approximately 60-70% going to large distribution chain stores and about 10% to the local market. Moreover, about 10-15% of the fish is sold to as frozen products.

Sesimbra is the main landing port in mainland Portugal, with landings in the years 2006-2008, amounting to half of total landings in Portugal.

Table 5-8 Total landings and value for both Sesimbra and Portugal, 2006-2008.
Source: Deepfishman Case Study 3 C Report (2010).

	2006		2007		2008	
Area	Sesimbra	Portugal	Sesimbra	Portugal	Sesimbra	Portugal
Volume (tons)	2656	5446	3421	6378	3591	6710
Value (€ '000)	7056	13755	10003	17803	10612	18021

Landings in Sesimbra and average prices received in the years 2006-2008 (€ per kg) are shown in Figure 5-8. Prices have fluctuated between €2.0-3.0, and do not appear to have been too greatly affected by variations in landings.

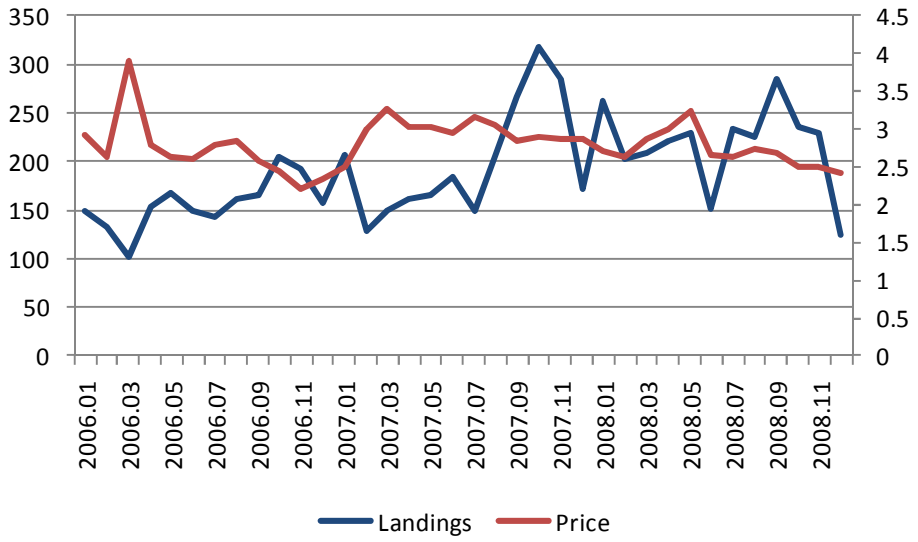

Figure 5-8 Total landings in tonnes (left axis) and average price in € per kg (right axis). Source: Deepfishman Case Study 3 C Report (2010).

5.8 Beaked redfish

5.8.1 Iceland

The Icelandic vessels are mainly freezer trawlers and the product is frozen at sea and landed as such. However, there are some fresh landings that are sold on local markets in Iceland as well as in Germany, Russia, and Japan. No information is available on landings for other fleets.

Table 5-9 presents the total quantity landed in Iceland and the value of the catch both in Icelandic krona (ISK) and Euros (€).

Table 5-9 Landings (tonnes) and value of beaked redfish in Iceland. Source: Statistics Iceland and Central bank of Iceland.

Year	Quantity	Value ISK million	Value € '000
2003	48.402	3,210	37,010
2004	36.826	2,637	30,264
2005	16.005	1,666	21,321
2006	24.646	3,130	35,680
2007	19.919	1,836	20,954
2008	6.786	921	7,228

Figure 5-9 shows both the total quantity landed (left axis) and the average price in € per kilo (right axis) of the redfish for the Icelandic landings.

Figure 5-9 Landings (left axis, in tonnes) and prices (right axis, in € per kg) for Icelandic catches. Source: Statistics Iceland

5.8.2 CS4 – Norway

Most of the catch of *S. mentella* caught by Norwegian vessels is processed frozen. A common form is the "Japanese cut" (headed) for export to the Japanese market. Some of the fish is also sold fresh on local markets as well as exported fresh.

Norwegian exports of *S. mentella* are revealed in Table 5-10. In the beginning of the 2000s most of the exports were frozen products, but in later yeras the relative share of fresh products has increased considerably.

Table 5-10 Norwegian export in tonnes by product type.
Source: Kaspersen 2008.

	Whole frozen	Whole fresh
2000	11,681	6,809
2001	9,253	9,353
2002	5,362	5,677
2003	5,344	5,982
2004	4,192	6,535
2005	3,630	4,313
2006	2,984	7,109

Prices for both frozen and fresh products increased substantially in the period 2000-2006. In the beginning of the period both products sold for about €1.60, but in 2006 the prices of frozen redfish had risen to €2.50 and for fresh redfish to €2.20.

Table 5-11 Product prices in €.
Source: Kaspersen 2008, Central bank of Norway.

	Whole frozen	Whole fresh
2000	1.63	1.58
2001	1.76	1.74
2002	2.07	1.61
2003	1.90	1.32
2004	2.04	1.43
2005	2.25	2.00
2006	2.50	2.20

5.9 NAFO Greenland halibut

Catches of the Spanish and Portuguese NAFO fleets are landed in either country, with Vigo in Galicia in Spain being the most important port. The frozen catch is usually exported. For the Spanish fleet the most important frozen products are sold with skin for the national market, and without skin for the Japanese market. The fish is sometimes sold filleted with and without skin but this is uncommon. The principal export markets for Spanish Greenland halibut products are Portugal, France and Japan. The products are sold in open auction after processing.

The Portuguese vessels also process their catches on board; head and guts are removed and the fish then frozen by size category. After the landings have been sold buyers may process the fish further according to their needs and preferences. Portugal exports the majority of its Greenland halibut landings to Asian countries, such as Japan, China, and Korea, but and also to Europe. The exports are sold through brokers.

5.10 Conclusions

Trawlers in the large Icelandic, Portuguese and Spanish industrial fleets usually freeze their catches on-board and the products are then usually exported. Norwegian catches of redfish are either exported frozen or fresh, with exports of the latter having increased in recent years.

As France is the most important European market for deep-water fish products, catches of the Irish, UK and France deep-water fleets are usually transported to France and sold there in acutions or at auction prices. Limited processing takes place in Ireland and the UK, but transport and logistic facilities have been developed in British Isles for swift transport to the mainland.

In 2006, there were 324 companies active in the French fish processsing and marketing sector, and the sector employed a total of 18,500 individuals and a turnover of 1,703 million euros. Most of the firms are located in coastal areas.

Catches of the artisanal fleets are usually sold in open auctions in the port of landing for direct consumption or further processing. The black scabbardfish is though sold fresh or frozen. Most of the black scabbardfish catches are bought by large distribution stores, but only a small portion sold in the local market.

6 Financial performance

6.1 Ireland

At the hight of the direct fishery for orange roughy in the years 2001-2004, normal revenue per week in Ireland was approximately €100,000-200,000. When fishing on peaks, fuel consumption was approximately 2,500 litres per day, but 6,000 litres when fishing flat grounds. Total cost per week was approximately €20,000. Annual capital costs varied between €700,000 and €1.1 million. As these figures indicate, the fishery enjoyed huge profits and there were anecdotes of skippers retiring early.

The financial performance of the Irish trawler fleet is presented in table 18 below. The data is not specific for the trawlers participating in the blue ling fishery. No data is available for the larger trawlers. The smaller trawlers have been operated with profits for the period 2005-2007. There are currently no subsidies in force for deep-water fisheries in Ireland.

Table 6-1 Financial performance of the Irish fleet al.l figures in € million. Source: AER 2009.

	2005	2006	2007
24-40 m			
Income	39.6	26.9	28.0
Costs	38.2	25.1	24.4
Profits	1.4	1.8	3.5

6.2 France

No data exist for the French deep-water fleet, but the financial performance of the two above-mentioned fleet segments are provided in Table 6-2. The largest trawlers have been operated with losses in recent years, but the smaller vessels turned profits in 2007, after sustaining losses in the previous two years.

Table 6-2 Financial performance of the French fleet al.l figures in € million. Source: AER 2009.

	2005	2006	2007
24-40 m			
Income	84.1	85.7	89.9
Costs	91.2	89.4	85.9
Profits	-7.1	-3.7	4.0
> 40 m			
Income	48.7	50.0	46.3
Costs	52.5	55.5	50.9
Profits	-3.8	-5.5	-4.6

Subsidies in France are for the whole fishing and aquaculture industry, and not specifically for the deep-species segment. According to information from The Ministry of the Environment,

Sustainable Development and the Sea website, gross monthly salaries for skippers range from €1900-10,000 and from €1500-3800 for deckhands.

6.3 UK

The financial performance of the UK trawler fleet is presented in table 6-3. Because no data is available for the UK deep-water fleet, the numbers in the table can only be interpreted as an indication of the financial performance of the trawlers participating in the southern blue ling. The smaller trawlers have remained profitable for the time period while the larger trawlers showed slight losses in 2006.

Table 6-3 Financial performance of the UK fleet al.l figures in € million**.**.
Source: AER 2009.

	2005	2006	2007
24-40 m			
Income	117.6	126.3	128.4
Costs	116.8	118.7	118.3
Profits	0.9	7.6	10.0
>40 m			
Income	49.8	30.7	39.6
Costs	46.2	30.8	33.3
Profits	3.6	-0.1	6.3

6.4 Spanish Basque country

During the years 2001-2005, the Spanish Basque country fleet was only once – in 2002 – operated with profits. In other years, losses have been high, even amounting to almost 80% of revenue in 2004. It should be noted that profits are calculated as revenue less both variable and fixed costs.

Table 6-4 Financial performance of the Spanish Basque country fleet. € '000. Source: Diez, 2009.

	2001	2002	2003	2004	2005
Total revenue	1,323.8	1,022.6	860.3	1,046.2	1,433.7
Total variable cost	1,111.8	419.8	662.8	776.5	1,029.0
Total fixed cost	713.5	592.0	766.0	1,088.1	1,133.6
Profit*	-501.5	10.9	-568.4	-818.3	-728.9

* Profit = revenue – (fixed + variable costs).

6.5 Artisanal fisheries

6.5.1 Greek seabream fishery

The financial performance of the trawl fleet on the one hand and gillnetters, trammel netters and longliners on the other is analysed in Tables 6-5 and 6-6 respectively. Net income is here defined as income minus variable costs other than fuel, fuel costs and fixed costs. This definition of net income does therefore not make allowance for wages. In order to assess the

profitability of the fishery, it is therefore necessary to subtract wages and associated costs from net income. The information on wage costs is, however, unavailable.

Table 6-5: Financial performance of the trawl fleet. Deepfishman Case Study 3 b Report (2010).

	2004	2005	2006	2007
Income	439,108	619,958	289,865	834,341
Variable cost	33,876	19,447	34,316	62,619
Fixed cost	4,431	5,351	4,594	2,236
Fuel cost	137,721	64,409	74,166	124,471
Net income	263,080	530,751	176,789	645,015

Table 6-6: Financial performance of the gillnet, trammelnet and longline fleet. Deepfishman Case Study 3 b Report (2010).

	2004	2005	2006	2007
Income	52,476	98,585	94,021	125,818
Variable cost	3,375	8,884	5,569	6,163
Fixed cost	423	493	441	665
Fuel cost	11,377	9,164	9,321	13,442

The income and costs figures refer to the whole fleet segments, and not just those vessels that take part in the red black-spot seabream fishery. Information on cost and revenue in that fishery *per se* is limited.

6.5.2 Portugues scabbardfishery

During the period 2006-2008, the black scabbardfishery was always operated with a profit. Both costs and revenues increased by 150% from the previous year in 2007 and 2008.

Table 6-7 presents revenues, costs, and profits for the years 2006-2008 for ArtesanalPesca, the local association of producers and ship owners.

Table 6-7 Financial performance of ArtesanalPesca, 2006-2008. Source: Deepfishman Case Study 3 C Report (2010).

	Revenue	Costs	Profits
2006	1,669	1,394	274
2007	4,308	4,254	54
2008	10,985	9,612	1,372

Some vessels have applied for subsidies from the European Union in order to modernize their vessels. These subsidies are intended for the purchase of technical equipment such as radios and also for plastic materials in which to increase the storage quality of fish.

6.6 Iceland

No separate statistics exist for the redfish fleet as such, but the economic performance of the Icelandic freezer trawler fleet is presented in Table 6-8. Although these trawlers catch other fish stock as well as the pelagic *S. mentella*, the results give an indication of the overall financial performance of these vessels. For the years considered here, the fleet was always operated with substantial profits.

Table 6-8 Financial performance of Icelandic freezer trawlers. Source: Statistics Iceland and Central bank of Iceland.

	2003	2004	2005	2006	2007	2008
ISK million						
Income	19.84	23.415	29.871	28.209	27.731	37.722
Costs	15.352	18.945	22.883	20.8	22.439	29.386
Profits	4.487	4.47	6.989	7.409	5.292	8.336
€ million						
Income	229	269	382	322	317	296
Costs	177	217	293	237	256	231
Profits	52	51	89	84	60	65

6.7 Norway

Revenues and costs for the Norwegian redfish industry for the years 2003-2005 are presented for the conventional fleet and industrial fleet in Tables 5 and 6 resepectively. As revealed in Table 6-9, the conventional fleet was operated with a profit in the years 2003-2005.

6-9 Financial performance of the conventional fleet (NOK '000). Source: Central bank of Norway.

	Revenue	Cost	Profit
2003	43.761	43.043	718
2004	42.94	41.388	1.552
2005	42.302	39.309	2.993

Table 6-10 reveals the financial performance of the industrial fleet which can be used as a proxy for the *S. mentella* fishery for the years 2003-2005. Here, losses are observed in the year 2003, but profits in the two later years. There are no known direct subsidies for the fishery

6-10 Financial performance of the industrial fleet (NOK '000).
Source: Central bank of Norway.

	Revenue	Cost	Profit
2003	3.568	3.771	-203
2004	4.558	4.324	234
2005	8.217	7.471	746

6.8 Spanish NAFO fleet

In a recent study, Garza-Gil and Varela-Lafuente (2009) analyse the profitability of the Spanish Greenland halibut fishery. Using data for the years 2001-2005, they show that during this period net profits were 10-22% of income of the fleet. Income from the NAFO fisheries amounted to more than half of total income in the first part of the period, but in 2004 and 2005 income from fishing in other areas accounted for more than half.

Table 6-11 Economic performance of the Spanish NAFO fleet in 2001-2005. EUR '000 in fixed (2005) prices.
Source: Garza-Gil and Varela-Lafuente (2009).

	2001	2002	2003	2004	2005
Variable costs, incl. wages	106,009	103,584	100,403	81,537	73,258
Income	161,821	143,679	144,083	108,978	97,164
NAFO income	85,323	72,179	76,948	53,399	46,124
Income from other areas	76,498	71,500	67,135	55,579	51,040
Gross cash flow	55,812	40,095	43,680	27,441	23,906
Amortisations	18,871	20,513	16,865	14,218	12,333
Interest	1,963	1,846	2,003	2,260	2,181
Net profits	34,978	17,736	24,812	10,963	9,392
Net profits as % of income	21.6	12.3	17.2	10.1	9.7

Although the Spanish fleet is engaged in other fisheries than the Greenland halibut fishery, that fishery has been very important in the last two decades. In the years 2001-2005, 43.6% of the fleet's landings came from NAFO zones, and of this 43.6%, 32.8% corresponds to the Greenland halibut landings. The figures above can thus be assumed to reflect well the profitability of the halibut fishery. In their study, Garza-Gil and Varela-Lafuente (2009) conclude that "the Spanish Greeland halibut fleet ... generates possibilitites for profitability higher than those that might be obtained by making alternative investments" (p. 257).
Since NAFO's Greenland halibut recovery plan was initiated in 2003, total allowable halibut quotas have been cut drastically. This decrease in quotas and landings has seriously affected the Galilcian economy. In a recent report it is estimated that the recovery plan may have caused a direct loss of more than 500 jobs and economic losses of at least EUR 300 million from 2003 to 2010.[1] The report further states that for each million euros lost due to smaller

[1] FIS World News. See: http://fis.com/fis/worldnews/worldnews.asp?monthyear=9-2009&day=25&id=33963&l=e&country=0&special=&ndb=1&df=0.

catches in the NAFO area, the Galician economy would shrink by EUR 2.25 million and 43 full-time jobs would be lost.

6.9 Conclusions

The financial performance of the deep-water fleets, or segments to which these vessels belong, varies considerably, both between fisheries, as well as betwee years.

The Irish orange roughy enjoyed huge profits at first, but their performance deteriorated thereafter. In 2005-2007 the fleet was though operated with profits. The French fleets were run with losses in 2005-2008, except the smaller vessels (24-40 meters) in 2007. The UK fleet has generally experienced profits in recent years, whereas the Spanish Basque country fleet has most often in the last few years been operated with losses.The Spanish NAFO fleet and Norwegian fleet have both enjoyed decent profits, but the Icelandic deep-water fleet appaers to have constantly outperformed the other industrial fleets.

Information on the artisanal fleets is limited. The trawl vessel segment of the Greek fleet though appears to have been doing quite well, and the Portuguese black scabbardfish fishery has also enjoyed profits in recent years.

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