

Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries

DTU Aqua Report No. 263-2013

Nielsen, J. Rasmus; Ulrich, Clara; Hegland, Troels Jacob; Voss, Birgit de; Thøgersen, Thomas T.; Bastardie, Francois; Goti, Leyre; Eigaard, Ole R.; Kindt-Larsen, Lotte

Publication date:
2013

Document Version
Early version, also known as pre-print

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Nielsen, J. R., Ulrich, C., Hegland, T. J., Voss, B. D., Thøgersen, T. T., Bastardie, F., Goti, L., Eigaard, O. R., & Kindt-Larsen, L. (2013). *Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries: DTU Aqua Report No. 263-2013*. DTU Aqua - Institut for Akvatiske Ressourcer. http://www.aqua.dtu.dk/english/~media/Institutter/Aqua/Publikationer/Forskningsrapporter_251_300/263-2013_Critical_report_of_current_fisheries_management_measures_implemented_for_the_North_Sea_mixed_demersal_fisheries.ashx

General rights

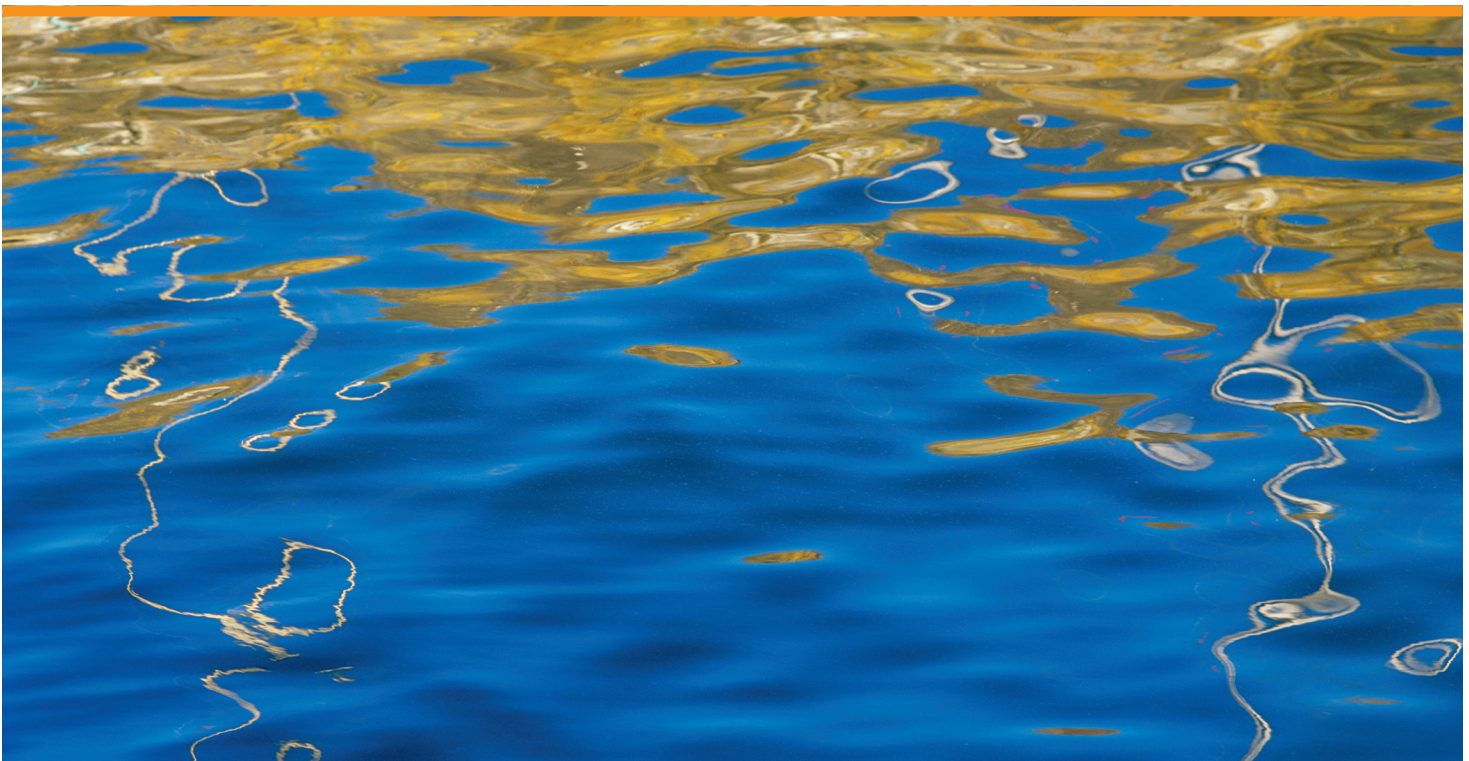
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries



DTU Aqua Report No. 263-2013

By J. Rasmus Nielsen, Clara Ulrich, Troels J. Hegland, Birgit de Voss, Thomas T. Thøgersen, Francois Bastardie, Leyre Goti, Ole R. Eigaard and Lotte Kindt-Larsen

Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries

DTU Aqua Report No. 263-2013

By J. Rasmus Nielsen, Clara Ulrich, Troels J. Hegland, Birgit de Voss, Thomas T. Thøgersen, Francois Bastardie, Leyre Goti, Ole R. Eigaard and Lotte Kindt-Larsen

This report is a deliverable of the project *Socio-economic effects of management measures of the future CFP* (SOCIOEC). The project is co-funded by the European Commission within the Seventh Framework Programme

Table of contents

Abstract.....	5
1. Introduction	9
2. Historical background	9
3. Fleets and fisheries	11
3.1 Economic Results for the North Sea Fisheries	11
3.2 Size/Average length/HP of vessels	13
3.3 Type of activities in terms of gear and target species	13
3.4 Spatial distribution of fishing effort.....	14
3.5 Harvested stocks and resources	15
3.6 Ecosystem Considerations in relation to relevant single stock assessment	17
4. Management processes.....	21
4.1 Science and provision of scientific management advice	21
4.2 Operational policy	22
4.3 Decision-making	23
5. Management objectives and principles	35
5.1 FAO Code of Conduct and EU CFP Objectives.....	35
5.2 Regional objectives.....	35
5.3 National objectives	36
6. Management strategies.....	37
7. Management tools	39
7.1 Conservation measures	39
7.2 Access regulations	45
7.3 Compliance monitoring measures.....	50
8. Management performances	53
8.1 Conservation	53
8.2 Economics.....	58
8.3 Social aspects	59
9. Conclusions	63
10. ... References	67
APPENDIX A: Effort Distribution – North Sea	73

Abstract

The present report is an EU-FP7-SOCIOEC Report giving an overview and critical evaluation of the current management measures implemented for the North Sea mixed demersal fisheries and the fish stocks involved in this. Also, this involves review and critical evaluation of the scientific advice supporting the fisheries management for the North Sea mixed demersal fisheries and the stocks involved herein.

Management of the demersal roundfish and flatfish fisheries in the North Sea is conducted mainly through the EU Common Fisheries Policy (CFP) and the yearly EU-Norway Bilateral Fishery Agreements. The prevailing management system and principle has been landing quotas (TAC, Total Allowable Catch) mainly based on the EU principle of relative stability in the international sharing of the TAC. Also, general effort limitations and technical measures are set for the EU and Norwegian fisheries on top of the TAC regulations. Technical measures have mainly aimed at reducing the retention and discard of the juveniles through gear measures and to protect the spawners and/or recruits in the fish populations through closures. Furthermore, the management is based on a set of national measures especially concerning control and enforcement measures, national distribution of the overall TAC, individual special technical measures, allocation (distribution) of national TACs to different fisheries and vessels including the share to e.g. Individual Transferable Quotas (ITQs) or Vessel Quota Shares (VQSs).

The management of the North Sea demersal fisheries has changed quite a lot over the last decades following the need to rebuild the fish stocks, and in particular the North Sea cod stock in relation to the present case study. The CFP has increasing focus towards implementing multi-annual or long term management plans (MAMPs, LTMPs) partly to avoid the annual political battles over setting the TAC. There has furthermore been a trend during the last decade to move away from the Precautionary Approach and towards Maximum Sustainable Yield as the overarching management objective and Harvest Control Rules (HCRs) based on this. There have been introduced increasingly restrictive fisheries-based effort limitations with possibilities for exemption or for less drastic effort reductions provided that cod avoidance behavior can be demonstrated. Although the decision-makers under the CFP have had a reputation of consistently setting TACs way above the scientific advice, the development in recent years has been towards this gap being reduced.

Management of the fisheries has undergone a number of structural and behavioral changes, and these have already yielded some positive results as the state of the demersal stocks in the North Sea have globally improved. The status of main demersal stocks has considerably improved over the last decade. Fishing mortality has globally decreased and biomass has increased, and most of the assessed demersal stocks are now within sustainable limits. Some issues remain with North Sea cod, for which recovery is slower. At present, cod is the limiting species for all the North Sea demersal fisheries. Over a time span from the 1960s landings of demersal stocks have declined with an accelerating decrease since the mid-1990s in line with the falling stock sizes and regulated reductions in total allowable catches (TACs). A clear decrease in the mean fishing mortality (F) is observed in the 2000-2010 period with current F values between F_{msy} and F_{pa} , and the spawning stock biomass (SSB) has on average been above B_{pa} for the period 1983-2010 for the assessed stocks. The effort in the central North Sea and along the Norwegian waters has decreased as well as the number of operating fishing vessels (capacity). Overall, the nominal effort (kW-days) by European fleets using demersal trawl, seine, beam trawl and gillnet in the North Sea, Skagerrak and the Eastern Channel have

been substantially reduced (-20% between 2003 and 2011). Since 2000, the total fish biomass for exploited stocks in the North Sea is about 4-5 million tonnes with an increasing trend in the most recent years. Despite the decrease of landings and fishing mortality in the last recent decade, the overall recruitment has shown a clear decreasing trend from 1985-2010. The recent increase in SSB during the last decade, which is likely due to lower landings and fishing mortality levels in the last 15 years, indicate inclinations of the North Sea ecosystem to recover. However, this has not converted in higher recruitment levels in the most recent years in which there may be a time delay.

There is a clear trend that both the gross profit and the net profit has improved from 2008-2010 for the main fleets of the North Sea with the only exception of the Dutch beam trawlers 18-24m, for which the gross profit decreased by nearly 90%. The positive development in economic performance measures can be a result of the structural changes that have recently occurred in many fisheries. There are fewer vessels sharing the available resources (reduction in over-capacity). Especially, the movement towards right-based systems is expected to have had positive effects on reducing the over-capacity and improving the economic performance of many fleets. Historically, EU subsidies over the years have contributed to making the fleet more efficient, so the success of the CFP in the area of developing an efficient fleet has historically contributed to its failure in relation to conserve fish stocks, as overcapacity is consistently mentioned as one of the fundamental reasons for the conservation failure historically.

Employment in fishing as a social indicator is shrinking, not least for the North Sea, and has been so for many years. There are multiple explanations for this: i) individual vessels are getting more efficient, ii) consolidation of fleets whereby fewer vessels catch the available resources with noticeable decrease in number of operating fishing vessels, and iii) decreasing fishing opportunities in the shape of lower quotas. The raw number of fishers tells a story of a sector that in reality, at least in the prosperous countries around the North Sea, provides only few jobs.

Despite the above trends indicating positive effects of the most recent fisheries management of the North Sea mixed demersal fisheries there are a row of general problems in the present management.

Population dynamics with respect to recruitment variations, sub-populations and changes in distribution of several demersal North Sea stocks influenced by environmental factors besides fishery are not fully understood and taken into consideration in management (and management advice). Also, biological multi-species interactions between the stocks are not fully taken into account in the management of the stocks when setting the MSY management and exploitation limits for the stocks. Management is not based on broader ecosystem and multi-species objectives, but based mainly on single stock objectives.

Also technical interactions between fisheries are not taken fully into account in management of the North Sea demersal fisheries. The fisheries targeting cod, whiting, haddock, saithe, flatfish and Nephrops in the North Sea and Kattegat-Skagerrak are mixed demersal fisheries for towed gears. Mixed fisheries considerations are of primary importance for the management of North Sea species. Single stock management is a cause of discarding in mixed fisheries, because individual stock management objectives may not be consistent with each other. As such, the TAC of one species may be exhausted before the TAC of another, leading to catches of valuable fish that cannot be landed resulting in over-quota discard.

Overall, present management and fisheries policy is characterized by the CFP having in many ways taken form of a classical intergovernmentalist, state-centric command-and-control, top-down management system, where member states' ministers in the Council have exercised strong control over the fisheries management measures which have been developed and adopted on the background of proposals from the Commission and the Parliament, though since the ratification of the Lisbon Treaty the Parliament has assumed a role of co-legislator alongside the Council. EC has identified the lack of stakeholder involvement as one of the major weaknesses of the CFP, recognizing that this fact clearly undermine its legitimacy. Establishment of the Regional Advisory Councils (RACs) with the 2003 CFP can be seen as the first formal attempt to generate a network of multi-national, multi-interest advisory organizations with a strong regional focus among other involving resource users in the decision making. However, the RACs have at present only an advisory function on decisions and are not formally integrated directly in management on a regional basis, i.e. the RAC system is primarily intended to provide a regional stakeholder perspective to the Commission's deliberations rather than providing stakeholders with real decision-making authority. RACs constitute, nevertheless, a move towards regionalization of the fisheries policy.

Present management is, furthermore, characterized by a high degree of complexity, bureaucracy, and examples of micro-management where different management systems and measures are implemented in parallel making evaluation of impact of the individual measures and systems very complicated and the system suffers from lack of transparency. With respect to the complexity the different management measures are acting top of each other with impact on the same fisheries and stocks at the same time (and with time overlap in their implementation) creating a very complex management and associated advisory system, where it is difficult to distinguish specific effects and impacts of each individual measures implemented. Accordingly, it is also very difficult to make scientific management evaluation and advice associated to the individual measures.

1. Introduction

The present report is an EU-FP7-SOCIOEC Report giving an overview and critical evaluation of the current management measures implemented for the North Sea mixed demersal fisheries and the fish stocks involved in this. Also, this involves review and critical evaluation of the scientific advice supporting the fisheries management for the North Sea mixed demersal fisheries and the stocks involved herein.

The report is based on SOCIOEC project work by project involved scientists where input on the above issues from various stakeholders is also included.

It is to be used in the continued project work on evaluation of current management measures and in this context propose and evaluate alternative/emerging management measures and procedures to improve existing fisheries management. In present context this is with focus on the case study of the North Sea mixed demersal consume fisheries for roundfish, flatfish and Nephrops.

2. Historical background

Management of the North Sea demersal consume fisheries and their exploited stocks: The management of North Sea demersal fisheries has changed quite a lot over the last decades, to a large extent following the need to rebuild the fish stocks, and in particular the North Sea cod stock. Since the 2002 reform of the CFP, there has been increasing focus in Europe towards implementing multi-annual or long-term management plans (MAMPs, LTMPs), partly to avoid the annual political battles over setting the TAC, and partly as a result of knowledge drawn from successful fisheries management. Additionally, there has been the generic trend during the decade to move away from the Precautionary Approach and towards Maximum Sustainable Yield (MSY) as the overarching management objective. Both aspects are particularly true in the North Sea, where most demersal stocks are now managed through MSY-driven harvest control rule, accompanied or not by additional measures. (ICES, 2012a). A major driver of changes has been the implementation of the two “cod plans”, first in 2004 (Council Regulation (EC) No 423/2004) then in 2008 (Council Regulation (EC) No 1342/2008) which introduced increasingly restrictive fisheries-based effort limitations. Meanwhile, as one of the first example in Europe, the 2008 plan introduced also some possibilities for exemption or for less drastic effort reductions provided that cod avoidance behavior could be demonstrated, and this has triggered a variety of alternative responses, often industry-led, to be experimented over the last couple of years, including e.g. new selective trawls, real-time closures and Catch Quota Management trials involving Fully Documented Fisheries (see Kraak *et al.* (2012) for a global discussion around this cod plan). All together, it is certain that the management of the fisheries in the North Sea has undergone a number of structural and behavioral changes, and these have already yielded some positive results as the state of demersal stocks in the North Sea have globally improved, many stocks being now within sustainable limits and exploited around Fmsy target (ICES, 2012a)

The main changes that have occurred in the recent (last 10 years) management history of the North Sea mixed demersal consume fisheries in relation to the CFP are:

- Introduction of Long Term Management Plans for cod, haddock, whiting, plaice and sole in the North Sea, and for cod in the Kattegat area;

- Introduction of effort restrictions (kw-day regulations) in the fishery on top of the TACs regulations;
- Introduction of ITQs and FKAs in the fishery on national levels;
- Additional technical measures including fishing closures in relation to certain fish species and stocks, e.g. cod and plaice in the North Sea and Kattegat
- Introduction of fully documented fishery trials with among other camera monitoring on board fishing vessels, which in a future management perspective can be used in relation to catch quota management, discard bans and certification of fisheries.

Recent enforcement of the EU Habitat Directive has resulted in a row of NATURA 2000 marine protected areas. Only few of these influence the fishery, and only a very few affect the North Sea mixed demersal fisheries. Among those are restrictions in relation to gillnet fishery in the NATURA 2000 areas appointed according to harbor porpoise protection.

Emerging spatial explicit fisheries management measures can in future be expected not only to be based on the EU Common Fisheries Policy (EU CFP), e.g. fishing closures to protect certain stocks and/or life stages, or the Habitat Directive, e.g. NATURA 2000 areas, but also in relation to the EU Marine Strategy Framework Directive (EU MSFD). In relation to the latter spatial explicit management of fishery is likely to also depend on broader marine management, where also spatial planning of other sectors use of the marine environment is considered (e.g. renewable energy, fossil fuel extraction, transport, recreational use such as tourism and recreational fishery, etc.).

3. Fleets and fisheries

A number of information is available in the STECF (EU Scientific, Technical and Economic Committee for Fisheries) reports on the evaluation of effort regimes (STECF, 2012c. STECF-12-16), which have collected effort and catch information for most EU fisheries since 2003. Economic data are found in the STECF Annual Economic Report (STECF, 2012a. STECF 12-10), but the compatibility of the two data sets is limited due to differences in definition and collection in the transversal data. In addition for the North Sea, an alternative fleet-based data collection is taking place within ICES, and a combined data call is issued, fulfilling the needs of both single-species assessment and advice (WGNSSK, ICES 2012a, www.ices.dk) and the mixed-fisheries advice (WGMIXFISH, ICES 2012b). A number of handy aggregations have been performed on this dataset, which then contains fewer fleets and métiers categories compared to the STECF data above, and is also fully linked with the biological data. These data were also merged as much as possible with the available economic data during a JRC workshop, WKBEM 2012, leading to an operational bio-economic dataset linking assessment data with catches, effort and economy at the fleet and métier level. These various data are the key sources of information used below.

3.1 Economic Results for the North Sea Fisheries

The main fleets of the North Sea are defined as the 15 fleets that have the highest value of landings in 2010. These fleets are shown in Table 3.1.1 for the period 2008-2011. Overall, the landings value increased from 654 million Euro to 755 million Euro from 2008 to 2011, corresponding to an increase of 16% (prices not adjusted for inflation ¹).

Table 3.1.1: Value of landings (million Euro) for the main fleets of the North Sea

Country	Length	Gear type	2008	2009	2010	2011
Denmark	18-24 m	DTS	13.4	13.2	16.2	16.3
Denmark	24-40 m	DTS	38.0	34.4	39.4	36.4
Denmark	>40 m	DTS	82.0	72.7	137.6	155.2
France	>40 m	TM	0.0	0.0	20.7	0.0
Germany	24-40 m	DTS	13.0	13.6	14.6	14.1
Netherlands	18-24 m	TBB	58.9	43.8	46.2	36.0
Netherlands	24-40 m	TBB	26.6	26.1	25.5	19.3
Netherlands	>40 m	TBB	113.9	109.3	120.4	105.1
United Kingdom	0-10 m	FPO	26.1	20.7	20.3	25.2
United Kingdom	12-18 m	DTS	22.0	17.8	17.0	17.2
United Kingdom	18-24 m	DTS	89.1	75.0	81.9	85.7
United Kingdom	24-40 m	DTS	80.2	69.9	77.0	81.7
United Kingdom	>40 m	DTS	11.8	10.3	15.8	15.7
United Kingdom	>40 m	PS	65.0	67.1	67.6	131.4
United Kingdom	>40 m	TBB	13.4	12.8	15.9	16.0
Total value (NS)			653.5	586.8	716.0	755.1

Source: Data Collection Framework (DCF) of the European Commission;

Notes: DTS=demersal trawl and seine; TM=pelagic trawl and seine; TBB=beam trawl; FPO=pots and traps; PS=purse seine

¹ The average annual inflation rate in Europe from 2009-2011 was approximately 1,5% (Eurostat)

A general trend is that the large vessels that catch pelagic and/or industrial species in the NS (the large Danish demersal trawlers and seiners is to a large extent targeting pelagic species) have significantly increased their landings value, while the landings value for the smaller vessels below 18 m and the Dutch beam trawlers have decreased during the period.

The cost and earnings for the main fleets of the North Sea are presented in Table 3.1.2. Due to the characteristics of the data collection framework (DCF), fleet costs are gathered in an aggregated way across seas, i.e. fleet costs are not available for regions such as the North Sea, Baltic Sea, Norwegian Sea, Irish Sea. This is an issue for most of the included fleets, except the Dutch beam trawlers that almost solely operate in the North Sea. Therefore, the landings value of all regions, and not only the landings value of the North Sea, is included as income in Table 3.1.2. The proportion of the North Sea landings value to the income is also included in the table.

The income and costs of the fleets are depending on the total size of the fleet, which is combination of the number of vessels that is operating in the given fleet and the size of the vessels. To have a performance measure that is comparable across fleets, the net profit per income is calculated. From this measure, it can be seen that the larger demersal trawl and seine fleets are performing well, compared to demersal trawl and seine fleets below 24m. For the Dutch beam trawlers, there also seems to be increasing returns to scale, i.e. the large Dutch beam trawlers above 40 m are performing relative better than the ‘TBB 24-40 m’, while the ‘TBB 18-24m’ have economic loss.

Table 3.1.2: Cost and earnings (million Euro) for the main North Sea fleets.

Country	Length	Gear type	Income	North Sea landings value / income	Variable costs	Gross profit	Depreciation and interests	Net profit	Net profit per income
Denmark	18-24m	DTS	47.2	0.34	36.1	11.1	10.2	0.9	0.02
Denmark	24-40m	DTS	59.2	0.67	39.9	19.3	12.9	6.4	0.11
Denmark	>40m	DTS	176.3	0.78	76.8	99.5	40.1	59.4	0.34
France	>40m	TM	20.7	1.00	20.4	0.4	0.5	-0.2	-0.01
Germany	24-40m	DTS	17.7	0.83	12.4	5.3	1.2	4.0	0.23
Netherlands	18-24m	TBB	46.4	1.00	45.3	1.0	6.0	-4.9	-0.11
Netherlands	24-40m	TBB	26.1	0.98	22.9	3.2	1.4	1.8	0.07
Netherlands	>40m	TBB	121.4	0.99	88.9	32.5	10.7	21.8	0.18
United Kingdom	0-10m	FPO	67.5	0.30	51.8	15.7	10.3	5.3	0.08
United Kingdom	12-18m	DTS	55.3	0.31	45.9	9.4	2.8	6.6	0.12
United Kingdom	18-24m	DTS	109.5	0.75	90.8	18.7	8.4	10.3	0.09
United Kingdom	24-40m	DTS	132.1	0.58	96.6	35.5	7.1	28.4	0.21
United Kingdom	>40m	DTS	45.9	0.34	32.9	13.0	2.5	10.4	0.23
United Kingdom	>40m	PS	215.4	0.31	150.5	64.9	29.4	35.5	0.16
Total			1140.6	0.61	811.2	329.5	143.5	185.9	0.16

Source: Data Collection Framework (DCF) of the European Commission

Notes: ¹Income is calculated as the value of landings plus other income; ²Interests are calculated as the opportunity cost of capital; The fleet “GBR,>40m,TBB” is not included in the table, since there are no economic data available for this fleet in DCF

3.2 Size/Average length/HP of vessels

As seen in the tables 3.1.1-2 above, North Sea fisheries include both small coastal fisheries, medium size vessels and some very large fleet segments, targeting industrial species but also demersal species such as saithe.

For the whole area North Sea-Skagerrak-Eastern Channel in 2011, the effort from vessels <10m was 10% of the total effort in this area (STECF, 2012c)

3.3 Type of activities in terms of gear and target species

The fisheries targeting primarily cod, whiting, haddock, saithe, monkfish, flatfish and *Nephrops* in the North Sea and Kattegat-Skagerrak are mixed demersal fisheries for towed gears. Beyond the main commercial species listed above, the mixed demersal fisheries catch a variety of other species. A typical Shetland whitefish trawler reports more than 50 different species ², and Deporte *et al.* (2012) reported almost 300 different species in a regional data set combining North Sea log-books trawling records from five countries.

Mixed-fisheries considerations are of primary importance for the management of North Sea species including cod. Single-stock management is a cause of discarding in mixed fisheries, because individual management objectives may not be consistent with each other. As such, the TAC of one species may be exhausted before the TAC of another, leading to catches of valuable fish that cannot be landed legally. For example, cod are targeted by some fleets, but are also caught as part of mixed fisheries catching haddock, whiting, *Nephrops*, plaice, and sole. Cod discards relative to catch have declined from the highest on record in 2008 to a just above the historical average in 2011 (from 50% to 25%, weight of cod discarded from the total estimated cod catch). Whiting are caught in mixed demersal roundfish fisheries, fisheries targeting flatfish, the *Nephrops* fisheries, and as bycatches in the industrial sandeel and Norway pout fisheries. Haddock are primarily caught by demersal trawlers (single, twin, and pair), and (to a lesser extent) by seiners. Haddock is a specific target for some fleets, but is also caught as part of a mixed fishery catching cod, whiting, and *Nephrops*. Saithe in the North Sea are mainly taken in a directed trawl fishery in deep water along the Northern Shelf edge and the Norwegian Trench. Analyses show a substantial shift in the Norwegian and German trawlers' fishing pattern after 2008, both in time and spatial distribution. The importance of the fisheries on the spawning aggregations in the first quarter of the year has declined. Plaice is predominantly caught by beam trawlers in the central part of the North Sea with a minimum mesh size of 100–120 mm depending on area. A mixed fishery with sole in the southern North Sea takes place with a minimum mesh size of 80 mm. This mesh size catches plaice under the minimum landing size of 27 cm, which causes high discard rates (in the range of 50% by weight). The discard ratio in the catch has declined in recent years.

There is a great variety of gears and target species in the North Sea (STECF 2012d, STECF-EWG 12-12; STECF 2012b, STECF-12-14; ICES 2012 a, b). Demersal activities (corresponding to the “regulated gears” evaluated by STECF with reference to the effort regulations) represent 70% of the effort in the area. Main demersal species include roundfish (cod, haddock, whiting, saithe, monkfish), flatfish (plaice, sole mainly but many other species are also caught), crustaceans (*Nephrops*, brown shrimp). Additionally, a number of non TAC species are also targeted in the Southern area and in the English Channel, including squids,

² nsrac.org/wp-content/uploads/2013/01/Shetland-Multi-Species-Fishery-Report-2013-02-05.docx

cuttlefish, sea bass, etc. (Deporte *et al.*, 2012). Noticeably, there has been an increase in catches of a number of species less traditionally associated with the North Sea over the recent years. These are mainly species living in warmer waters and which are increasingly observed in the North Sea, likely in conjunction with global warming. In the Southern North Sea, there is for example increased abundance of gurnards and striped red mullet, and in the Northern North Sea there has been a boom in Northern hake abundance. These new species create new challenges for the management of mixed-fisheries, as the relative stability, based on historical landings patterns, does not provide adequate quotas opportunities for the North Sea countries.

Main fishing gears include otter trawls and beam trawls, but also gillnet and trammel nets are important in some local areas.

In terms of fleets and métiers, a number of definitions and classifications exist (Deporte *et al.*, 2012, Ulrich *et al.*, 2012). We describe here the classification retained by ICES WGMIXFISH (ICES, 2012b), combining métiers information as from the DCF and fleet segments as of the STECF AER, and aggregating these into a limited number of fleets and fisheries following the definition of the Cod Plan (EC 1432/2008). WGMIXFISH métiers are thus defined as combinations of gear, mesh size and area (North Sea (area 4), Skagerrak (area 3AN) or Eastern Channel (area 7D)). In 2012, WGMIXFISH identified 39 national fleets from nine countries. These fleets engage in one to four different métiers each, resulting in 88 combinations of country*fleet*métier*area. The WGMIXFISH data set links these to the main commercial species (cod, haddock, whiting, saithe, plaice, sole and *Nephrops*), but as mentioned above a great number of other species are also caught.

3.4 Spatial distribution of fishing effort

Overall, there is distribution of demersal effort over most of the North Sea (Figure 3.4.1), but this hides large differences across gears, reflecting the diversity of fisheries and target species. Many maps are available in STECF EWG 12-12, showing distribution of effort for the main gears, and selected maps are shown in Appendix A of the present report.

The Otter trawls/seines with 100+mm mesh (TR1) are the main roundfish gear and are mainly used along the Norwegian trench and the shelf edge. There is a constant concentration of effort in the Skagerrak area around the Shetlands, while the area between these two concentrations has decreased over the years.

Otter trawls with 70-99 mm mesh size (TR2) are the main *Nephrops* gears, but are also used for targeting whiting. They are now mostly used on the places of the largest *Nephrops* Functional Units (i.e. in the Fladen ground area and along the English and Scottish coast) as well as in the Skagerrak and in areas where whiting is fished, for example the English Channel. The effort in the Central North Sea and along the Norwegian waters has decreased. Beam trawls with mesh size 70 to 120 mm (BT2) are mainly used in the southern North Sea up to the 50m depth line to fish for flatfish. The distribution of effort has moved south in recent years. One explanation could be that fishermen want to target sole and avoid plaice due to low market prices.

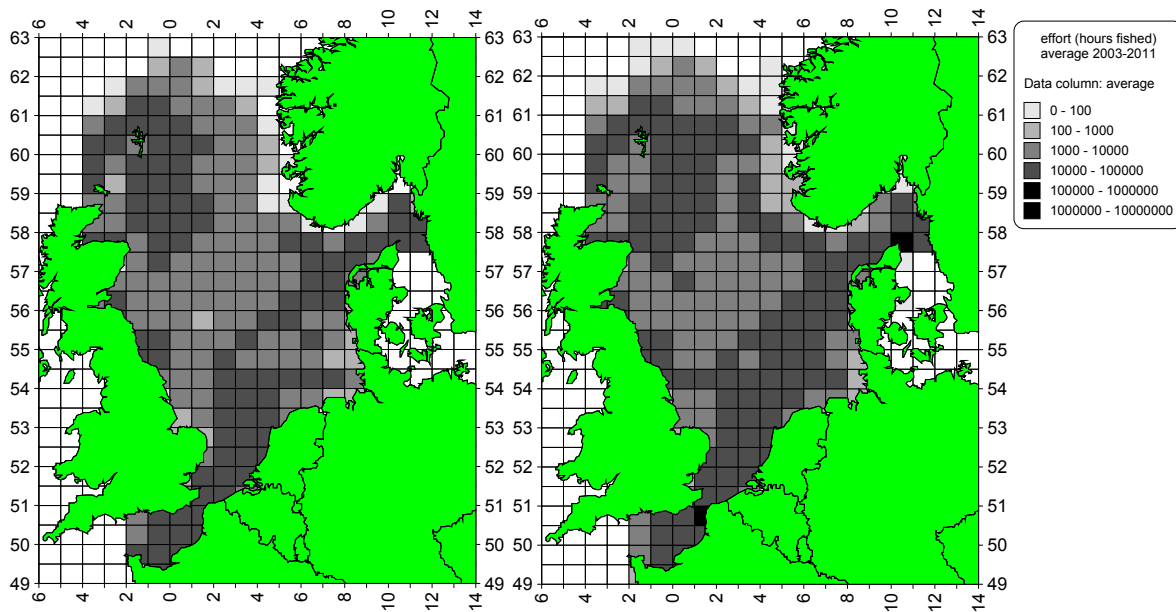


Figure 3.4.1. Annual fishing effort (hours fished) of effort regulated gear groups per rectangle in 2011 (left panel) and averaged for the period 2003-2011 (right panel).

Static gears (GN1 and GT1) have traditionally been localised closer to the shores, often in patchy fishing grounds (Figure A.6 and A.7). There are slight indications that fishing grounds for these gears have contracted in recent years.

3.5 Harvested stocks and resources

Recent trends in the main harvested stocks and resources in the North Sea demersal mixed fisheries are described on a stock-by-stock basis in the ICES single stock assessment working group reports with single-species assessment and advice (WGNSSK, ICES 2012a), and latest advice by fish stock is available on the ICES website in the single stock advice sheets provided by ICES (www.ices.dk). The main trends for the main stocks in the North Sea demersal mixed consume fisheries are summarized below.

The main aspect to bring forward is that the status of main demersal stocks has considerably improved over the last decade (ICES, 2012a). Fishing mortality has globally decreased and biomass has increased, and most of the assessed demersal stocks are now within sustainable limits. Some issues remain with North Sea cod, which recovery is slower due to a number of reasons (Kraak *et al.*, 2012), but nevertheless the stock is improving gradually.

In 2012, ICES offers mixed-fisheries advice for the first time (ICES, 2012b). In contrast to single-species advice there is no single recommendation for mixed fisheries but rather a range of plausible scenarios, assuming fishing patterns and catchability in 2012 and 2013 unchanged from those in 2011. Major differences between the outcomes of the various scenarios indicate potential undershoot or overshoot of the TACs corresponding to the single-species advice. As a result, fleet dynamics may change, but cannot be determined.

More general biological trends in the development of the stocks and ecosystem considerations in relation to this are also provided in the single stock assessment working groups (ICES WGNSSK, 2012a; ICES HAWG, www.ices.dk) described under Section 3.6. Broader North

Sea ecosystem developments and aspects in relation to harvesting the resources and fisheries management is given in Section 8.1 of the present report as summarized in STECF (2012e): Development of the Ecosystem Approach to Fisheries Management (EAFM) in European Seas. STECF-11-13.

Recent trends in developments of main stocks in the North Sea mixed demersal consume fisheries based on the ICES 2012 advice (ICES, 2012a and associated Advice Summaries, www.ices.dk) are summarized as follows:.

Cod in the North Sea and Skagerrak and Eastern Channel:

There has been a gradual improvement in the status of the stock over the last few years. SSB has increased from the historical low in 2006, but remains just below B_{lim} . Fishing mortality declined from 2000 and is now below F_{pa} , but is estimated to be well above F_{MSY} . Recruitment since 2000 has been poor. The proportion of discards is still high relative to the historical period. The main sources of uncertainty are the estimation of unallocated removals and the assumption of fishing mortality.

Haddock in the North Sea and Skagerrak:

Fishing mortality has been below F_{pa} and around F_{MSY} and SSB has been above MSY Btrigger since 2001. Recruitment is characterized by occasional large year classes, the last of which was the strong 1999 year class. Apart from the 2005 and 2009 year classes which are about average, recent recruitment has been poor.

Whiting in the North Sea and Eastern Channel:

The perception of the stock abundance has been revised upwards, due to changes in predation estimates. However, the trends in stock dynamics are unchanged. The improvement of predation estimates as well as the quality of landings and discard data have lead to a significant revision of the perception of the stock. Overall, the quality of the assessment is considered to have improved. Discards are an important component of the catch. The sensitivity of the assessment outcomes to the raising procedure of discard data as well as whether the discard sampling programme coverage is sufficient have not been explored. SSB is around the average of the time-series. Fishing mortality has been stable with minor fluctuations since 2003. Recruitment was low between 2003 and 2007, then increased slightly, but has remained below average since 2008.

Saithe in the North Sea and Skagerrak:

SSB has been above B_{pa} since 1997 but has declined since 2005 towards B_{pa} . Fishing mortality has fluctuated around F_{MSY} since 1997. Recruitment has been below average since 2006. The stock biomass is estimated to be close to B_{pa} and recruitment estimates for the terminal year are uncertain. The forecast and resulting advice are highly sensitive to the recruitment estimate.

Plaice in the North Sea:

The plaice stock has been within safe biological limits as defined by the multiannual management plan since 2005. The sole stock has been within safe biological limits in terms of fishing mortality since 2008, while SSB has been slightly fluctuating around the biomass limit ($B_{pa}=35$ kt) since 2008. Both the North Sea plaice and sole stocks have been within safe biological limits in the last two years. Consequently, ICES concludes that the objectives of stage 1 of the management plan are currently met and provides advice based on the plan's TAC setting procedure acknowledging to be in a transitional stage at present.

Sole in the North Sea:

The sole stock has been within safe biological limits in terms of fishing mortality since 2008, while SSB has been slightly fluctuating around the biomass limit ($B_{pa}=35$ kt) since 2008. Both the North Sea plaice and sole stocks have been within safe biological limits in the last two years. Consequently, ICES concludes that the objectives of stage 1 are currently met and provides advice based on the plan's TAC setting procedure acknowledging to be in a transitional stage at present (as stipulated in article 5 of the EC regulation)

Hake in Division IIIa, Subareas IV, VI, and VII, and Divisions VIIIa,b,d (Northern stock):

The spawning biomass has been increasing since 1998 and is estimated to be record high in 2011. Fishing mortality has been decreasing in recent years, but is still above FMSY. Recruitment fluctuations appear to be without substantial trend over the whole series. After several high recruitments in 2006 to 2008, the last two recruitments are estimated to be low. Hake is caught in mixed fisheries together with megrim, anglerfish, and Nephrops. Discards of juvenile hake can be substantial in some areas and fleets. An important increase in landings has occurred in the northern part of the distribution area (Division IIIa, and subareas IV and VI) in recent years.

*Anglerfish (*Lophius piscatorius* and *L. budegassa*) in Division IIIa, and Subareas IV and VI:*

Due to the uncertainty in the landings data, ICES is not able to advice and catch. The stock status is not known, but recent surveys indicate a decline in abundance and biomass since 2008.

*Megrim (*Lepidorhombus* spp.) in Divisions IVa and VIa:*

Fishing mortality has been below FMSY for almost the full time-series and the biomass well above MSY B trigger. There are two separate TAC areas for megrim, Subareas VI and IV, but there is little evidence to suggest that the megrim in Subarea IV and Division VIa are separate stocks. ICES (2011b) concluded that megrim in Divisions VIa and IVa should be treated as a single stock and megrim in Division VIb (Rockall) should be treated as a separate stock.

3.6 Ecosystem Considerations in relation to relevant single stock assessment

Ecosystem considerations in relation to the addressed individual species and single stock advice are provided by ICES through the ICES WGNSSK Advisory Sheets and Stock Summaries (ICES, 2012a; www.ices.dk). This has for the main individual stocks been summarized below while broader ecosystem considerations for the North Sea in relation to fisheries management is summarized in Section 8.1.

Cod in the North Sea and Skagerrak and Eastern Channel:

Cod are widely distributed throughout the North Sea, but there are indications of sub-stocks. Genetic studies have indicated two subpopulations with long-term differences in recruitment trends, and largely inhabiting different regions of the North Sea, with cod from the deep-water subpopulation not expected to re-colonize depleted areas in the southern North Sea. There has been an apparent northerly shift in the mean latitudinal distribution of the stock in the North Sea. However, this is not thought to be due to cod migrating from the south to the north in response to climate change. More likely, cod in the North Sea are composed of a complex of more or less isolated sub-stocks and there do appear to be long-term differences in recruitment trends. The presence of subpopulations largely inhabiting different regions of the North Sea will mean that there is the potential for regional differences in mortality, because

cod from the Northern deep-water subpopulations would not be expected to re-colonize areas depleted in the southern North Sea. The contracted range of the North Sea cod stock can be linked to reduced abundance as well as climate factors.

The distribution of 0-group cod (recruits) over the last 10–15 years has shifted towards the eastern part of the North Sea region (i.e. the Skagerrak and Kattegat). This means that the abundance of recruits is stable and shows no trends in the eastern part, whereas in the North Sea, a pronounced decline is clearly discernible. This change in distribution of cod recruits is likely to reflect changes (erosion) of the stock structure in the North Sea, so that the only productive units left in the North Sea are those which tend to use the eastern North Sea region as a nursery area.

Recent recruitments have been low, with possible influence of changes in the availability of food resources for cod larvae to increasing predation pressure. There is evidence of cannibalism and seal predation. Multispecies model runs estimate a decrease in cannibalism rates for age 1 and age 2 cod at current low stock levels, while seal predation on ages 3 to 6 has increased over the years due to an increase in seal abundance. Harbour porpoises also take a substantial amount of cod up to age 3.

Fishing mortality rates have been reduced from 2000 and the stock has increased since 2006. The low average age of the spawning stock may reduce its reproductive capacity as first-time spawners may reproduce less successfully than older fish, a factor that could be a contributor to continued low recruitment.

Gillnet fishery for cod takes bycatches of harbour porpoise. Since 2001, effort reductions in this fishery have likely led to decreased bycatches. Hiddink *et al.* (2006) estimates that in areas of bottom trawl activity in the North Sea, benthic biomass and production is reduced by 56% and 21% respectively, compared with an unfished situation.

Haddock in the North Sea and Skagerrak:

The North Sea haddock stock exhibits sporadic high recruitment, leading to dominant year classes in the fishery. These large year classes often grow more slowly than less abundant year classes, possibly due to density-dependent effects. Recruitment appears poorly determined by either spawning-stock biomass or egg production. Haddock primarily prey on benthic and epibenthic invertebrates, sandeels, and herring eggs. Haddock are an important prey species, mainly for saithe and other large gadoids.

Haddock growth may be linked to water temperature. Warmer waters may lead to faster growth in early life stages, but also to faster maturation and a lower maximum size. There are indications that haddock recruitment success is determined, in part, by the available area of suitable substrate at settlement time.

Whiting in the North Sea and the Eastern Channel:

The spatial distribution of whiting is considered to have changed over the last decade. This may represent a contraction to a sub-stock structure that coincides with the main spawning areas in the North Sea. The 2011 key run of the North Sea multispecies model (SMS), on which natural mortality estimates for this stock are based, indicates that whiting is a major prey component in the diet of many piscivorous fish and marine mammals. Whiting are largely mature from age 2, which means that recruitment can heavily influence the SSB in the following year at low stock sizes.

Saithe in the North Sea and Skagerrak:

The juveniles (ages 0–2 years) generally occur in shallow coastal areas where they are protected from large fisheries. The fish are long-lived (20+ years) and tend to form large

aggregations to a higher extent than for instance cod. Saithe starts to mature at age 4 (15% mature) and at age 7 all fish can be regarded as being mature.

A decrease in the mean weight-at-age has been observed since the mid-1980s, but this trend has now been reversed. Current information is insufficient to establish whether these reductions are linked to changes in the environment. There is no indication that the observed decline in weight-at-age is density dependent.

Plaice in the North Sea:

Plaice is a bottom dwelling species, mainly feeding on annelids and molluscs. Plaice aggregate at spawning grounds in the first quarter of the year. The condition factor for plaice is highest in summer/autumn on the more dispersed feeding grounds. These feeding grounds are generally located more northerly than the spawning grounds.

Juvenile plaice have been distributed more offshore in recent years. This could be linked to environmental changes in the productivity or changes in the temperature of the southern North Sea, but these links have not been shown conclusively. The distribution shift of plaice increased the bycatch of small plaice further offshore.

The mixed plaice and sole fishery is dominated by bottom trawls, with bycatch of both commercial and non-commercial species and a physical impact on the seabed. Bottom trawling impacts biomass, production, and species richness. For plaice, the size selectivity may lead to a shift in the age and size at maturation, which means individuals start spawning earlier. For the North Sea, an ecosystem model showed that the beam-trawl fleet reduced benthic biomass and production by 56% and 21%, respectively, compared with an un-fished situation. Chronic fishing has caused a shift from communities dominated by relatively sessile, emergent, and high biomass species to communities dominated by infaunal, smaller-bodied fauna. (ICES, 2012a).

The flatfish benchmark in 2010 recommended to explore the potential to perform an integrated assessment of the continuum of plaice stocks from the Baltic to the English Channel. ICES is in the process of evaluating the identity of different plaice stocks which may imply changes in assessment units as well as in management areas.

Sole in the North Sea:

Sole is a nocturnal predator and therefore more susceptible to capture by fisheries at night than in daylight.

Sole is mainly caught by the beam-trawl fleet working with 80 mm mesh. In recent years, an increasing proportion of the traditional beam trawl fleet has switched to sumwing and/or pulse trawl for which ecosystem effects is not fully known. The mixed plaice and sole fishery is dominated by bottom trawls, with bycatch of both commercial and non-commercial species and a physical impact on the seabed. Bottom trawling impacts biomasses and biological benthic production, and species richness (biodiversity). The impacts of trawling differ among benthic habitats and are likely to be more important in deeper water with silty sediments than in shallow areas characterized by sandy grounds.

More general North Sea ecosystem considerations in relation to fisheries management is described in Section 8.1 of the present report.

4. Management processes

4.1 Science and provision of scientific management advice

Overall, international bodies delivering scientific advice for fisheries management include the International Council for the Exploration of the Sea (ICES, www.ices.dk) and the EU Scientific, Technical and Economic Committee for Fisheries (STECF, at European level, <https://stecf.jrc.ec.europa.eu/web/stecf/about-stecf>). This advice is provided to the EU and the National Governments as well as to involved stakeholders.

At the ICES level, there is provided single-species advice on a fish stock-by-stock basis in the ICES assessment working groups performing single-species assessment. For the stocks involved in the North Sea mixed demersal fisheries, this is covered by the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK, ICES 2012a). Single stock advice sheets are provided by ICES (see Sections 3.5 and 3.6)

Multi-species considerations in the biological advice are also provided by ICES, involving biological interactions between fish species, e.g. predation of one species on another. For the North Sea, multi-species considerations are among other covered by the Working Group on Integrated Assessment in the North Sea (ICES WGINOSE) and Working Group on the Multi-Species Assessment Methods (WGSAM). The multi-species considerations are written in under ecosystem considerations in the single stock advice sheets provided by ICES.

In 2012, ICES offered mixed-fisheries advice for the first time (ICES WGMIXFISH, 2012b). In contrast to single-species advice, there is no single recommendation by stock for mixed fisheries but rather a range of plausible fishing effort scenarios (fishing patterns and catchability) and evaluation of their impacts on the stocks and the quota up-take. The mixed fisheries considerations are written into the single stock advice sheets by ICES as well.

Broader North Sea ecosystem developments and aspects in relation to harvesting the resources and fisheries management are also provided by ICES and summarized in the STECF (2012e): Development of the Ecosystem Approach to Fisheries Management (EAFM) in European Seas. STECF-11-13 (see Section 8.1). Also, broader ecosystem considerations are covered to some extent in the single stock advice sheets provided by ICES.

The advice process is organized through gathering of international fisheries biological scientists from national fisheries research institutes throughout the year at different ICES expert group meetings. This feed among other into specific STECF expert working groups on fisheries advice with participation of fisheries biological and fisheries economic scientific experts. In the STECF Expert Groups the ICES Advice is evaluated further (see also Section 4.3 for further details). The result of the STECF working groups is then discussed at the STECF plenaries, that is held three times during the year and from which the advice is delivered. The advice can be biological (e.g. reference points for the stock), economic (e.g. economic impact assessment), technical (e.g., recommended mesh sizes) or social (e.g. social impact assessment). Among other, Long Term Management Plans (LTMP) and Management Strategy Evaluation (MSE) are advised upon by ICES and STECF as described under Sections 6 and 8.1 of the present report. The advice takes the form of public reports available at the ICES web page (www.ices.dk) and on the STECF website (<https://stecf.jrc.ec.europa.eu/web/stecf/about-stecf>).

Scientists as the connection between science and stakeholders regarding the North Sea is seen at different levels, from STECF meetings to Regional Advisory Council (RAC) meetings and research projects (see section 4.2 and 4.3 for further details). RAC meetings also have the possibility of having scientists as observers. At STECF meetings a certain number of stakeholders are invited as observers. The communication between European Commission, scientists at the STECF and stakeholder representatives is also assured through transversal meetings throughout the year. See also section 4.3 for more details.

Several European research projects include stakeholder involvement at different levels, including among others RAC representatives, producer organizations and fishermen. Examples of such projects are the EU 6th and 7th Framework Programme funded projects of which examples are mentioned in Section 4.2 below.

4.2 Operational policy

The EC identified the lack of stakeholder involvement as one of the major weaknesses of the CFP, recognizing that this fact clearly undermined its legitimacy. One of the outcomes of the reform of the European common fisheries policy (CFP) in 2002 was the establishment of Regional Advisory Councils (RACs) to enable the European Commission to benefit from the knowledge and experience of stakeholders in the formulation and implementation of fisheries management measures by the European institutions. RACs are now in operation for the Baltic Sea, the North Sea, North-Western Waters, South-Western Waters, the High-Seas/Long-Distance Fleet, Pelagic Stocks, and the Mediterranean Sea (Long, 2010).

There is a long-standing tradition in EU fisheries management for involving resource users in decision making (Mikalsen and Jentoft, 2001). The European Commission's (EC) first step for involving resource users in decision-making was the introduction of the Advisory Committee on Fisheries (ACF) in the early 1970s. This measure was reformed in 2000, to include new sectors and interest groups, and the ACF was renamed the Advisory Committee on Fisheries and Aquaculture (ACFA). The committee has an advisory function – the Commission consults it on measures related to the Common Fisheries Policy (CFP) – and can issue opinions on its own initiative (Pita *et al.*, 2010). Apart from the ACFA, a number of Europe-wide bodies are consulted by the Commission from time to time on draft legislation and these include: Europêche, the EU Fish Processors' Association, the EU Federation of National Organizations of Importers and Exporters of Fish, the European Association of Fish Producers' Organisations, and the Federation of European Aquaculture Producers (Churchill and Owen in Long 2010).

Although involving stakeholders in fisheries policy making is not a new phenomenon, the RACs can be seen as the first “formal attempt to generate a network of multi-national, multi-interest advisory organizations with a strong regional focus” within the CFP (Sissenwine and Symes, 2007). The primary task of the RACs is to advise the Commission on decisions concerning fisheries management in respect of certain sea areas or fish stocks. The RACs are composed of representatives of the fishing industry and other parties concerned with the CFP, such as environmental organizations, aquaculture producers, consumers and recreational fishermen (Long, 2010). The establishment of the RACs constitute a move towards regionalization of fisheries policy (Pita *et al.*, 2010), as the RAC system is primarily intended

to provide a regional stakeholder perspective to the Commission's deliberations rather than providing stakeholders with real decision-making authorities (Hegland *et al.*, 2012).

The European commission not only seeks to involve stakeholders in policy making, but the EC has also stated its commitment to reconcile the expert knowledge of scientists with the experience of fishers, through processes that build trust and foster openness and transparency. The reasoning is that including fishers' knowledge and know-how will enhance scientific understanding and improve the quality of data required for scientific assessments of fish stocks (Mackinson *et al.*, 2011). Direct routes for stakeholder involvement in European research include participation in research programmes, such as the EU Joint Data Collection programme (DG Mare), or in specific research projects such as EFIMAS (www.efimas.org), JAKFISH, CEVIS, GAP, VECTORS, SOCIOEC, MYFISH, FACTS, and BENTHIS. The most influential European example has been the North Sea Commission Fisheries Partnership. This group worked closely with ICES in improving the relationship between scientists and the industry and initiated a number of research efforts including a survey of fishers' perceptions of North Sea stocks that is still ongoing. This group was also instrumental in the formation of the North Sea RAC (Mackinson *et al.*, 2011).

Despite the logical connection between the CFP and expectations for involving RACs in research, RACs experience many difficulties that make it extremely challenging for them to do so. The demands for inputs on the diverse topics that directly and indirectly (e.g. wind farm, aggregates and oil) affect fisheries consumes the time of members, each of whom have many other representative hats and responsibilities. Furthermore, RACs have no budget for scientific advice (Mackinson *et al.*, 2011).

The regionalization aspect in advice and management is central in relation to the RACS. In Section 4.3.3 the North Sea RAC and the Pelagic RAC are introduced. The Pelagic RAC is more involved into actual management than the North Sea RAC.

4.3 Decision-making

4.3.1 Introduction

Providing a schematic overview of the institutional setup underlying the governance system of the Common Fisheries Policy (CFP) of the European Union (EU) is difficult.³ It easily runs the risk of either creating the illusion of a simple system or further confuse what is in reality a quite complex system. Figure 4.3.1 is an attempt to provide a schematic overview of the system. The model includes the main actors in CFP governance and streams between them of knowledge, legal processes and policy/management interventions.

Although the model in Figure 1 includes a multiplicity of actors and interactions, the model remains a simplified picture of the actual setting in which CFP governance unfolds. Other streams of interactions, as well as actors could have been added. Moreover, neither the EU nor the member states are unitary bodies, as it is evident from the model.

³ The following sections build on material previously presented in van Hal *et al.* (2010) as part of the EU funded MEFEPO project; where needed updated to reflect the most recent state-of-affairs.

The human governance system can be understood as operating on several political levels. In Figure 4.3.1, three levels have been included: EU supranational/intergovernmental level, EU regional seas level and EU member state level. However, above the EU level there is a global / international level, on which the EU has signed a number of treaties, conventions and declarations dealing with fisheries policy and management among other issues. At the other end of the spectrum, there may be regional and / or local level governance considerations beneath the national level. Whilst this may not be particularly relevant for countries such as Denmark where fisheries management is highly centralised (Hegland and Raakjær 2008), in countries such as Spain it is necessary to consider regional / local level governance issues when discussing fisheries policy and management.

It should be noted that one significant fishing state operating in the North Sea, namely Norway, is not a member of the EU. The setup for governance relating to fisheries management in Norway will be dealt with separately beneath.

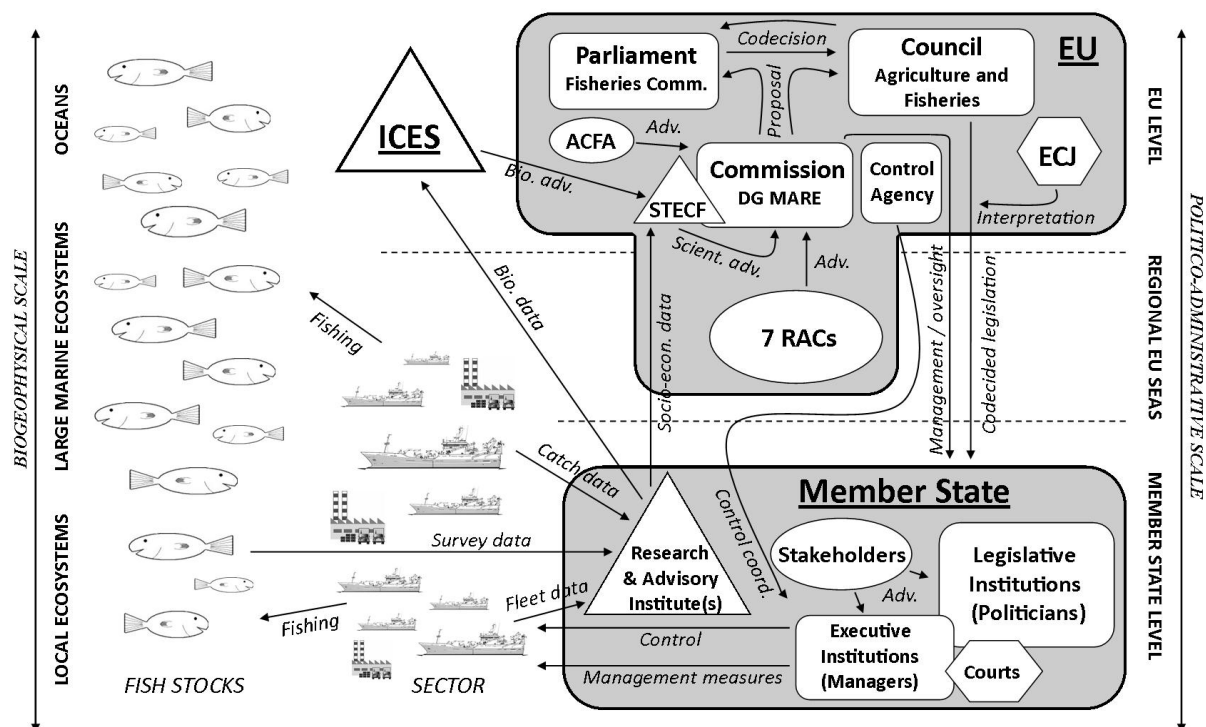


Figure 4.3.1: The Institutional Setup for Fisheries Management in the EU. The scientific bodies are depicted as triangles, legal bodies as hexagons, stakeholder bodies as eclipses, and policy/management bodies as ‘soft’ rectangles.

The CFP is the fisheries policy framework of the EU. In its present, comprehensive form, it covers measures relating to markets, conservation, sector structures, external relations and control. It was first established in 1983 (Council 1983). Conservation of living aquatic resources (a main pillar under the CFP) is, as one of only a handful of policy areas, under the exclusive competence⁴ of the EU. In this area it governs primarily by means of regulations that are binding and directly applicable at member state level. As such these legislative acts

⁴ Exclusive competence on behalf of the EU “means that the member states cannot adopt their own legislation within the area [...] unless that power has explicitly been given back to them” (Hegland and Raakjær 2008: 164).

do not need to be transposed into national legislation. However, although the EU has exclusive competence, it is up to the member states to implement and operationalize the policy. The first acts relating to markets and fisheries sector structures were adopted as early as 1970 (Council 1970, 1970a). Since 1983, the policy has undergone reforms in 1992/93 (Council 1992) and 2002/03 (Council 2002) and it is currently in the process of yet another major reform.

Over the years, the primary focus of the CFP has, alongside the general development in fisheries management worldwide, increasingly gone from being that of ensuring efficient fishing fleets and well-functioning markets for fish products, towards conserving the resource base, which the sector ultimately stands and falls by (Gezelius *et al.*, 2008). In practice, EU subsidies over the years have contributed to making the fleet more efficient, so, paradoxically; the success of the CFP in the area of developing an efficient fleet has contributed to its failure in relation to conserve fish stocks, as overcapacity is consistently mentioned as one of the fundamental reasons for the conservation failure. As a consequence, the focus of the policy has in part gone from that of developing the sector to that of conserving the stocks.

In the following sections we will, with reference to Figure 4.3.1, briefly introduce the institutions and actors at the different levels as well as present their roles in the governance system. We will start at EU level and move downwards. As mentioned previously, Norway will be dealt with separately in section 4.3.4.3.

4.3.2 EU level Institutions and Actors

The formulation, adoption and implementation of EU fisheries legislation is, as it is evident from Figure 1 process involving a multiplicity of actors and institutions operating on various levels in the political system. The standard procedure of EU fisheries policy-making involves that a unit within the Directorate General for Maritime Affairs and Fisheries (DG MARE) (which is the relevant directorate-general within the Commission of the European Communities (Commission)), drafts the envisioned piece of legislation. In this process, DG MARE incorporates to varying extents, depending on the nature of the proposal, input from stakeholders and/or scientific bodies. Once the proposal has been agreed according to the internal procedures of the Commission, it is forwarded to the European Parliament (EP, Parliament) and the Council of the European Union (Council), which under the ‘co-decision procedure’, now also called the ‘ordinary legislative procedure’ that since the adoption of the Lisbon Treaty covers most fisheries issues, have joint decision-making powers (Hegland 2004; Hegland and Raakjær 2008a):

“Ordinary legislative procedure gives the same weight to the European Parliament and the Council of the European Union on a wide range of areas (for example, economic governance, immigration, energy, transport, the environment and consumer protection). The vast majority of European laws are adopted jointly by the European Parliament and the Council.

- *The Commission sends its proposal to Parliament and the Council.*
- *They consider it, and discuss it on two successive occasions.*
- *After two readings, if they cannot agree, the proposal is brought before a Conciliation Committee made up of an equal number of representatives of the Council and Parliament.*
- *Representatives of the Commission also attend the meetings of the Conciliation Committee and contribute to the discussions.*

- *When the Committee has reached agreement, the text agreed upon is sent to Parliament and the Council for a third reading, so that they can finally adopt it as a legislative text.*
- *The final agreement of the two institutions is essential if the text is to be adopted as a law.*
- *Even if a joint text is agreed by the Conciliation Committee, Parliament can still reject the proposed law by a majority of the votes cast.”*
(<http://www.europarl.europa.eu/aboutparliament/en/0080a6d3d8/Ordinary-legislative-procedure.html>, accessed 28 February 2013)

Once legislation is adopted, it is passed on to the member states for implementation. Should disputes on the interpretation of EU fisheries legislation arise, it is ultimately up to the Court of Justice of the European Communities (Court; ECJ) to make a ruling (Hegland 2004; Hegland and Raakjær 2008a).

4.3.2.1 EU Commission:

The Commission serves as the EU bureaucracy in the area of fisheries policy as in most other policy areas. However, compared to a traditional, national bureaucracy, the Commission has a considerable degree of authority and political power *vis-à-vis* the decision-making bodies of the Council and Parliament (see sections 4.3.2.5 and 4.3.2.4). The Commission fulfils a number of other functions in the EU system, but in the following we will focus on the role of the Commission as the developer and proposer of legislation. However, as indicated in Figure 1, other important tasks of the Commission in the area of fisheries include carrying out direct management (e.g. by filling out Council legislation with more detailed or technical legislation) and overseeing that the member states fulfil their obligations, and if they are not take action possibly by referring disputes to the Court of Justice of the European Communities (see section 4.3.2.7).

In practice, a Commission proposal, communication, paper etc. relating to fisheries is drafted in the relevant office under the relevant Directorate under the Directorate General for Maritime Affairs and Fisheries (DG MARE). In drafting the proposal, DG MARE takes to a varying extent, depending on the nature of the proposal, information from other relevant Directorate Generals, various committees, institutions and organisations into consideration. If scientific expertise is needed to draft the proposal, DG MARE is particularly dependent on information from other sources, as there is limited in-house scientific capacity (Commission 2003). The International Council for the Exploration of the Sea (ICES) (see sections 4.1 and 4.3.2.8) and the Scientific, Technical and Economic Committee for Fisheries (STECF) (see immediately beneath) are of particular importance in these instances. The Regional Advisory Councils (RACs) (see sections 4.2 and 4.3.3) are now also consulted on a routine basis on most of the substantial initiatives from DG MARE.

Once DG MARE has received the information it has deemed necessary from the various sources, the responsible Directorate finishes drafting the proposal and passes it upwards through the Commission hierarchy. Ultimately, the proposal is dealt with in the College of Commissioners, which consists of 27 Commissioners, each appointed by a member state. The Commissioners can then accept the proposal (in that case it is passed on to the European Parliament and the Council), reject it, refer it back for re-drafting or decide not to take any decision whatsoever. The Commissioners decide by simple majority voting and individual votes as well as results of votes are confidential (Hegland 2006).

4.3.2.2 Scientific, Technical and Economic Committee for Fisheries:

The Scientific, Technical and Economic Committee for Fisheries (STECF) is an independent committee, appointed by the Commission that advises the Commission / DG MARE on matters where scientific knowledge is vital (see section 4.1 above for more details). The committee consists primarily of scientists with a background in marine biology or ecology, fisheries science, nature conservation, population dynamics, statistics, fishing gear technology, aquaculture, or the economics of fisheries and aquaculture (Commission 2005). STECF forms internal sub-groups, which can include experts from outside the STECF (Commission 2003)

STECF and its sub-groups draw to a large extent on the same (limited) pool of expertise as the International Council for the Exploration of the Sea, which according to the Commission (2003) has led to repetitive work on behalf of some of the STECF members, as one of the main tasks of the STECF is to review scientific advice emanating from ICES. Notably, besides reviewing advice and advising the Commission on its use, STECF contributes with economic calculations on potential effects of the predominantly biological conclusions on selected fleets. (EU Commission 2003; Hegland 2006)

4.3.2.3 Advisory Committee on Fisheries and Aquaculture:

The Advisory Committee on Fisheries and Aquaculture (ACFA) is a consultative body set up in 1971 by the Commission to provide stakeholder input from European-level stakeholder groups and umbrella-organisations on fisheries matters (as opposed to the RACs). The mandate of the committee is to issue opinions and resolutions on fisheries issues and proposals emanating from the Commission (see also section 4.2 above).

ACFA was reorganised in 1999 and 2004, and according to Lequesne (2000), the actual impact of ACFA on Commission proposals has over the years been limited. Consequently, he argues, "[t]he core *raison d'être* of the Consultative Committee [ACFA] has been an exercise in mutual legitimization" (Lequesne 2000: 353).

4.3.2.4 European Parliament:

The European Parliament (EP, Parliament), which consists of democratically elected parliamentarians from the 27 member states, has decision-making powers jointly with the Council under the co-decision procedure / ordinary legislative procedure, as further described above in Section 4.3.2.

Most of the work on fisheries legislation is carried out in the standing Committee on Fisheries, which, after having discussed the issues based on a report drafted by one of its members, adopts a proposal for a resolution by a simple majority. This proposal for a resolution is subsequently dealt with by the Parliament in plenary, where each proposed amendment has to gather a majority of present parliamentarians. (Hegland 2004; 2006)

4.3.2.5 Council of the European Union:

In the Council of the European Union (Council), the member states are each represented by their minister responsible for fisheries issues. These ministers meet in the Agriculture and Fisheries Council, which acts as the primary decision-making body in relation to the CFP.

Fisheries policy issues in the Council are subject to qualified majority voting (QMV), which means that no single member state is in a position to block a proposal. The member states hold different numbers votes in the Council; the largest member states have most votes but

the smaller member states have more votes than the size of their populations would strictly suggest. The question of how often a member state finds itself in the favourable position to decide if a proposal is adopted or not depends, consequently, on its size (number of votes and size of population), and on the prevailing coalition patterns within the Council.

In practice, it is only a limited number of fisheries issues that actually reach the level of ministers. The Council is a hierarchical structure where proposals are initially scrutinised by member states' civil servants in lower level working groups. The least contentious issues can be negotiated at this level. Questions of a more contentious nature are passed on upwards to the higher ranking civil servants in the Permanent Representatives Committee (Coreper). Only the most politically sensitive issues are discussed in substance and subsequently decided on by the ministers in the Council.

Although there is, as described above, a voting arrangement in the Council, networking and informal contacts and communication remain extremely important in Council negotiation processes on fisheries issues. The informal communication serves multiple purposes, e.g. leaking one's own and getting other countries' positions in order to explore possible compromises or gaining a better understanding of other member states' underlying motives (Hegland 2004).

4.3.2.6 Community Fisheries Control Agency:

The recent establishment⁵ of the independent Community Fisheries Control Agency (CFCA) is an integral element in the progressive implementation of the previous 2002/03 reform of the fisheries policy framework, and the objective of the CFCA is to strengthen the uniformity and effectiveness of enforcement across the EU territory. This should be done by assisting with the organisation of operational cooperation and coordination of monitoring and enforcement activities among member states (Council 2005).

The powers of the CFCA are highly limited, and it is specifically stated in its legal foundation that the agency does not have the power to impose additional obligations on the member states besides those outlined in the basic regulation of the CFP. Neither does the agency have any powers to sanction member states (Council 2005). In practice, the main task of the CFCA is to adopt 'joint deployment plans' (for specific stocks in specific sea areas) with the aim of coordinating the use of the different member states' human and material resources related to control and inspection as well as solving issues related to how and when control and enforcement activities of one member state may take place in waters under the sovereignty and jurisdiction of another member state, among other things. The relevant RACs should be involved in developing the plan (Council 2005, Community Fisheries Control Agency Undated).

4.3.2.7 Court of Justice of the European Communities:

The Court of Justice of the European Communities (ECJ, Court) is the legal body mandated to rule in disputes on the interpretation of EU law (including fisheries legislation) and thereby settle disputes between citizens and member states, between member states and EU institutions, as well as between EU institutions or between member states etc. In principle, the Court is a neutral actor in the governance system. However, as briefly mentioned in Hegland (2004), the Court has in some instances been accused of having engaged in 'judicial activism' to favour increased integration.

⁵ Operational from 2007 in Brussels and physically set up in Vigo, Spain, in 2008.

4.3.2.8 International Council for the Exploration of the Sea⁶:

The International Council for the Exploration of the Sea (ICES) is an international scientific organisation covering the North East Atlantic and is the predominant source of scientific input to the decision-making process relating to the CFP. The science is almost exclusively biological, and mainly in the form of stock assessments, which are essentially statistical interpretation of sampling programmes (see section 4.1 above for more details). However, it is important to note that ICES is not an EU institution and that ICES delivers advice to a range of clients besides the EU. Nevertheless, the EU is its largest client.

ICES' advice is based on data provided by national scientific institutes in either the shape of fisheries-independent data (e.g. from trawl surveys carried out by research vessels) or fisheries-dependent data (e.g. catch statistics from commercial vessels). Within the ICES system, the data from the various sources are analysed in a large system of working and study groups and turned into scientific advice for ICES clients'. Their clients include governments and international organisations with marine management responsibilities of which the EU is the single largest.

4.3.3 The Regional Seas level: The Regional Advisory Councils

Seven Regional Advisory Councils (RACs) were set up under the CFP following the 2002 reform (see also section 4.2 above). These are stakeholder fora consisting of representatives of the fisheries sector (ideally 2/3 of the membership), defined as *"the catching sub-sector, including shipowners, small-scale fishermen, employed fishermen, producer organisations as well as, amongst others, processors, traders and other market organisations and women's networks"* (Council 2004: art. 1), as well as a smaller group (ideally 1/3) of representatives of other interest groups, including *"amongst others, environmental organisations and groups, aquaculture producers, consumers and recreational or sport fishermen"* (Council 2004: art. 1). Other than the members, a number of people can be involved either as experts or active observers. These include Commission representatives, member state representatives, scientists, representatives from third countries etc. The RACs are primarily meant to function as advisory bodies towards the Commission but member states can also draw on the RACs for resolutions. The RACs are also mandated to issue resolutions on their own initiative (Council 2002). The Commission (or the member state authorities) is not obliged to follow a recommendation from a RAC and, therefore, in practice the advantage of following a recommendation from the RAC will always be weighed against other preferences of those receiving the recommendation.

The RACs are either organised along specific sea areas roughly corresponding to large marine ecosystems / regional seas (five RACs⁷) or specific types of fisheries (two RACs⁸) (Council 2004) (Figure 4.3.2). It is noteworthy that the introduction of RACs introduced a new political level in EU fisheries management which meant there was, for the first time, a close one-to-one match between a level of management in the governance system and a biological, ecological scale in the natural system (see Figure 4.3.1). Each RAC consists of a General Assembly (GA) and an Executive Committee (ExCom). However, in practice most of the work on the resolutions is done in a number of specific working groups set up under each RAC. It is the ExCom that adopts recommendations, as far as possible, by consensus. However, if it is not possible to arrive at a compromise that is acceptable to all, then decisions

⁶ This section builds in part on information from the ICES website: <http://www.ices.dk/> (accessed 28 February 2013).

⁷ Baltic Sea RAC, North Sea RAC, South Western Waters RAC, North Western Waters RAC and Mediterranean RAC.

⁸ Pelagic RAC and Distant Waters RAC.

can be taken by a majority vote but dissenting opinions should then be recorded in the resolution (Council 2004). However, it is clear that generally consensus resolutions have considerably more political clout in the decision-making process than resolutions including dissenting opinions; particularly if a broad selection of RAC members both from the sector and other interests has been active in the process of drafting the resolution.

Two RACs are operating in the North Sea, namely the North Sea RAC and the Pelagic RAC. The North Sea RAC was as the first RAC declared operational in 2004 and covers ICES area IV and sub-area IIIa. The Pelagic RAC became operational in 2005 and deals with issues related to four pelagic species in all EU waters: blue whiting, horse mackerel, mackerel and herring.

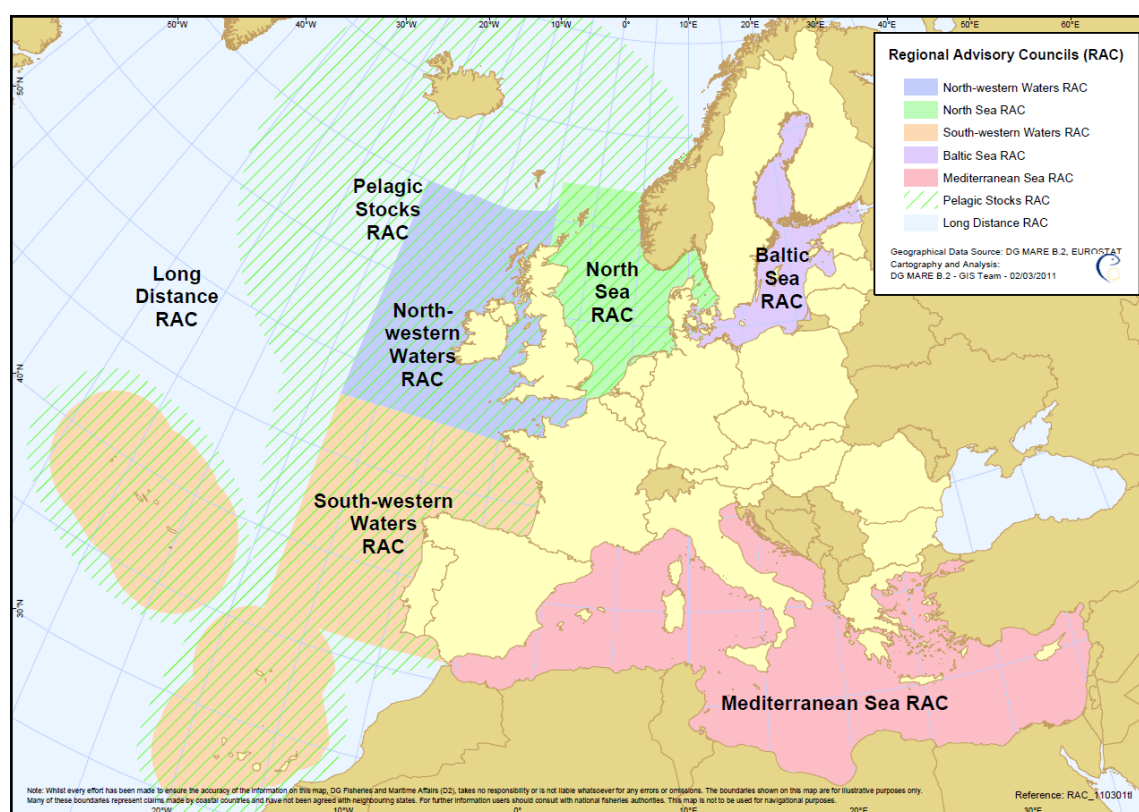


Figure 4.3.2: The Regional Advisory Councils.
(http://ec.europa.eu/fisheries/partners/regional_advisory_councils/rac_en.pdf, accessed 21 October 2011)

4.3.4 The Member State Level

Aside from Norway, the European countries of relevance in the North Sea are all EU member states. This means, as described earlier, that they are subject to the CFP framework. In the following section we will provide a brief understanding of the role and responsibilities of the member states in the EU governance system.

4.3.4.1 The Role of the EU Member States in the CFP Governance System:

Although the conservation of resources is a fundamental pillar of the CFP, and under the exclusive competence of the EU, this does not mean that member states are powerless to

protect marine resources. Importantly, the member states occupy a central role in the decision-making process through their membership of the Council. Though the Commission is also a powerful actor at the EU level, it is ultimately the member states themselves that adopt the legislation of the CFP together with the Parliament.

Moreover, it is the member states that are tasked with implementing CFP legislation nationally, although most of the legislation under the CFP is adopted in the shape of regulations that are directly binding on the member states. The power of implementation does allow the member states to take national considerations into account. As discussed in Gezelius *et al.* (2008), the Commission is only to a limited degree able to control and sanction member states that take these national considerations too far and engage in implementation practices that are problematic as seen from central EU perspective. This is particularly the case when unsustainable implementation practices are not outright against the rules but rather against the ‘spirit of the rules’.

How the national institutional setup for fisheries management looks like in practice differs from member state to member state; something we will look more at in the following section. However, in Figure 4.3.1 above we have outlined the basic elements of any national system: 1) Political institutions to legislate in the areas where the member states themselves are in charge, e.g. allocation of fishing rights. 2) Managerial institutions tasked with executing the decisions of the political system including the EU. 3) Stakeholders, often predominantly from industry but increasingly from conservationist NGOs, offering advice both to managers and politicians either through formal or informal channels. 4) National research and advisory institutes that monitor the state of fish stocks (as well as carry out other research activities related to fish and fisheries) and feed data and experts into ICES and STECF. Besides the institutions depicted in the figure, there is also a national legal system. And as mentioned earlier, if the state has delegated responsibilities to regional governments then the picture gets more complicated.

4.3.4.2 Bilateral Cooperation between Member States:

It is possible for member states to decide fisheries management measures jointly on a bilateral basis. However, the measures have to respect the CFP regulations and it is not possible to make the regulations binding on other member states’ vessels than those making the agreement.

A recent example of such cooperation is the agreements made between Denmark and Sweden on closing or restricting fishing activities in certain areas in Kattegat from 2009 to protect the cod stock. In total three areas are established. Two have certain restrictions on fishing and one area is completely closed.

A decision-making problem in relation to this has been that the closure has not been taken on-board by the EU system and therefore a few German vessels have been able to continue to exercise their fishing rights in the area, which has clearly limited the legitimacy of the bilateral agreement. The legality of this bilateral procedure is highly contested by the industries in Sweden and Denmark, who have seen their fishing possibilities reduced as a result.

4.3.4.3 Norway:

Except for the supra-national level which the EU-authorities constitute, the Norwegian institutional set-up very much resembles that of the EU member states (see Figure 4.3.1). The highest authority in Norway is the Ministry for Fisheries and Coastal Affairs, which is responsible for issuing laws and regulations. The executive administrative body is the

Directorate of Fisheries, which is a decentralised authority consisting of seven regional offices spread along the coast, in addition to the main office.

Norway works through two channels in order to influence the management of commercially important straddling stocks, which they share with other countries (Ministry of Fisheries and Coastal Affairs 2008):

- 1) Bi- and multilateral agreements with other countries about quotas on specified shared stocks in international waters and specification of access to quotas in the economic zones of other countries and *vice versa*.
- 2) Participation in international organisations regulating fishing activities in international waters.

The agreements are renegotiated annually, and the most important bilateral agreements Norway has are with the EU, Russia, Greenland and the Faroe Islands. The agreement with the EU is a framework agreement, entered into in 1978. The agreement is based on a mutual understanding of common responsibility for the management of stocks in the North Sea, and a mutual access to fisheries within the economic zones of the countries. The Norwegian and EU quotas in the North Sea, the Norwegian fisheries west of the British Islands and the EU fisheries in the Norwegian economic zone in the Barents Sea are negotiated annually.

4.3.5 Characteristics of the Common Fisheries Policy Governance System

The CFP can in many ways be argued to take the form of a classical intergovernmentalist, state-centric command-and-control, top-down management system, where member states' ministers in the Council exercise strong control over the fisheries management measures, which are developed and adopted⁹ on the background of proposals from the Commission. This has, however, changed somewhat with the adoption of the Lisbon Treaty, which has provided the European Parliament with a stronger position. The member states are responsible for the implementation of the rules and for monitoring compliance in relation to fishing activities taking place in waters under their jurisdiction, and they report back to the Commission, which is among other issues tasked with "*making sure that CFP rules are effectively implemented and that Member States set up and apply appropriate systems and rules to manage, control and enforce the limitations on fishing possibilities and fishing effort required by the CFP*" (DG MARE 2008).

4.3.5.1 Implementation Drift:

Though situated at the top of the top-down structure together with the Council and the Parliament, the Commission has very weak powers in relation to direct control and monitoring of fishing activities compared to the member states. Gezelius *et al.* (2008) analyse with outset in the principal-agent approach the relationship between the EU (in that analysis treated as principal) and the member states (in that analysis treated as multiple agents) and document how the EU, represented by the Commission, is on crucial points in a weak position *vis-à-vis* the member states. One of the key findings of the analysis is the apparent inability of the EU to sanction member states whose implementation practices conflict with the intention

⁹ If necessary by means of qualified majority vote (QMV).

of the rules or the with overall political goals *but are not directly against the rules* (in principal-agent terminology this can be referred to as *non-criminal agency drift*).¹⁰ Usually non-criminal agency drift can be moderated by amending the framework that the agents operate under to change the incentive structure or make rules less open to interpretation. However, this has often not been possible under the CFP, which to a wide extent rests on sticky historical compromises. Moreover, the member states in the Council tend to be aligned in semi-permanent groups, each able to produce a blocking minority (Hegland 2004 and Raakjær 2008). Another key finding relates to the fact that the Commission largely relies on the member states themselves in the process of monitoring and overseeing their management efforts (although conservation NGOs can and do function as watchdogs). The Commission does not have the institutional capacity or legal mandate to genuinely monitor the member states and the member states in the Council are traditionally reluctant to transfer ‘police-like’ authorities to the Commission. Consequently, Gezelius et al. (2008: 217) conclude that “*it is hard to escape the fact that what seems to characterise the CFP from a principal-agent perspective seems to be strong incentives for the agents to drift away from conservation and weak powers on behalf of the principal to prevent this*”.

4.3.5.2 A Stronger Commitment to Science:

Although the decision-makers under the CFP have had a reputation of consistently setting TACs way above the scientific advice, the development in recent years has been towards this gap being reduced. The explanation for this is multi-faceted. One part of the explanation is that eNGOs have increasingly mobilised and organised *vis-à-vis* the CFP. Another explanation is the incremental shift towards managing stocks by means of harvest control rules (HCR). Moreover, the spread of certification schemes, in particular MSC, has changed the way the fishing industry view quota setting by putting a premium on not setting quotas too high. All these developments together have created a climate in which the pressure for inflated TACs is lower than in previous years.

¹⁰ One example could be that for the most fundamental conservation measures under the CFP, the TACs and quotas, there are few incentives for the member states to catch their quotas in a conservationist manner, i.e. reduce discards (fish thrown back dead or dying in the sea because they are too small or the vessel does not have a quota for them), at least if the stocks in question are shared with other member states. Whereas the benefits of being able to fish even with high discard rates are reaped by the individual member state, the negative impact of the non-conservationist behaviour is shared among all the member states, who will receive lower quotas in the following year. This is a telling example of the “tragedy of the commons” dynamic (Hardin 1968).

5. Management objectives and principles

5.1 FAO Code of Conduct and EU CFP Objectives

The highest level objectives regarding fisheries can be found in the FAO Code of Conduct (FAO 1995), which states: “Fisheries management should promote the maintenance of the quality, diversity and availability of fishery resources in sufficient quantities for present and future generations in the context of food security, poverty alleviation and sustainable development”.

Overall in Europe, the objective for fisheries management is expressed in the proposal for a basic regulation as “The CFP shall ensure that fishing and aquaculture activities provide long-term sustainable environmental, economic and social conditions and contribute to the availability of food supplies.” The proposal further mentions the precautionary approach and ecosystem based management as guiding principles for fisheries management. Another relevant regulation is the Marine Strategy Framework Directive (MSFD), agreed on between the European Parliament and the European Commission in December 2007. The main objectives are stated in article 1.3 as being “enabling the sustainable use of marine goods and services by present and future generations”. This will be achieved by establishing marine regions and sub-regions, which will be managed by member states in an integrated manner based on environmental criteria. With respect to neighbouring countries, the EU has a framework agreement with Norway, with an objective to “ensure proper management and conservation of the living resources of the sea”

In practice, these European objectives materialize in the prevailing management system, whose fundamental instrument has been landing quotas (TAC, Total Allowable Catch) mainly based on the EU principle of relative stability in the international sharing of the TAC. Also, general effort and technical measures are set for the EU and Norwegian fisheries in relation to the principles of obtaining sustainable fish stocks under fisheries management.

5.2 Regional objectives

Focusing closer on regional objectives covering the North Sea, the North Sea Regional Advisory Council (NSRAC) declares its aim to be “to work towards integrated and sustainable management of fisheries in the wider context of the sustainability of the marine environment”. Furthermore, the NSRAC considers the concepts of sustainability, ecosystem approach and precautionary principle within its objectives. However, it should be recalled that the NSRAC holds no decision-making powers (see section 4.2 and 4.3.3). In the case of specific management plans referring to the North sea, the cod long term management plan states as its objective to “ensure the sustainable exploitation of the cod stocks on the basis of maximum sustainable yield” Management of the demersal roundfish and flatfish fisheries in the North Sea is conducted mainly through the EU Common Fisheries Policy (CFP 1983, 1993, 2003, 2013) and the yearly EU-Norway Bilateral Fishery Agreements

5.3 National objectives

In relation to specific national management objectives, some nations have expressed the CFP objectives even more firmly. For instance, one of the objectives in the Danish national management system was to address how to obtain the highest economic outcome from the allocated quotas. In Denmark, beside reference to the CFP, the Ministry highlights that it works on securing a sustainable and development-oriented fisheries industry, creating flexible framework conditions for the industry, as well as reducing the administrative burdens placed on the fisheries industry. For other countries, as Germany, the objective of the fisheries policy of the Federal Ministry for Nutrition, Agriculture, and Consumer Protection is to manage the stocks sustainably, to fight illegal fishing effectively and a proper labelling for consumers. In the Netherlands the Ministry of Economic Affairs aims to stimulate a responsible fisheries, a sustainable exploitation of fish stocks, and a balance between fisheries and nature conservation. The Ministry is responsible for the main tasks, but delegates tasks to the industry (co-management), and tries to improve cooperation within the fisheries value chain. Moreover, fisheries policy needs to be embedded in broader policy themes such as the regional policy, and international water policy. The Dutch government also stimulates (through subsidies) fishing companies to develop sustainable fishing methods

6. Management strategies

Long term management plans for the central stocks involved in the mixed demersal North Sea consume fisheries area summarised below. This is done according to management targets under the MSY-approach (Maximum Sustainable Yield) and PA-Approach (Precautionary Approach), i.e. management reference limits and harvest control rules associated hereto.

Cod in the North Sea and Skagerrak and Eastern Channel:

The EU–Norway agreement management plan was updated in December 2008, and re-considered in 2012. The EU has adopted a long-term plan for this stock with the same aims (EC, 2008: Council Regulation (EC) 1342/2008). ICES evaluated the plans in 2009 and concluded that they are both in accordance with the precautionary approach if implemented and enforced adequately.

Haddock in the North Sea and Skagerrak:

In 2008 the EU and Norway agreed a revised management plan for this stock (EC, 2008), which states that every effort will be made to maintain a minimum level of SSB greater than 100 000 t (Blim). Furthermore, fishing was restricted on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups, along with a limitation on interannual TAC variability of $\pm 15\%$. Following a minor revision in 2008, interannual quota flexibility (“banking and borrowing”) of up to $\pm 10\%$ is permitted (although this facility has not yet been used). The stipulations of the management plan have been adhered to by the EU and Norway since its implementation in January 2007. ICES has evaluated the management plan from 2008 and concludes that it can be accepted as precautionary (ICES, 2012a).

In 2012, ICES puts forward mixed-fisheries advice for the first time (ICES, 2012b). In contrast to single-species advice there is no single recommendation but a range of plausible scenarios, assuming fishing patterns and catchability in 2012 and 2013 unchanged from those in 2011. Major differences between the outcomes of the various scenarios indicate potential undershoot or overshoot of the TACs corresponding to the single-species advice. As a result, fleet dynamics may change, but cannot be determined.

In 2013, cod is the limiting species for all the North Sea demersal fisheries. Following the ‘cod’ scenario (full implementation of the cod management plan), the haddock management plan catch options could not be fully utilized.

Within an ecosystem context, species-specific assessments and the latest developments in mixed-fisheries approaches need to be considered. A reduction in direct effort on one stock may lead to a reduction or an increase in effort on another and, hence, the implications of any changes need to be identified and carefully evaluated.

Whiting in the North Sea and the Eastern Channel:

The response to the Joint EU–Norway request on the management of whiting in Subarea IV (North Sea) and Division VIIId (Eastern Channel) from ICES in September 2010 stated that “maintaining fishing mortality at its current level of 0.3 would be consistent with long-term stability if recruitment is not poor” for several consecutive years (ICES, 2012a; www.ices.dk). Consequently the EU and Norway have agreed to interim management of whiting at this level of total fishing mortality for 2011, conditional on a $\pm 15\%$ TAC constraint. ICES assumes that this approach is still in place.

Following this management plan in 2013 implies a fishing mortality of 0.3, which would increase the TAC by more than 15%. Applying the TAC constraint would lead to human consumption landings of no more than 19 614 t for the North Sea. Although not covered by the management plan, this option would lead to low landings in Division VIIId.

After the considerable revisions in this year's assessment in the level of fishing mortality in 2012, caused by new estimates of natural mortality, the target F is no longer considered applicable and the management target needs re-evaluation.

Saithe in the North Sea and Skagerrak:

The EU–Norway agreed management plan as updated in December 2008 (see under cod, haddock and whiting), which ICES in 2008 has evaluated and considered to be consistent with the precautionary approach in the short term.

Plaice in the North Sea:

A multiannual plan for plaice and sole in the North Sea was adopted by the EU Council in 2007 (EC regulation 676/2007) which describes two stages: to be deemed a recovery plan during its first stage and a management plan during its second stage. Objectives are defined for these two stages; to rebuild the stocks to within safe biological limits and to exploit the stocks at MSY respectively. Stage 1 is deemed to be completed when both stocks have been within safe biological limits for two consecutive years. TAC setting procedures are provided to accommodate stage 1 as well as a transitional period during which an Impact Assessment should take place to reconsider long term objectives. The management plan prescribes effort limitations (kW-days per metier) to be adjusted in line with changes in fishing mortality. The current advice implies a reduction of 10% in effort (following a 10% reduction in F for sole).

Sole in the North Sea:

A multiannual plan for plaice and sole in the North Sea was adopted by the EU Council in 2007 (EC regulation 676/2007) – see above under plaice. The current plan prescribes effort limitations (kW-days per metier) to be adjusted in line with changes in fishing mortality. The current advice implies a reduction of 10% in effort (following a 10% reduction in F to 0.27 for sole).

7. Management tools

7.1 Conservation measures

7.1.1 MSY based TACs and F levels (ICES, 2012a; www.ices.dk):

Cod in the North Sea and Skagerrak and the Eastern Channel:

The EU–Norway agreement management plan as updated in December 2008 (EC, 2008) aims to be consistent with the precautionary approach and is intended to provide for sustainable fisheries and high yield, leading to a target fishing mortality of 0.4. The EU has adopted a long-term plan for this stock with the same aims (Council Regulation (EC) 1342/2008). In addition to the EU–Norway agreement, the EU plan also includes effort restrictions, reducing kW-days available to community vessels in the main métiers catching cod in direct proportion to reductions in fishing mortality until the long-term phase of the plan is reached, for which the target F is 0.4 if SSB is above B_{pa} . Following the management plan implies a reduction in effort ceilings of 18.2% in 2012 and 22.2% in 2013, compared to the preceding year. In both plans, fishing mortality should be reduced to levels corresponding to 75% of F_{2008} in 2009 and 65% of F_{2008} in 2010. Until the long-term phase of the management plans has been reached, further annual reductions of 10% must be applied to achieve an F in 2013 equal to 35% of F_{2008} . This would lead to a TAC reduction of more than 20%. The management plans limit annual TAC variations to 20%. According to these rules, landings should be no more than 25 441 t in total for Subarea IV and Divisions IIIa West and VIId in 2013.

Haddock in the North Sea and Skagerrak:

In 2008 the EU and Norway agreed a revised management plan for this stock (EC, 2008), which states that every effort will be made to maintain a minimum level of SSB greater than 100 000 t (Blim). Furthermore, fishing was restricted on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups, along with a limitation on interannual TAC variability of $\pm 15\%$.

Whiting in the North Sea and Eastern Channel:

Following this management plan in 2013 implies a fishing mortality of 0.3, which would increase the TAC by more than 15%. Applying the TAC constraint would lead to human consumption landings of no more than 19 kt for the North Sea. Although not covered by the management plan, this option would lead to landings in Division VIId of no more than 7 kt.

Saithe in the North Sea and Skagerrak:

SSB has been above B_{pa} since 1997 but has declined since 2005 towards B_{pa} . Fishing mortality has fluctuated around F_{MSY} since 1997. Recruitment has been below average since 2006. The EU–Norway agreement management plan does not clearly state whether the SSB in the intermediate year or the SSB at the beginning or end of the TAC year should be used to determine the status of the stock. ICES interprets this as being the SSB at the beginning of the intermediate year (2012). Since SSB at the beginning of 2012 is above B_{pa} , and a $F = 0.3$ will give a larger change than 15%, paragraph 5 of the harvest control rule applies, resulting in a TAC of 100 684 t and an SSB in 2014 of 252 000 t. Following the ICES MSY framework implies a fishing mortality of $F_{MSY} = 0.3$. This would result in landings of no more than 113 100 t in 2013 and an SSB in 2014 of 241 000 t. According to the precautionary approach fishing at $F_{pa} = 0.4$ results in landings of less than 143 000 t in 2013 and a SSB of 214 000 in 2014.

Plaice in the North Sea:

Following the EU multiannual plan (Council Regulation (EC) No. 676/2007) would imply a TAC of 97 070 t ($F=0.27$) for Subarea IV in 2013, which is a 15% increase in comparison to 2012, complying to the constraint of 15% TAC change of the plan. This is expected to lead to an SSB of 665 000 t in 2014. Both the North Sea plaice and sole stocks have been within safe biological limits in the last two years. FMSY has been set to 0.25 based on simulation studies and equilibrium analyses, taking into account a number of stock–recruitment relationships that generated a range of values between 0.2 and 0.3.

Sole in the North Sea:

SSB has fluctuated around the precautionary reference points for the last decade and is estimated to be above Bpa in 2012. Fishing mortality has shown a declining trend since 1995 and is estimated to be between FMSY and Fpa since 2008. Following the EU multiannual plan would imply a 10% reduction of F to 0.27, resulting in a TAC of 14 000 t in 2013 (an exact 15% reduction in comparison to 2012, without applying the 15% TAC change bounds of the plan) and implying a 10% reduction in fishing effort. This is expected to lead to an SSB of 49 000 t in 2014. ICES has evaluated this management plan and considers it to be precautionary. Following the ICES MSY framework implies fishing mortality to be reduced to 0.22 (FMSY, as $SSB_{2012} > MSY_{Btrigger}$), resulting in landings of less than 12 000 t in 2013. This is expected to lead to an SSB of 51 000 t in 2014. Following the transition scheme towards the ICES MSY framework implies fishing mortality to be reduced to 0.27 ($(0.36 * 0.4) + (0.22 * 0.6)$), which will result in landings of less than 14 000 t in 2013. This is expected to lead to an SSB of 48 000 t in 2014. The precautionary Fpa for North Sea sole is 0.4. This would lead to landings of 19 000 t in 2013 and an SSB of 41 000 t in 2014.

7.1.2 Individual Transferable Quota (ITQ) and Vessel quota share (FKA) measures

Furthermore, the management is based on a set of national measures especially concerning control and enforcement measures, national distribution of the overall TAC, individual special technical measures, allocation (distribution) of national TACs to different fisheries and vessels including the share to e.g. Individual Transferable Quotas (ITQs) or vessel quota shares (VQSs). For example, the structure of the Danish fishing fleet has changed considerably since 2003, where the first ITQ regulation was implemented in the herring fishery. Since then, ITQs has gradually been introduced in other pelagic fisheries, and from 2007 demersal fisheries were also managed with individual and transferable Vessel Quota Shares (VQS). The VQS were given to the fishermen free of charge (i.e. the grandfathering method), and each vessel was allocated a share based on their landings in the reference period 2003-2005. These measures have been undertaken in order to reduce overcapacity in the Danish fishery and to increase the economic performance of the Danish fleets. (See also Section 7.2 for more details).

7.1.3 Effort measures

Effort restrictions in the EC were introduced in 2003 (annual annexes to the TAC regulations) for the protection of the North Sea cod stock. In 2009, the management programme switched from a days-at-sea to a kW-day system (EC, 2009, 2009 Council Regulation (EC) N°43/2009), in which different amounts of kW-days are allocated within each area by member state to different groups of vessels depending on gear and mesh size. Effort ceilings are updated annually.

Overall nominal effort (kW-days) by European demersal trawls, seines, beam trawls, and gillnets in the North Sea, Skagerrak, and Eastern Channel had been substantially reduced (–20% between 2003 and 2011). Following the introduction of days-at-sea regulations in 2003, there was a substantial switch from the larger mesh (>100 mm, TR1) gear to the smaller mesh (70–99 mm, TR2) gear. Subsequently, effort by TR1 has been relatively stable, whereas effort in TR2, beam trawl (80–120 mm, BT2), and gillnet has shown a continuous decline (–12%, –39%, and –35%, respectively, between 2004 and 2011). Nominal effort reported by Norway has increased in 2011 after the generalization of electronic logbooks (ICES, 2012a,b).

7.1.4 Technical measures including closures

Technical measures have been largely introduced to reduce the retention and discarding of juveniles of commercial and non-commercial species and to improve species selective characteristics of fishing gears. The history of technical measures in EU waters and also in non-EU waters is one of numerous regulations, amendments, implementing rules and temporary technical measures introduced into the annual Fishing Opportunities (TAC and Quota) Regulations as a stop-gap. All told across all the different sea basins, including non-EU waters, since 1980 no less than 90 different technical measures regulations or regulations containing technical measures have been enacted by the EU.

The first technical measures regulation for EU fisheries in the Northeast Atlantic and the North Sea was introduced in 1980, and contained definitions of areas, mesh size and catch composition regulations, minimum landing sizes, prohibitions on certain gears, closed area/seasons and gear restrictions as well as the legal basis for the establishment of emergency measures (STECFWG on technical measures, 2012). (See examples below of closures in the North Sea).

The minimum trawl mesh size for e.g. cod, haddock, whiting mixed fisheries was increased to 120 mm in the northern area of the North Sea in 2002 and this may have contributed to the substantial decrease in landings of whiting. Plaice is predominantly caught by beam trawlers in the central part of the North Sea with a minimum mesh size of 100–120 mm depending on area. A mixed fishery with sole in the southern North Sea takes place with a minimum mesh size of 80 mm.

Scotland implemented in February 2008 a national scheme known as the ‘Conservation Credits Scheme’. The principle of this scheme involves additional time at sea in return for the adoption of measures which aim to reduce mortality on cod and lead to a reduction in discard numbers. In particular, a pillar of this scheme is the instigation of Real-Time-Closures (RTCs) intended to divert demersal fishing effort away from areas of abundant cod, and hence to reduce cod mortality (Needle and Catarino, 2011). The RTCs were initially stipulated as areas of ~50 square nautical miles and were initially defined as 7×7 nautical mile squares, although this limitation has subsequently been relaxed and RTCs may now be of different shapes. Since June 2010, the maximum possible area of each RTC has been increased to 225 square nautical miles. Each RTC is in place for 21 days, following which period they are reopened automatically. Further, the rules limit the number of RTCs that can be enacted simultaneously in proximity to prevent certain local fishing communities being unfairly disadvantaged. There were 165 closures in 2010, and 185 in 2011.

The closure of an area is triggered by an upper limit on the observed cod density, defined as 40 cod (of any size) per hour's fishing. Notification is via skipper's logbooks, monitored

landings, or by on-board observation, and a single high-density haul is sufficient to instigate a closure. There may only be a maximum of 11 closures defined by logbook or landings data in operation at any one time, along with an additional three closures defined by positive on-board samples. Since 2009, observance of RTCs by Scottish demersal fishing vessels has been mandatory. There is no legal impediment to vessels from other countries fishing in RTCs, although they have been encouraged by the Scottish Government and the EU not to do so, and anecdotal evidence from compliance officers and the Scottish fishing industry suggests that RTCs have generally been respected by non-Scottish vessels. Analyses conducted by Holmes et al., (2011) and Needle and Catarino (2011) have both showed that Real-Time closures have had some positive effects on reducing cod catches, and compliance with the closure elements of the scheme was judged to have been good. However, the overall effects on the stock dynamics and total fishing mortality are difficult to estimate. The effects of this regulation on the behaviour of the fleet and on the haddock stock are still unclear.

The expansion of the closed-circuit TV (CCTV) and fully documented fisheries (FDF) programmes in 2010–2012 in Scotland, Denmark, and England is expected to have contributed to the reduction of cod mortality. Under this scheme, UK vessels are not permitted to discard any cod, while Danish vessels are still permitted to discard undersize cod. For both nations, all cod caught are counted against the quota. Vessels carrying CCTV systems may preferentially target haddock to prevent exhausting the cod quota and having to tie up.

An example of a closure in the North Sea is the Plaice Box¹¹:

The Plaice Box (PB) is a special management measure in the North Sea. It was established as a technical fisheries management measure to protect undersized plaice from discarding, closing the area for trawl fisheries with vessels >221kW, with the expectation that yield and spawning stock biomass would increase (see Fig. 7.1.1).

For vessels <221 kW this meant less competition from larger vessels on the fishing grounds. The main objective of the PB, the increasing biomass of plaice due to conservation of undersized fishes, was not achieved as plaice biomass decreased substantially after the introduction. The reasons for that are not totally clear.

The main question is whether the decrease in the plaice stock is due to the establishment of the PB or due to a change in the environment unrelated to the establishment of the PB (ocean climate, eutrophication, others). The effort decreased in the box, especially of vessels also targeting finfish. The smaller vessels have more or less the same fishing effort targeting shrimps and some vessels also fishing on flatfish species (see Table 7.1.1).

The discarding of plaice mainly occurs in the fishery for brown shrimps (beam trawl 16-32 mm), sole (beam trawl 80 mm) and the 80 mm otter trawl fishery. As the PB is not as effective as it was expected at the time of introduction and the plaice and sole stocks are increasing and now fished nearly on the level of MSY, a discussion may start if the Box can be opened up again for larger vessels.

In relation to the Plaice Box, the spatial distribution of juvenile and adult sole remains constant, following the removal of a large amount of effort. The proportion of undersized sole (<24 cm) did not change after closure and remained stable at a level of 60–70%. Different length groups showed different patterns in abundance. Sole of around 5 cm showed a decrease in abundance from 2000 onwards, while the groups of 10 and 15 cm seemed rather stable. The largest groups showed a declining trend in abundance, which had already set in years before the closure.

¹¹ This section is mainly based on the EU funded study 'Revision of the plaice box' by Beare et al. 2010.

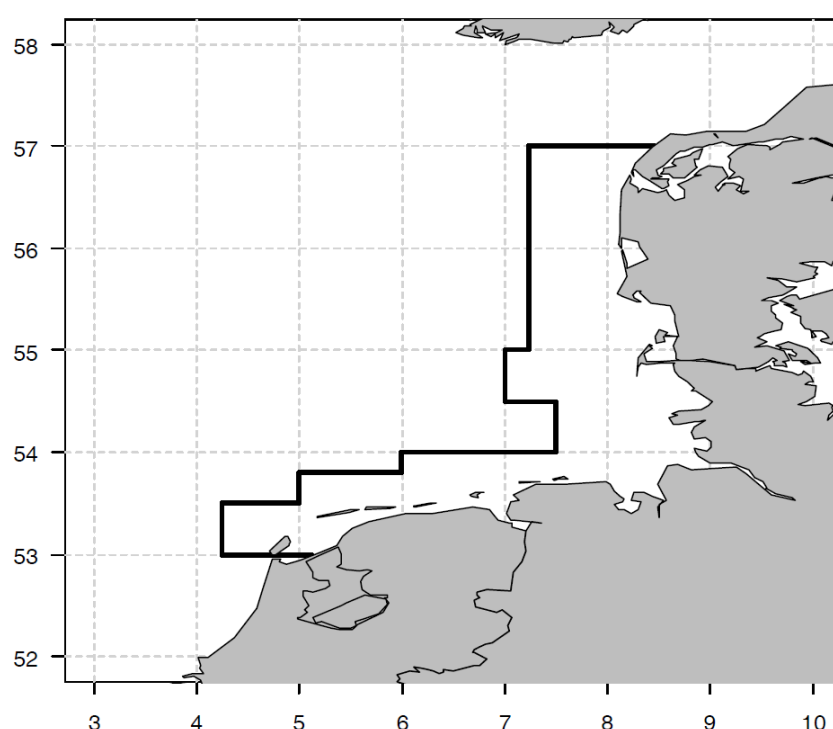


Fig. 7.1.1: Plaice Box (Beare et al. 2010: 35)

Table 7.1.1: Percentages of effort, catch and earnings inside the PB of total (in and outside the PB) effort, catch and earnings for small (<221 kW) and large (>221 kW) vessels (mean of the year 2005 to 2008 for all countries combined , calculated VMS data (Beare et al. 2010: 6)

Power	Metier	Effort	Catch	Earnings
<=221kW	BEAM.16-31	79	82	82
	BEAM.80-99	23	22	19
	BEAM.>100	64	73	71
	GILL-TRAMMI	29	32	34
	OTHER	13	14	14
	OTTER.80-99	3	4	4
	OTTER.>100	20	20	20
>221kW	BEAM.16-31	-	-	-
	BEAM.80-99	-	-	-
	BEAM.>100	-	-	-
	GILL-TRAMMI	31	25	32
	OTHER	19	27	27
	OTTER.80-99	-	-	-
	OTTER.>100	-	-	-

There are also recently implemented real time closures in the demersal mixed fisheries in the North Sea in relation to by-catch levels of cod.

7.1.5 Economic incentives: landing taxes, decommissioning schemes, subsidies

Economic (financial or remunerative) incentives are said to exist where an agent can expect some form of material reward, especially money, in exchange for acting in a particular way (Dalkir, 2005). There are several risks when applying economic incentives. The first one is that incentives can enhance performance, but they don't guarantee that actors will earn them by following the most moral or ethical paths. Especially when strong financial incentives are in place, ethical boundaries to earn them are more easily crossed. Actors will convince themselves that the ends justify the means. Secondly, financial rewards can also create inequalities, which in turn can reduce performance. Thirdly, they can reduce intrinsic motivation. When actors are willing to cooperate on a voluntary basis, and after a certain period a financial reward is given to them, this will change their intrinsic motivation. At the moment the reward is withdrawn again, actors will stop their cooperation, because their motivation has changed. This is called the overjustification effect.

Financial incentives in the form of subsidies are a common place in the fisheries industry, although questions about their effectiveness and controllability, about the role of government in society and the economy, and about the relative roles of environmental protection and economic development have increasingly come up. Subsidies in many areas of the economy generally are considered bad things, never more than in fisheries.

Subsidies¹² can be categorised as follows:

- Direct government payments to the industry. E.g. a diverse range of subsidies as grants made for the purchase of new fishing vessels, vessel decommissioning payments (buybacks), fishermen's unemployment insurance, compensation for closed seasons, equity infusions, and price support programmes
- Tax waivers and deferrals. This classification includes such programmes as fuel tax exemptions for fishing vessel fuel, sales tax exemptions, special income tax deductions for fishermen and deferred tax programmes.
- Government loans and loan guarantees, and insurance. The government may make loans to fishermen or fishing firms on favourable terms, such as loans with lower than market interest rates or longer than usual amortization periods. Alternatively, the government may guarantee repayment of private sector loans when financial institutions require added security that cannot be offered by the industry itself. The government may offer insurance when private insurers decline to insure fishermen because of the perceived highly uncertain risk in the industry.
- Implicit payments to, or charges against the industry. These are programmes that do not transfer funds to the industry and do not waive or defer payments that normally would be made by the industry to the government. They may include programmes that reduce the prices that industry pays government for goods to below market prices, or programmes that may not involve government payments at all. There may also be negative subsidy programmes that reduce the profitability of fishing firms.
- General programmes that affect fisheries

Apart from the above mentioned subsidies that can be introduced to either support existing fishers directly or to increase the overall long term economic performance of the fishing fleet, landings taxes or input taxes can be imposed at the fishers. The idea of introducing input/output taxes is to affect the relative prices and through that ensure that an optimal

¹² <http://www.fao.org/docrep/006/Y4647E/y4647e06.htm>

combination of input/output on the production factors. Furthermore, taxes will make it more costly to fish and thereby reduce the fishing effort and catches. This method is optimal from a society point of view, but the fishermen will earn less, which could be adjusted for by lowering the overall income tax for fishermen. The main argument against taxes is that it is costly to manage since taxes should be imposed on every input/output factor. Furthermore, fishers will have incentives to find gaps in the system, i.e. the fishers will substitute to input measures that are not taxed and thereby avoid the tax restrictions. Large administrative costs are thus related to the tax system that should be adjusted continuously.

Another conservation measure that uses economic incentives to increase the overall economic performance of the fleets is the ITQ system. ITQ is used to ensure that the quotas are distributed among the fishers that will gain the highest value of these. Therefore, vessels with the lowest marginal costs of fishing will purchase the quotas. Another advantage of ITQ is that it allows vessels to adjust their catches to their quota holdings by buying or selling quotas, which will reduce the incentives to discard and/or to land fish illegally. Additionally, the individual rights of the system reduce the incentives for fishers to invest in vessel capacity, i.e. in a non-right based system vessel capacity investment would give them advantages, since it would make them able to catch the fish before somebody else. The current overcapacity of the European fleet will thereby be reduced to a more cost-efficient level with ITQ system. An often mentioned drawback of the ITQ system is that the distribution of the profit will change from many fishers that gain a little each towards fewer owners that gain more each. Of the same reason, there are in some countries, such as in the Danish ITQ system for pelagic species in the North Sea, restrictions on how large percentage of the total Danish quota that one person can own. Similarly, ITQs or ITQ-like systems can also have quite profound regional effects by leading to geographical relocation of fishing capacity/rights, something which has also been experienced in the Danish VQS system for demersal fisheries.

7.2 Access regulations

While the multiannual plans, and in a wider scale the CFP, are the main regulatory framework for most countries in the North Sea, the allocation of the national quota is still a responsibility of the national governments. Most member states apply individual rights in various forms in the North Sea. Table 7.2.1 gives an overview of the implementation of individual fishing rights for the EU member states around the North Sea, for both larger vessels and coastal areas.

Every country around the North Sea has special measures adopted for their fleets inside the territorial waters. In Germany the fishermen have to have a special license which they can typically receive after a three-year training as fisherman. For larger vessels using mobile gear, fishermen receive an individual quota for regulated target species from the BLE (German Agency for Agriculture and Nutrition) or their cooperative receives it. Smaller vessels using static gear need also a special allowance to fish with that gear in certain areas. In most cases the total length of gill nets or the number of trap nets is fixed for each individual fisherman. Historically fishing rights were with the regional provinces. In Denmark there are restrictions as to how much quota can be handled by one vessel and owner, including different percentages of the total quota for a species in an area. For example, a vessel can only have a maximum of 5% of the national quota for cod in the North Sea within a year.

Between Denmark and Sweden agreement has been made to set up specific areas in Kattegat in which there are restrictions on fishing or it is altogether prohibited (see Section 4.3.4.2 above). As a further example, trawling is prohibited in the Sound (ICES SD 23) due to shipping concerns.

7.2.1 Natura 2000 Areas in relation to fisheries management measures

In order to declare areas of conservation or species of special interest under the Natura 2000 framework, each member state often needs to assess whether additional fisheries management measures are needed for the area. The European Commission then needs to evaluate this fisheries management measures requests, and does it under scientific and other stakeholder consultation, especially with the RACs¹³. In addition to this, the member state has to provide for monitoring and control measures for these fisheries management measures in the Natura 2000 areas.

According to Council Regulation (EC) No. 812/2004 of 26.04.2004 (EC, 2004b) laying down measures concerning incidental catches of Cetaceans in fisheries and amending Regulation (EC) No. 88/98 pingers must be used on gillnets with mesh sizes from 220 mm and with length above 400 m (wreck fishery) operated from vessels above 12 m in length.

No other fisheries management measures in relation to fish trawl and gillnet fishery in the North Sea in relation to NATURA 2000 Areas (Figure 7.2.1) are at present in force.

Fisheries management measures in relation to Natura 2000 areas have been proposed by the German government in addition to the closed areas in the cod management plan. A summary of the proposed measures can be seen in Table 7.2.2.

Denmark is proposing a ban for bottom trawling in areas mapped as reefs. Some areas are already protected, some 4 additional sites will probably be protected soon and a larger number later in 2013. In relation to harbor porpoise and seabirds - several studies have been initiated in terms of gathering information of bycatch rates. Denmark is at the moment not planning any fishery regulation in relation to harbor porpoise and seabirds (besides the above) as the results indicate that no alarming bycatch rates exist. Once the initiated projects have been finalized decisions will be made.

In the Netherlands, In December 2011, an agreement was signed by four NGOs, the Fish product Board, the fishermen's organisations, and the Ministry of Economic Affairs regarding restriction of fisheries in the North Sea. A quarter of the North Sea will be closed for bottom trawling. In 2014, this closure will be extended to almost half of the the Natura 2000 areas, followed by a complete closure in 2016. Also shrimp fisheries will be limited in the coastal area and *Vlakte van Rhaan*¹⁴.

¹³ European Commission, Fisheries measures for marine Natura 2000 sites.

¹⁴ http://www.noordzeenatura2000.nl/index.php?option=com_content&view=article&id=196&Itemid=178&lang=nl

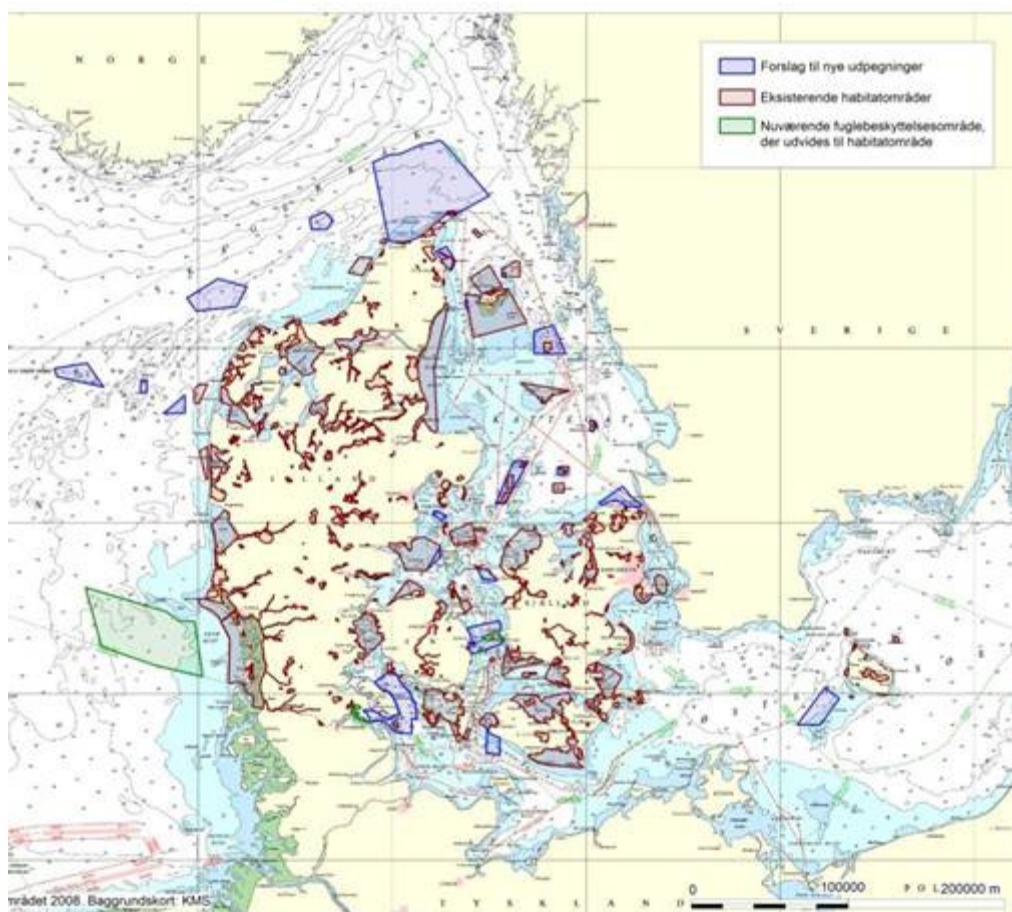


Figure 7.2.1. Natura 2000 areas appointed in relation to Harbor Porpoise in the North Sea.

Table 7.2.1 Catch allocation mechanisms for large scale and coastal fisheries in selected North Sea countries

Countries	Year	IQ	ITQ	Capacity/ entry lim.	Comments for large vessels	Comments for coastal fisheries
Denmark	2000-2009	X	(X)	X	ITQ stepwise since 2003 (from open access through setting of quota) Newcomers can obtain specific extra allocation of quota.	Special regulations for small-scale fishermen (< 17m, normally one day trips, etc.). Quota may be bought only from larger vessels to prevent concentration, and concentration is restricted. There is huge debate on to what extent coastal fishing is sufficiently shielded under current regulations
	2010		X			
	after 2010		X			
Germany	2000-2009	X		X	Better transferability of IQs may be possible in the future. At present fishermen may lose their IQs if they are not used and IQs are then given to another fisherman.	Effort limitations apply, as length of gillnets, number of trapnets and hooks.
	2010	X				
	after 2010	X				
The Netherlands	2000-2010		X		IQ since 1976, and ITQs since 1985. POs are responsible for managing, and swapping quota.	Within 12 miles, restriction of maximum 300hp. Effort limitations apply, as length of gillnets
	2010		X			
	after 2010		X			
UK	2000-2010	X*	X*	X	* Almost all vessels fishing for quota stocks belong to POs who have responsibility for managing quotas. Some POs operate ITQ systems, some still use common quota pools and monthly limits but many of these allow individual boats to lease in additional quota to supplement their allowances.	* Inshore (10m and under) vessels subject to monthly quota limits for a number of stocks from a common quota pool. Limited opportunities for these vessels to lease additional quota on an individual basis since 2010.
	2010	X*	X*	X		
	after 2010	X*	X*	X		

Source : adapted from Blenckner et al. 2011

Table 7.2.2 Summary of fisheries related conservation measures for German Natura 2000 sites in the North Sea of the area for fisheries with mobile bottom-contacting gears

	Reefs	Sandbanks	Harbour porpoise	Sea birds
Dogger Bank		1: Experimental closure of 50%	2a : Year-round exclusion of fisheries with gillnets and entangling nets in the entire Natura 2000 site (BfN) 2b : Year-round use of pingers in all gillnets and entangling nets (vTI)	
Sylt Outer Reef	1. Exclusion of fisheries with mobile bottom- contacting gear from the central area	2: Experimental closure of the Northern part (50%) of the Amrumbank for fisheries with mobile bottom-contacting gears	3: Exclusion of fisheries with gillnets and entangling nets 3a: Year-round (BfN) 3b: Seasonally (1 May – 31 August) and use of pingers on all gillnets and entangling nets throughout the year (vTI)	
Western Rönne bank	1. Exclusion of fisheries with mobile bottom- contacting gear in sandbanks and reef areas		2a : Year-round exclusion of fisheries with gillnets and entangling nets in the entire area (BfN) 2b : Year-round use of pingers in all gillnets and entangling nets irrespectively of vessel size. (vTI)	
Borkum Reef Ground	1: Exclusion of fisheries with mobile bottomcontacting gears in the entire Natura 2000 site	1: Exclusion of fisheries with mobile bottom-contacting gears in the entire Natura 2000 site	2a: Year-round exclusion of fisheries with gillnets and entangling nets in the entire Natura 2000 site (BfN) 2b: Year-round use of pingers on all gillnets and entangling nets (vTI)	
Eastern German Bight Nature Conservation Area		1. Exclusion of fisheries with mobile bottom- contacting gear in sandbanks and reef areas	2a : Year-round exclusion of fisheries with gillnets and entangling nets in the entire area (BfN) 2b : Year-round use of pingers in all gillnets and entangling nets irrespectively of vessel size. (vTI)	

Source: Proposed measures for fisheries management in Natura 2000 sites in the German EEZ of the North Sea and the Baltic Sea, 2011.

7.3 Compliance monitoring measures

The monitoring of fishing vessel activities at sea is done by the Vessel Monitoring System (VMS). VMS are used to allow fisheries regulatory organizations to monitor the compliance in spatial and temporal effort allocation by collecting the position, time at a position, and course and speed of fishing vessels in the exclusive economic zones (EEZ) of the EU member states. From 2000, all vessels over 24 m in length were required to transmit their location every 2h or less. The legislation was revised in 2005 to include all vessels of 15 m and over (EC, 2003). VMS data are further extended in 2012 to include all vessels of 12 m and over. VMS enables the authorities to enforce the compliance to any regulated areas for fisheries (by monitoring of entry into and exit from specific areas) or to a larger extent to any direct constraints on the application of the fishing effort. Hence, VMS is seen as a reliable technology capable of producing evidence of vessel activity in relation to e.g. control of compliance to spatial regulations and measures such as the case of incursion into a closed area to fishing

In European waters, all fishing vessels (larger than 10 meters in length) has according to the Data Collection Framework (EU DCF, Commission decision 2008/949/EC) to declare the catches into logbooks for every trip at sea, together with several other mandatory information (the catch area, the used gear type, the number of days at sea, etc.) so that the regulator can monitor and trace the origin of landings and control the total amount simultaneously caught by all the vessels in a given area in case of TAC, or the time spent at sea in case of effort control. However the obligation does not include the discard part of the catches. When commercial vessels are getting rid of unwanted catch of fish, crustacean or other marine organism by throwing it over board it is considered to be discard. The amount of yearly discard is essential information and necessary input for a trustworthy assessment for most stock assessments. Indeed the EU TAC system in practice regulates landings rather than catches that put the stocks at risk by creating uncertainties in stock estimates when fisheries are managed on certain levels of fishing mortality. The first step into reducing the discard problem is to investigate where discard is occurring in larger amounts, to highlight the pattern in different fleet components and to document the monitoring of the sampling program. Since the introduction of the EU data collection regulation (2002- 2008) and the subsequent data collection framework (Commission decision 2008/949/EC) monitoring the catches onboard commercial fishing vessels has routinely been undertaken by the member states through observers on board collecting discard data.

Improved monitoring is reinforced by the introduction of electronic logbooks (into force since 2012). For example in UK since 2010, fishing vessels have been able to record and report fishing activity electronically. The fishing logbook data is transmitted to a central UK hub and is accessible on a real time basis to inspectors. The system records and reports, among other things, fishing effort, catch on entry or exit and prior notification of entry into port. Cross-checking with the VMS information is also ongoing.

Improved monitoring is reinforced by mounting video cameras on fishing vessels to report for fully documented fishery (Kindt-Larsen *et al.*, 2011). Growing interest in Europe is put on alternative management options (for the incoming CFP reform) such as discard bans or total catch quota schemes in place of the TAC system alone. Both discard bans and catch quota schemes require that both landings and discards be monitored that creates a challenge to control and enforce them in practice, because the total catches cannot be determined accurately without 100% observer coverage. However, most of these control and enforcement

issues can possibly be resolved in most fisheries by the use of cameras on board of each vessels e.g. by mounting an imagery unit. The imagery unit is closed-circuit television (CCTV) cameras. During all catch events, it recorded overhead views of the working deck and catch-handling areas, and closer views of the discard chutes.

On the long run, further insights to support the monitoring of commercial fishing are provided using these new technologies and source of data (Ulrich *et al.* 2012). For example, the access by scientists to individual VMS data allows the derivation of more precise estimates of the spatial distribution of effort and landings (Bastardie *et al.*, 2010; Hintzen *et al.*, 2012), and more in-depth investigation of the links between both. These tools can also supplement other particular concerns when assessing e.g. the impact of fleet-specific activities on the sea floor and benthic communities, and provide information to the broader marine spatial planning and EU Marine Strategy Framework Directive (MSFD). Thanks to these tools, continuous improvements on the quantification (nominal vs. effective) and the qualification (e.g., low vs. high impact for a given pressure indicator) of the fishing effort are expected to be gained in a near future.

STECF (2012f, ANNEX III) recently evaluated the potential for compliance facing the future probable management options for the North Sea region (discard ban, individual quotas, gear limitations) in terms of *Controllability, enforcement tools and cost efficiency, Compliance, Obstacles, and Incentives*. STECF states that in order for the management option to achieve its objectives it is important that the effect on compliance and enforcement of the entire system of management measures is considered. From this perspective it is crucial that the control measures:

- are re-harmonized over regions and MS as far as possible to avoid actual or perceived unfairness.
- are kept to a minimum to avoid spreading limited control funds over a large number of measures.
- ensure that the fishers receive the benefits of complying with the rules as well as the bearing the costs of non-compliance.
- carry appropriate penalties for non-compliance; failure to have sufficiently stringent penalties could incentivize non-compliance.
- consider incentives for fishers to comply with the rules.
- are stable over time (as far as possible) to avoid confusion and mistakes.
- are understood and accepted by the industry
- are applied in the most cost- efficient way using the appropriate tools and intensity to control each management option.

The CCTV-system would improve compliance of reporting rules as well as any potential discard ban. However, a system of CQM with some type of discard ban cannot be successful if the right surrounding measures are not in place. Systems for receiving undersized or unwanted catch in harbors, rules of conducts etc. has to be developed so that compliance is not hindered.

If only part of the fleet is equipped with CCTV, a sense of unfairness that potentially could influence compliance could be created. This has to be considered alongside the benefits of equipping only parts of the fleet based on a risk based approach.

The initial allocation of Individual vessel/business catch quotas is an important key to achieve compliance. In fisheries with a large overcapacity the initial allocation is difficult.

Furthermore, the allocation of choke species in fisheries where the national quota of the species is very small, due to the relative stability, is difficult.

The usage of certain gears might not be economically optimal which might drive non-compliance.

8. Management performances

8.1 Conservation

8.1.1 Stock and mixed fisheries management performance

At present (2013-forward), cod is the limiting species for all the North Sea demersal fisheries. Following the 'cod' scenario (full implementation of the cod management plan), the haddock and whiting management plan catch options could not be fully utilized.

There are new issues raised wrt. mixed-fisheries, and in particular the fact that the relative stability is based on historical catch distribution, which may no more reflect the current species distribution in a warmer environment. A strong example of this are the problems linked to the increasing abundance of Northern Hake in the North Sea. Northern countries have only small quotas shares for this stock, and the increasing catches cannot be legally landed, leading to large tonnages being discarded.

Cod in the North Sea and Skagerrak and the English Channel:

ICES has evaluated the EC management plan (EC 1342/2008) and the EU–Norway agreed long-term plan in March 2009 and concluded that these management plans are in accordance with the precautionary approach only if implemented and enforced within given time frames. A joint ICES–STECF group met during 2011 to conduct a historical evaluation of the effectiveness of these plans (Kraak *et al.*, 2012). The group concluded that although there has been a gradual reduction in F and discards in recent years, the plans for North Sea cod have not controlled F as envisaged, and following the current regime is unlikely to deliver F_{MSY} by 2015. The assessment estimates that SSB in 2012 is still below B_{lim} and although F is now below F_{pa} , it is still largely above any management target. The objective of the EU management plan to reduce fishing mortality by 45% in 2011 compared to 2008 has not been achieved. The decrease in F from 2008 to 2011 is estimated to be around 9%. While ICES considers that a reduction in F has taken place, the intermediate year F assumption from the management plan is considered to be over-optimistic (Kraak *et al.*, 2012). An alternative assumption for the F in 2012 is made based on the continuation of the F trend from 2006 to 2010. Following the ICES MSY framework requires fishing mortality to be reduced to 0.10 (lower than F_{MSY} because $SSB_{2013} < MSY B_{trigger}$), resulting in landings of less than 10 000 t in 2012. This is expected to lead to an SSB of 123 000 t in 2014. To follow the transition scheme towards the ICES MSY framework the fishing mortality must be reduced to $(0.4 \cdot 0.58) + (0.6 \cdot 0.10) = 0.29$, which is lower than F_{pa} . This results in landings of less than 27 600 t in 2013, which is expected to lead to an SSB of 101 000 t in 2014.

Haddock in the North Sea and Skagerrak:

The stipulations of the long term management plan have been adhered to by the EU and Norway since its implementation in January 2007. Adherence to the EU–Norway management plan has contributed to lower fishing mortality levels and greatly improved stability of yield. Discards are highly variable without obvious long-term trend but appear to be declining in recent years. Within an ecosystem context, species-specific assessments and the latest developments in mixed-fisheries approaches need to be considered. A reduction in direct effort on one stock may lead to a reduction or an increase in effort on another and, hence, the implications of any changes need to be identified and carefully evaluated.

Whiting in the North Sea and Eastern Channel:

After the considerable revisions in this year's assessment, caused by new estimates of natural mortality, the target F in the long term management plan is no longer considered applicable and the management target needs re-evaluation. As an interim measure, it would be appropriate to scale the target F in the plan (0.3) according to the proportional change in F between the old and new assessment (F revised downwards by around 25% between the 2011 and 2012). Advice is given for Subarea IV and Division VIIId combined. However, TACs are set for Subarea IV and Divisions VIIb–k separately and there is no way of controlling how much of the Divisions VIIb–k TAC is taken from Division VIIId. There should be separate management for Division VIIId.

Saithe in the North Sea and Skagerrak:

The EU–Norway agreed management plan as updated in December 2008 was evaluated by ICES in 2008, and considered to be consistent with the precautionary approach in the short term (< 5 years).

Plaice in the North Sea:

An evaluation of the EU management plan for North Sea plaice and sole (Council Regulation (EC) No. 676/2007) by ICES in 2010 concluded that the management plan is precautionary. Both the North Sea plaice and sole stocks have been within safe biological limits in the last two years. According to the management plan (Article 3.2), this signals the end of stage one. Application of the plan is on the basis of transitional arrangements until an evaluation of the plan has been conducted (as stipulated in article 5 of the EC regulation). Mesh enlargement in the mixed North Sea flatfish fisheries would reduce the catch of undersized plaice, but would also result in loss of marketable sole. The current combined sole and plaice long-term management plan specifically reduces effort as a management measure. The reduction in fishing effort is reflected in reductions in estimated fishing mortality. Mesh enlargement would reduce the catch of undersized plaice, but would also result in loss of marketable sole.

Sole in the North Sea:

The management plan for North Sea sole and plaice (Council Regulation (EC) No. 676/2007) was evaluated by ICES in 2010, and ICES concluded that the management plan is precautionary. The sole stock has been within safe biological limits in terms of fishing mortality since 2008, while SSB has been slightly fluctuating around the biomass limit ($B_{pa}=35$ kt) since 2008. Both the North Sea plaice and sole stocks have been within safe biological limits in the last two years. Consequently, ICES concludes that the objectives of stage 1 are currently met and provides advice based on the plan's TAC setting procedure acknowledging to be in a transitional stage at present (as stipulated in article 5 of the EC regulation)

8.1.2 Ecosystem status and management performance

Broader North Sea ecosystem developments and aspects in relation to harvesting the resources and fisheries management is given in STECF (2012e): Development of the Ecosystem Approach to Fisheries Management (EAFM) in European Seas. STECF-11-13. The North Sea supplies approximately 1.5 to 2 million tonnes of fish each year, for both assessed and non-assessed species (Figure 8.1.1).

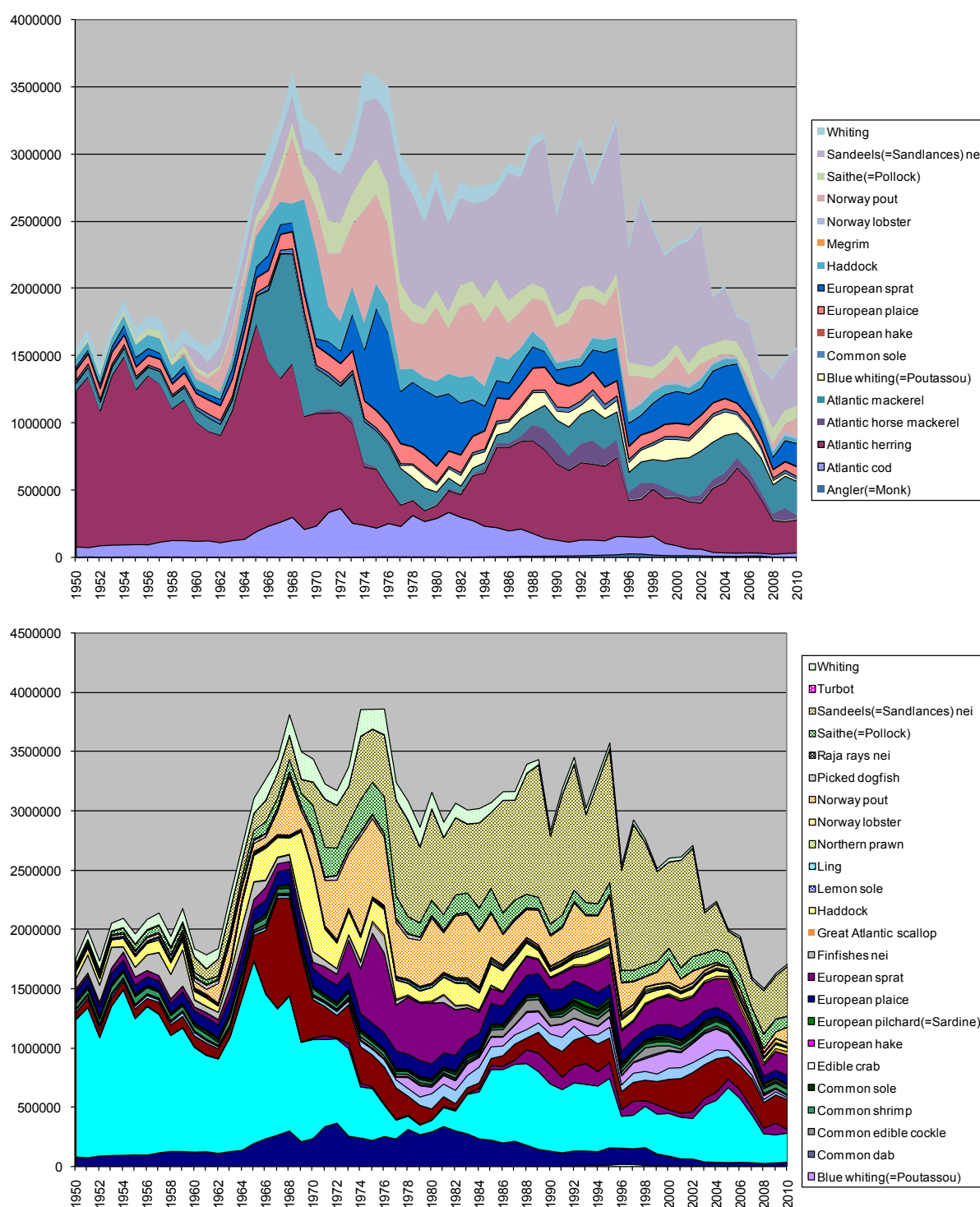


Figure 8.1.1. North Sea landings 1950-2010 from ICES Statlant. Top: Assessed species; Bottom: all species also including non-assessed species). (STECF, 2012e).

Demersal fisheries target roundfish species such as cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and whiting (*Gadus merlangus*) in addition to flatfish species such as plaice (*Pleuronectes platessa*), sole (*Solea solea*) and a fishery for saithe (*Pollachius virens*). Pelagic fisheries target herring (*Clupea harenguss*) and mackerel (*Scomber scomber*) and the industrial fisheries target sandeel (*Ammodytes spp*), Norway pout (*Trisopterus esmarkii*) and sprat (*Sprattus sprattus*). There are also important crustacean fisheries for

nephrops (*Nephrops norvegicus*), pink shrimp (*Penaeus borealis*), brown shrimp (*Crangon crangon*) and brown crab (*Cancer pagurus*).

Industrial and pelagic species combined have accounted for an increasing proportion of the landings, while landings of demersal stocks have declined in line with falling stock sizes and regulated reductions in total allowable catches (Figure 8.1.1 top). Total landings for the assessed species peaked above 3.5 million tonnes in the late 1960's and mid 1970's and have remained higher than 3 million tonnes from 1966 to 1977. Since this period of time, despite increasing landing of some stocks like sandeels, the total catches exhibit a declining trend, with an accelerating decrease since the mid-1990s. Current reported landings stand at around 1.5 million tonnes. The landings of the assessed species in the North Sea accounts for the major part of the total landings including the non-assessed species (see also below).

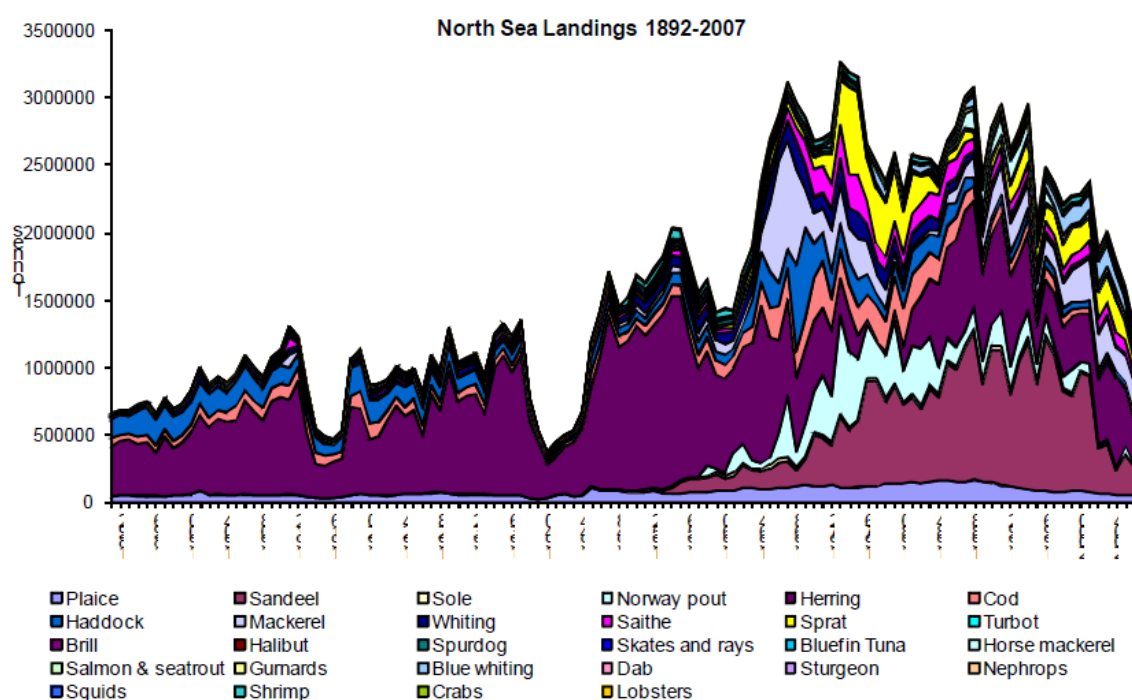


Figure 8.1.2. North Sea landings 1892-2007 (STECF, 2012e).

Total catches of North Sea fish since the turn of the century provide the broader context for the decline seen since the mid-1990s (Figure 8.1.2). Some stocks, especially herring and secondarily cod, haddock and plaice, were already intensively fished in the late 19th century, providing at that time more than 1 million tonnes of landings per year. Landing of these species and the total landings as well, regularly increased (except during the two world wars) reaching more than 2 million tons in 1956. This changed dramatically in the 1960s. Herring accounted for a large majority of catch before 1960, but when this fishery collapsed a wider range of the ecosystem became exploited. Total landings increased until the mid-1970s, then they decreased significantly in the mid 1990's. It should be noticed that these statistics underestimate total removals because of the prevalence of discarding and also in some periods unreported landings.

8.1.3 Current status of stocks and mean trajectories:

The data required to compare the current status of each stock (F^* , B^*) to the reference points (F_{pa} and B_{pa} , and F_{msy}) were available for 9 stocks in the North Sea ecosystem (Figure 8.1.3). Among these stocks, cod (Cod-347d) is currently in an unsustainable position with F and B beyond the precautionary levels. The F_s value for the North Sea mackerel and sole in Division VIIId (Eastern Channel) is beyond F_{pa} , while the sole biomass in Div. IIIa is just below B_{pa} . The North Sea sole and the saithe are in an intermediate situation with mortalities between F_{pa} and F_{msy} and biomasses above B_{pa} . The North Sea Haddock, plaice and the Blue whiting combined are currently in a favourable situation with biomasses above B_{pa} and F_s around F_{msy} . Note however that only a small fraction of the blue whiting stock is present in the North Sea. According to the MSY approach (i.e. in the green area on the figure), over the 9 assessed stocks only 3 stocks are in the sustainable zones while 4 stocks are considered outside the safe limits of the precautionary approach.

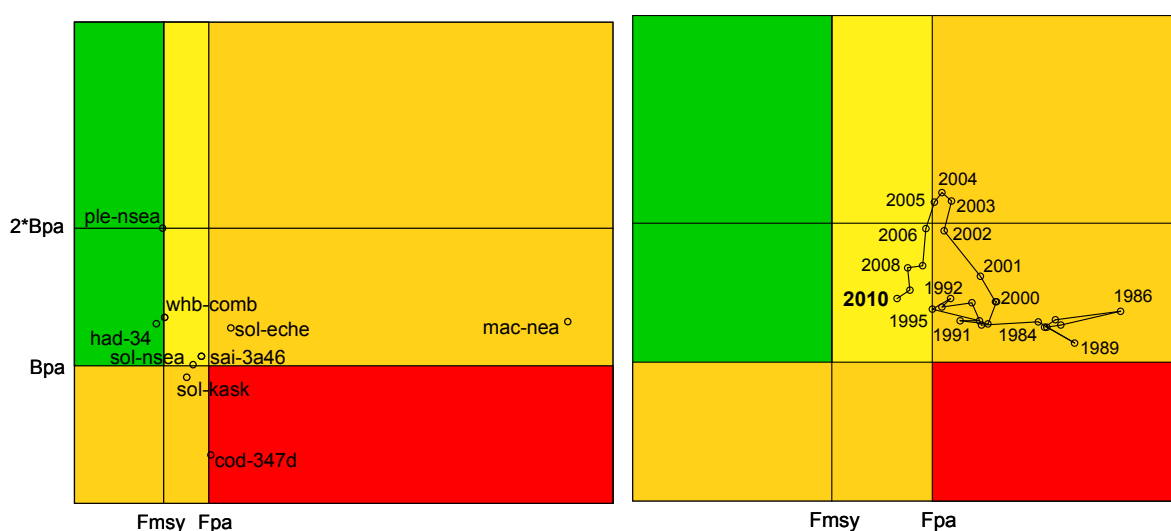


Figure 8.1.3. Status of stocks assessed in the North Sea compared to the precautionary approach (pa) and MSY reference points. Left: current state (last assessment for 9 stocks) – Right: mean trajectory from 1983 to 2010 (mackerel excluded, cf. § 4.3) (STECF, 2012e).

The mean trajectory of the average state of the assessed stocks was estimated from 1983 to 2010 (Figure 8.1.3 right). Until 2005 the stocks were on average in the overfished zone with F higher than the precautionary F_{pa} level and especially in the late 1980s. A clear decrease in the mean F is observed in the 2000-2010 period with current F value between F_{msy} and F_{pa} . The stocks' SSB was on average above B_{pa} over the whole period (1983-2010). It increased in the period 2000-2004 but came back in 2010 to the 2000's level despite the reduction of fishing pressure.

8.1.4 Conclusion of the stock synthesis:

The indicators on stock synthesis show a fluctuating state of the North Sea ecosystem from 1965 to 1995 when the ecosystem was experiencing very high exploitation rates (highest landings since 1950). Total landings from the North Sea had historical high levels between 2.5 to 3.5 million tonnes per year from 1965 to 1995. From 1995 to 2010 landings decreased

significantly to a level of about 1.5 million tons while mean fishing mortality has decreased by two-fold from about 0.6 to less than 0.3. The total spawning stock biomass displayed decadal oscillations since 1967 with low levels in the 1970's and 1990's. Since 2000 the total biomass is of about 4 to 5 million tonnes with an increasing trend in the most recent years. Despite the decrease of landings and fishing mortality in the last recent decade, the overall recruitment has shown a clear decreasing trend (although fluctuating) from 1985 to 2010 to reach a recent low index value at about 0.5. The recent increase in the spawning stock biomass during the last decade, which is likely due to lower landings and fishing mortality levels in the last 15 years, indicate inclinations of the North Sea ecosystem to recover. However, this was not converted in higher recruitment levels in the most recent years. Note that recruitment might also be influenced by trends in temperature (see under environmental indicators below). Although the average fishing mortality was significantly reduced, it just reached levels between F_{msy} and F_{pa} in the most recent years and is still higher than the F_{msy} target. (STECF, 2012e).

8.2 Economics

Two commonly used economic performance measures used in fisheries is gross profit and net profit. The gross profit is in the DCF defined as the income subtracted variable, semi-variable and fixed costs. Net profit is defined as the gross profit subtracted depreciation costs and interests, where interests are estimated as the opportunity cost of capital. The developments of both gross profit and net profit in the period 2008-2010 are shown in Table 8.2.1. Where the development changes from negative to positive profit or vice versa, the development (in percentage) does not have any interpretative meaning and is not shown.

There is a clear trend that both the gross profit and net profit has improved from 2008-2010 for the main fleets of the North Sea, as shown in Table 8.2.1. The only exception is the Dutch beam trawlers 18-24m, which gross profit decreased by 89%. The other fleets increased their gross profit from 21% and up to 780%, highest for the UK vessels between 18m and 24m using demersal trawl and seine. Similarly, the net profit increased from 15%-1302%, highest for the Danish vessels larger than 40m using demersal trawl and seine. The positive development in economic performance measures could be a result of the structural changes that have recently occurred in many fisheries. Especially the movement towards right based systems is expected to have had positive effects on reducing the overcapacity and improving the economic performance of many fleets.

Table 8.2.1: Development in gross profit and net profit for the main North Sea fleets in the period 2008-2010.

Country	Length	Gear type	Gross profit				Net profit			
			2008	2009	2010	% change 2008-2010	2008	2009	2010	% change 2008-2010
Denmark	18-24m	DTS	9.1	7.5	11.1	21%	0.3	-2.3	0.9	174%
Denmark	24-40m	DTS	10.3	12.9	19.3	88%	-1.8	-0.5	6.4	-
Denmark	>40m	DTS	48.3	42.4	99.5	106%	4.2	0.8	59.4	1302%
France	>40m	TM	-	-3.7	0.4	-	-	-3.7	-0.2	20.7
Germany	24-40m	DTS	-9.4	3.0	5.3	-	-11.6	1.2	4.0	-
Netherlands	18-24m	TBB	9.5	1.4	1.0	-89%	3.7	-4.7	-4.9	-
Netherlands	24-40m	TBB	1.6	5.9	3.2	105%	0.3	4.5	1.8	498%
Netherlands	>40m	TBB	21.5	25.7	32.5	51%	8.1	12.8	21.8	169%
United Kingdom	0-10m	FPO	12.5	12.1	15.7	25%	0.7	1.6	5.3	681%
United Kingdom	12-18m	DTS	7.9	4.9	9.4	19%	3.9	1.7	6.6	70%
United Kingdom	18-24m	DTS	8.3	9.9	18.7	126%	-1.5	1.0	10.3	-
United Kingdom	24-40m	DTS	4.0	6.7	35.5	780%	-4.7	-1.0	28.4	-
United Kingdom	>40m	DTS	5.5	4.4	13.0	136%	3.2	2.1	10.4	226%
United Kingdom	>40m	PS	52.7	75.2	64.9	23%	30.8	54.1	35.5	15%
Total			181.8	208.5	329.5	81%	35.6	67.5	185.9	422%

Source: Data Collection Framework (DCF) of the European Commission;

Note: The costs for the French pelagic trawl >40m is not available in DCF for 2008

8.3 Social aspects

Employment is likely the most telling ‘social’ indicator for which it is actually possible to obtain a time series of data on, which can be credibly compared for the different North Sea countries.

Overall, employment in fishing, not least in the North Sea, is shrinking and has been so for many years. There is a multiplicity of explanations for this, but at least the following deserves to be mentioned:

- individual vessels getting more efficient;
- consolidation of fleets whereby fewer vessels catch the available resources; and
- decreasing fishing opportunities in the shape of lower quotas.

In many fisheries dependent regions, not least in the North Sea area, this has resulted in a situation, where other sectors such as shipping and food processing (to some extent with externally sourced raw materials in the shape of imported fish) have increasingly replaced fisheries. Certain ports and municipalities around the North Sea can, however, still be considered fisheries dependent, but the number and extent of dependency is decreasing and this development can probably be expected to continue, though perhaps not at the same pace as recent years.

8.3.1 Development in Employment for Most Recent Years

The data in the following is taken from STECF data (<http://stecf.jrc.ec.europa.eu/>). It should be noted that the data beneath is national data and as such does not relate to only fishing taking place in the North Sea.

Table 8.3.1: Harmonised data on number of FTE fishers for the most recent years: 2008 – 2010

	2008	2009	2010
Denmark	1716	1544	1504
Netherlands	2200	2007	2006
United Kingdom	8163	7104	6918
Belgium	380	335	352
Germany	1384	1027	1149

Based on data from STECF Annual Economic Report 2012 appendices:
http://stecf.jrc.ec.europa.eu/documents/43805/366433/2012_EWG+12-05_EU+FLEET+ECONOMIC+AND+TRANSVERSAL+DATA_FS+LEVEL.xlsx

The short time-series in Table 8.3.1 above shows the trend towards fewer and fewer fishers. From 2008 to 2010 all the countries witnessed a reduction in the number of FTE fishers. For Germany and Belgium there seems however, to have been a smaller increase from 2009 to 2010.

The raw numbers of fishers also tells a story of a sector that in reality, at least in the prosperous countries around the North Sea, provides very few jobs. It should be noted, though, that fishing generates landbased activities as well, which are not included in the numbers above.

8.3.2 A Longer Perspective on Development in Employment

The overall development in the number of fishers stands out more clearly, if we take a longer perspective. Table 8.3.2 beneath shows the development of FTE fishers in Denmark for the period 2002 to 2009. The development is in many ways remarkable. Though, it should also be noted that Denmark is the country, which has witnessed the greatest relative reduction in the number of fishers in the EU countries around the North Sea in the period.

Table 8.3.2: FTE (National Data) Fishers in Denmark: 2002-2009

Year	2002	2003	2004	2005	2006	2007	2008	2009
FTE Fishers	4.038	3.643	3.315	2.951	2.635	1.917	1.722	1.546

Based on data from STECF: http://stecf.jrc.ec.europa.eu/documents/43805/256769/2011_EWG+11-16_EU+FISHING+FLEET+ALL+ECONOMIC+AND+TRANSVERSAL+DATA.zip

As evident from Table 8.3.2, the number of FTE fishers in Denmark has been reduced by more than 60 percent in the course of a very limited number of years. Although this is of course also related to the developments in catching opportunities and efficiency gains on behalf of individual vessels, in the Danish context a major driver has also been the incremental introduction of ITQs in pelagic fisheries and an ITQ-like system in the demersal fishery, which has led to a marked consolidation of the fleet and hence a very noticeable decrease in the number of operating fishing vessels.

Similar trends, although not quite so dramatic, can be seen for the other North Sea countries. The number of FTE fishers in the UK has been halved over the period. In Germany one-third of the fishermen have left the sector, which is a little more than in Belgium. Netherlands has been the country with the most stable number of fishermen over the period with a decrease of 20 percent.

9. Conclusions

Management of the demersal roundfish and flatfish fisheries in the North Sea is conducted mainly through the EU Common Fisheries Policy (CFP) and the yearly EU-Norway Bilateral Fishery Agreements. The prevailing management system and principle has been landing quotas (TAC, Total Allowable Catch) mainly based on the EU principle of relative stability in the international sharing of the TAC. Also, general effort limitations and technical measures are set for the EU and Norwegian fisheries on top of the TAC regulations. Technical measures have mainly aimed at reducing the retention and discard of the juveniles through gear measures and to protect the spawners and/or recruits in the fish populations through closures. Furthermore, the management is based on a set of national measures especially concerning control and enforcement measures, national distribution of the overall TAC, individual special technical measures, allocation (distribution) of national TACs to different fisheries and vessels including the share to e.g. Individual Transferable Quotas (ITQs) or Vessel Quota Shares (VQSs).

The management of the North Sea demersal fisheries has changed quite a lot over the last decades following the need to rebuild the fish stocks, and in particular the North Sea cod stock in relation to the present case study. The CFP has increasing focus towards implementing multi-annual or long term management plans (MAMPs, LTMPs) partly to avoid the annual political battles over setting the TAC. There has furthermore been a trend during the last decade to move away from the Precautionary Approach and towards Maximum Sustainable Yield as the overarching management objective and Harvest Control Rules (HCRs) based on this. There have been introduced increasingly restrictive fisheries-based effort limitations with possibilities for exemption or for less drastic effort reductions provided that cod avoidance behavior can be demonstrated. Although the decision-makers under the CFP have had a reputation of consistently setting TACs way above the scientific advice, the development in recent years has been towards this gap being reduced.

Management of the fisheries has undergone a number of structural and behavioral changes, and these have already yielded some positive results as the state of the demersal stocks in the North Sea have globally improved. The status of main demersal stocks has considerably improved over the last decade. Fishing mortality has globally decreased and biomass has increased, and most of the assessed demersal stocks are now within sustainable limits. Some issues remain with North Sea cod, for which recovery is slower. At present, cod is the limiting species for all the North Sea demersal fisheries. Over a time span from the 1960s landings of demersal stocks have declined with an accelerating decrease since the mid-1990s in line with the falling stock sizes and regulated reductions in total allowable catches (TACs). A clear decrease in the mean fishing mortality (F) is observed in the 2000-2010 period with current F values between F_{msy} and F_{pa} , and the spawning stock biomass (SSB) has on average been above B_{pa} for the period 1983-2010 for the assessed stocks. The effort in the central North Sea and along the Norwegian waters has decreased as well as the number of operating fishing vessels (capacity). Overall, the nominal effort (kW-days) by European fleets using demersal trawl, seine, beam trawl and gillnet in the North Sea, Skagerrak and the Eastern Channel have been substantially reduced (-20% between 2003 and 2011). Since 2000, the total fish biomass for exploited stocks in the North Sea is about 4-5 million tonnes with an increasing trend in the most recent years. Despite the decrease of landings and fishing mortality in the last recent decade, the overall recruitment has shown a clear decreasing trend from 1985-2010. The recent increase in SSB during the last decade, which is likely due to lower landings and fishing mortality levels in the last 15 years, indicate inclinations of the North Sea ecosystem

to recover. However, this has not converted in higher recruitment levels in the most recent years in which there may be a time delay.

There is a clear trend that both the gross profit and the net profit has improved from 2008-2010 for the main fleets of the North Sea with the only exception of the Dutch beam trawlers 18-24m, for which the gross profit decreased by nearly 90%. The positive development in economic performance measures can be a result of the structural changes that have recently occurred in many fisheries. There are fewer vessels sharing the available resources (reduction in over-capacity). Especially, the movement towards right-based systems is expected to have had positive effects on reducing the over-capacity and improving the economic performance of many fleets. Historically, EU subsidies over the years have contributed to making the fleet more efficient, so the success of the CFP in the area of developing an efficient fleet has historically contributed to its failure in relation to conserve fish stocks, as overcapacity is consistently mentioned as one of the fundamental reasons for the conservation failure historically.

Employment in fishing as a social indicator is shrinking, not least for the North Sea, and has been so for many years. There are multiple explanations for this: i) individual vessels are getting more efficient, ii) consolidation of fleets whereby fewer vessels catch the available resources with noticeable decrease in number of operating fishing vessels, and iii) decreasing fishing opportunities in the shape of lower quotas. The raw number of fishers tells a story of a sector that in reality, at least in the prosperous countries around the North Sea, provides only few jobs.

Despite the above trends indicating positive effects of the most recent fisheries management of the North Sea mixed demersal fisheries there are a row of general problems in the present management.

Population dynamics with respect to recruitment variations, sub-populations and changes in distribution of several demersal North Sea stocks influenced by environmental factors besides fishery are not fully understood and taken into consideration in management (and management advice). Also, biological multi-species interactions between the stocks are not fully taken into account in the management of the stocks when setting the MSY management and exploitation limits for the stocks. Management is not based on broader ecosystem and multi-species objectives, but based mainly on single stock objectives.

Also technical interactions between fisheries are not taken fully into account in management of the North Sea demersal fisheries. The fisheries targeting cod, whiting, haddock, saithe, flatfish and Nephrops in the North Sea and Kattegat-Skagerrak are mixed demersal fisheries for towed gears. Mixed fisheries considerations are of primary importance for the management of North Sea species. Single stock management is a cause of discarding in mixed fisheries, because individual stock management objectives may not be consistent with each other. As such, the TAC of one species may be exhausted before the TAC of another, leading to catches of valuable fish that cannot be landed resulting in over-quota discard.

Overall, present management and fisheries policy is characterized by the CFP having in many ways taken form of a classical intergovernmentalist, state-centric command-and-control, top-down management system, where member states' ministers in the Council have exercised strong control over the fisheries management measures which have been developed and adopted on the background of proposals from the Commission and the Parliament, though

since the ratification of the Lisbon Treaty the Parliament has assumed a role of co-legislator alongside the Council. EC has identified the lack of stakeholder involvement as one of the major weaknesses of the CFP, recognizing that this fact clearly undermine its legitimacy. Establishment of the Regional Advisory Councils (RACs) with the 2003 CFP can be seen as the first formal attempt to generate a network of multi-national, multi-interest advisory organizations with a strong regional focus among other involving resource users in the decision making. However, the RACs have at present only an advisory function on decisions and are not formally integrated directly in management on a regional basis, i.e. the RAC system is primarily intended to provide a regional stakeholder perspective to the Commission's deliberations rather than providing stakeholders with real decision-making authority. RACs constitute, nevertheless, a move towards regionalization of the fisheries policy.

Present management is, furthermore, characterized by a high degree of complexity, bureaucracy, and examples of micro-management where different management systems and measures are implemented in parallel making evaluation of impact of the individual measures and systems very complicated and the system suffers from lack of transparency. With respect to the complexity the different management measures are acting top of each other with impact on the same fisheries and stocks at the same time (and with time overlap in their implementation) creating a very complex management and associated advisory system, where it is difficult to distinguish specific effects and impacts of each individual measures implemented. Accordingly, it is also very difficult to make scientific management evaluation and advice associated to the individual measures.

10. References

- Bastardie, F., J.R. Nielsen, C. Ulrich, J. Egekvist, H. Degel, 2010. Detailed mapping of fishing effort and landings by coupling fishing logbooks with satellite-recorded vessel geo-location. *Fish. Res.* 106, 41–53
- Blenckner, T., Döring, R., Ebeling, M., Hoff, A., Tomczak, M., Andersen, J., Kuzebski, E., Kjellstrand, J., Lees, J., Motova A., Vetemaa, M. and Virtanen, J.. FishSTERN A first attempt at an ecological-economic evaluation of fishery management scenarios in the Baltic Sea region March 2011 Report 6428 Swedish Environmental Protection Agency report no. 6428. ISBN 978-91-620-6428-0.
- Churchill RR, Owen D. 2010. The EU Common Fisheries Policy. Oxford: Oxford University Press.
- Commission of the European Communities. 2003. Communication from the Commission, Improving scientific and technical advice for Community fisheries management. In: Official Journal of the European Communities. C 47, 27.2.2003: 5-16.
- Commission of the European Communities. 2005. Commission Decision of 26 August 2005 establishing a Scientific, Technical and Economic Committee for Fisheries. In: Official Journal of the European Communities. L 325, 31.8.2005: 18-22.
- Community Fisheries Control Agency. (Undated). Community Fisheries Control Agency: Joint deployment plans. From: http://cfca.europa.eu/pdf/jdps_vigo.pdf (accessed 6 January 2009).
- Council of the European Communities. 1970. Council Regulation (EEC) No 2141/70 of the Council of 20 October 1970 laying down a common structural policy for the fishing industry. In: Official Journal of the European Communities. L 236, 27.10.1970.
- Council of the European Communities. 1970a. Council Regulation (EEC) No 2142/70 of the Council of 20 October 1970 on the common organisation of the market in fishery products. In: Official Journal of the European Communities. L 236, 27.10.1970.
- Council of the European Communities. 1983. Council Regulation (EEC) No 170/83 of 25 January 1983 establishing a Community system for the conservation and management of fishery resources. In: Official Journal of the European Communities. L 024, 27.01.1983, pp. 1-13.
- Council of the European Communities. 1992. Council Regulation (EEC) No 3760/92 of 20 December 1992 establishing a Community system for fisheries and aquaculture. In: Official Journal of the European Communities. L 389, 31.12.1992: 1-14.
- Council of the European Union. 2002. Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy. In: Official Journal of the European Communities. L 358/59, 31.12.2002: 61-80.

Council of the European Union. 2004. Council Decision (EC) of 19 July 2004 establishing Regional Advisory Councils under the Common Fisheries Policy (2004/585/EC). In: Official Journal of the European Communities. L 256, 3.8.2004: 17-22.

Council of the European Union. 2005. Council Regulation (EC) No 768/2005 of 26 April 2005 establishing a Community Fisheries Control Agency and amending Regulation (EEC) No 2847/93 establishing a control system applicable to the common fisheries policy. In: Official Journal of the European Communities. L 128, 21.5.2005: 1-14.

Dalkir K, 2005. Knowledge management in theory and practice. Elsevier.

DG MARE. 2008. The mission of the Directorate General for Fisheries and Maritime Affairs. Accessed 24.11.2008: http://ec.europa.eu/fisheries/comm_fish/mission_en.htm

EC (European Commission) 2003. Commission Regulation (EC) No.2244/2003 of 18 December 2003 laying down detailed provisions regarding satellite-based Vessel Monitoring Systems. Official Journal of the European Union, L 333: 17-27.

EC (European Commission) 2004. Commission Regulation (EC), Council Regulation (EC) No 423/2004). Long Term Management Plan I.

EC (European Commission) 2004b. COUNCIL REGULATION (EC) No 812/2004 of 26.4.2004 laying down measures concerning incidental catches of cetaceans in fisheries and amending Regulation (EC) No 88/98

EC (European Commission) 2008. Commission Regulation (EC), Council Regulation (EC) No 1342/2008. Long Term Management Plan II.

EC (European Commission) 2009. Commission Regulation (EC), Council Regulation (EC) N°43/2009. Effort regulation and kWdays.

EC (European Commission) 2011. Commission Regulation (EC), Council Regulation (EC) No 404/2011 of 8 April 2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy.

EC (European Commission) 2013. European Commission, Fisheries measures for marine Natura 2000 sites. A consistent approach to requests for fisheries management measures under the Common Fisheries Policy http://ec.europa.eu/environment/nature/natura2000-marine/docs/fish_measures.pdf (Last retrieved 4.2.2013)

FAO. 1995. Code of Conduct for Responsible Fisheries. Rome, FAO. 1995. 41 p

Gezelius, S.S. *et al.* 2008. The Politics of Implementation in Resource Conservation: Comparing the EU/Denmark and Norway. In: S.S. Gezelius and J. Raakjær (Eds.): Making Fisheries Management Work. Implementation of Policies for Sustainable Fishing. Dordrecht: Springer: 208-229.

Hardin, G. 1968. The Tragedy of the Commons. In: Science. Vol. 162(3859): 1243-1248.

Hegland, T.J. 2004. The Common Fisheries Policy - caught between fish and fishermen? Master thesis. Aalborg: Department of International Affairs, Aalborg University. Unpublished. Available from: http://vbn.aau.dk/fbspretrieve/16716264/The_common_Fisheries_Policy.pdf.

Hegland, T.J. 2006. Fisheries Policy-Making: Production and Use of Knowledge. In: L. Motos and D.C. Wilson (Eds.): The Knowledge Base for Fisheries Management. Oxford and Amsterdam: Elsevier: 219-237.

Hegland, T.J. and J. Raakjær. 2008. Implementation Politics: The case of Denmark under the Common Fisheries Policy. In: S.S. Gezelius and J. Raakjær (Eds.): Making Fisheries Management Work. Implementation of Policies for Sustainable Fishing. Dordrecht: Springer: 161-205.

Hegland, T.J. and J. Raakjær. 2008a. Recovery Plans and the Balancing of Fishing Capacity and Fishing Possibilities: Path Dependence in the Common Fisheries Policy. In: S.S. Gezelius and J. Raakjær (Eds.): Making Fisheries Management Work. Implementation of Policies for Sustainable Fishing. Dordrecht: Springer: 131-159.

Hegland TJ, Ounanian K, Raakjær J. 2012. Maritime Studies 11:8 <http://www.maritimestudiesjournal.com/content/11/1/8>

Hiddink, J. G., Jennings, S., Kaiser, M. J., Queirós, A. M., Duplisea, D. E., and Piet, G. J. 2006. Cumulative impacts of seabed trawl disturbance on benthic biomass, production, and species richness in different habitats. Canadian Journal of Fisheries and Aquatic Sciences, 63: 721–736.

Hintzen, N.T., F. Bastardie, D.J.B. Beare, G. Piet, C. Ulrich, N. Deporte, J. Egekvist, H. Degel 2012. VMStools: open-source software for the processing, analysis and visualization of fisheries logbook and VMS data. Fish. Res. 115, 31–43

Holmes, S. J., Bailey, N., Campbell, N., Catarino, R., Barratt, K., and Gibb, A., and Fernandes, P. G. 2011. Using fishery-dependent data to inform the development and operation of a co-management initiative to reduce cod mortality and cut discards. – ICES Journal of Marine Science, 68: 1679–1688.

ICES 2012a. Report on the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 27 April – 10 May 2012. ICES CM 2012/ACOM: 13. <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2012/WGNSSK/WGNSSK%202012.pdf>

ICES 2012b. Report of the Working Group on Mixed Fisheries Advice for the North Sea (WGMIXFISH), 21-25 May 2012. ICES CM 2012/ACOM: 22. <http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2012/WGMIXFISH/WGMIXFISH%20Report%202012.pdf>

Kindt-Larsen, L., E. Kirkegaard, J. Dalskov, 2011. Fully documented fishery: a tool to support a catch quota management system. ICES J. Mar. Sci. 68, 1606–1610

Kraak SBM, *et al.* 2015. Lessons for fisheries management from the EU cod recovery plan. *Mar. Policy* (2015), <http://dx.doi.org/10.1016/j.marpol.2012.05.002>

Lequesne, C. 2000. The Common Fisheries Policy. Letting the Little Ones Go? In H. Wallace and W. Wallace (Eds.): *Policy-Making in the European Union*. 4th ed. Oxford and New York: Oxford University Press: 345-372.

Long, R. 2010. The Role of Regional Advisory Councils in the European Common Fisheries Policy: Legal Constraints and Future Options. *The International Journal of Marine and Coastal Law* 25 pp. 289–346.

Mackinson S, Wilson DC, Galiay P, Deas B. 2011. Engaging stakeholders in fisheries and marine research. *Marine Policy* 35 (1) pp. 18-24.

Mikalsen, KH, Jentoft, S. 2001. “From user-groups to stakeholders? The public interest in fisheries management”, *Marine Policy*, Vol. 25 No. 4, pp. 281-92.

Ministry of Fisheries and Coastal Affairs. 2008. Om dei fiskeriavtalane Noreg har inngått med andre land for 2008 og fisket etter avtalane i 2006 og 2007. Stortingsmelding nr 34 (2007-2008).

Needle, C. L., and Catarino, R. 2011. Evaluating the effect of real-time closures on cod targeting. – *ICES Journal of Marine Science*, 68: 1647–1655.

Pita C, Pierce GJ, Theodossiou I. 2010. Stakeholders’ participation in the fisheries management decision-making process: Fishers’ perceptions of participation. *Marine Policy* 34 (5) pp. 1093-1102.

Raakjær, J. 2008. A Fisheries Management System in Crisis - the EU common Fisheries Policy. Senior doctoral thesis. Department of Development and Planning. Aalborg: Innovative Fisheries Management - an Aalborg University Research Centre.

Sell, A., Pusch, C., von Dorrien, C., Krause J., Schulze, T. and Carstensen D.. (Working group North Sea and Baltic Sea). Proposed measures for fisheries management in Natura 2000 sites in the German EEZ of the North Sea and the Baltic Sea, 2011. Hamburg, Rostock, Isle of Vilm, 20th April 2011.

Sissenwine M, Symes D. 2007. Reflections on the Common Fisheries Policy. Report to the General Directorate for Fisheries and Maritime Affairs of the European Commission.

STECF. 2011. Report of the SGMOS-10-05 Working Group on Fishing Effort Regimes Regarding Annexes IIA, IIB and IIC of TAC & Quota Regulations, Celtic Sea and Bay of Biscay. Edited by Nick Bailey and Hans-Joachim Rätz. 27 September–1 October 2010, Edinburgh, Scotland.

STECF. 2012a. Scientific, Technical and Economic Committee for Fisheries (STECF) - The 2012 Annual Economic Report on the EU Fishing Fleet (STECF-12-10). Edited by Anderson J., Carvalho, N. Contini, F., Virtanen, J.). 2012. Luxembourg: Publications Office of the European Union 2012 – 380 pp. ISSN 1831-9424 (online).
http://stecf.jrc.ec.europa.eu/documents/43805/366433/2012-08_STECF+12-10+-+AER+EU+Fleet+2012_JRC73332.pdf

STECF. 2012b. Scientific, Technical and Economic Committee for Fisheries. Different Principles for defining selectivity under the future TM regulation (STECF-12-14). Edited by Graham, N. and Doerner, H. Luxembourg: Publications Office of the European Union 2012 – 61 pp. ISBN 978-92-79-27463-3

STECF. 2012c. Scientific, Technical and Economic Committee for Fisheries. Evaluation of Fishing Effort Regimes (STECF-12-16). http://stecf.jrc.ec.europa.eu/documents/43805/394916/2012-11_STECF+12-16+-+Evaluation+of+Fishing+Effort+Regimes+pII_JRC76738.pdf

STECF. 2012d. Scientific, Technical and Economic Committee for Fisheries. STECF-12-12

STECF. 2012e. Scientific, Technical and Economic Committee for Fisheries. Development of the Ecosystem Approach to Fisheries Management (EAFM) in European Seas. STECF-11-13.

STECF, 2012f. STECF (Scientific, Technical and Economic Committee for Fisheries) 2012. Management plans part 2 - changes to cod plans (STECF-12-13)

Ulrich, C., Wilson, D. C. K., Nielsen, J. R., Bastardie, F., Reeves, S. A., Andersen, B. S., & Eigaard, O., 2012. Challenges and opportunities for fleet- and métier-based approaches for fisheries management under the European Common Fishery Policy. . *Ocean & Coastal Management* 70, 38-47.

van Hal, R., Paramor, O.A.L., Le Quesne, W.J.F., Aanesen, M., Hegland, T.J., Armstrong, C., Raakjær, J., van Hoof, L.J.W., van Overzee, H.M.J., Frid, C.L.J., Valesco, F. and Piet, G.J. 2010. A technical review document on the ecological, social and economic features of the North Western Waters region. MEFEP0 Project: University of Liverpool.

APPENDIX A: Effort Distribution – North Sea

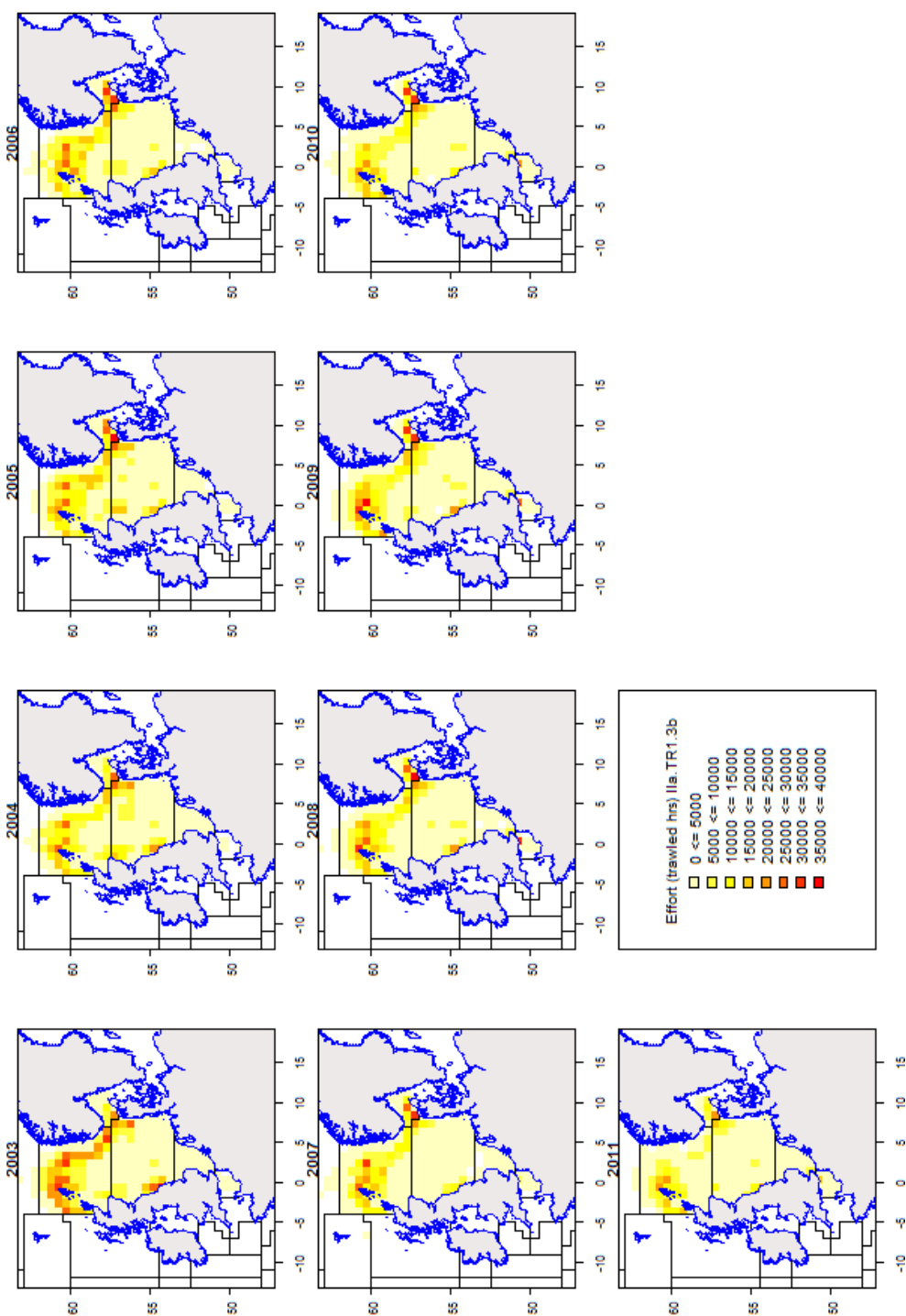


Figure A.1 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of TR1 gears (demersal trawls and seines with mesh size ≥ 100 mm) 2003-2011.

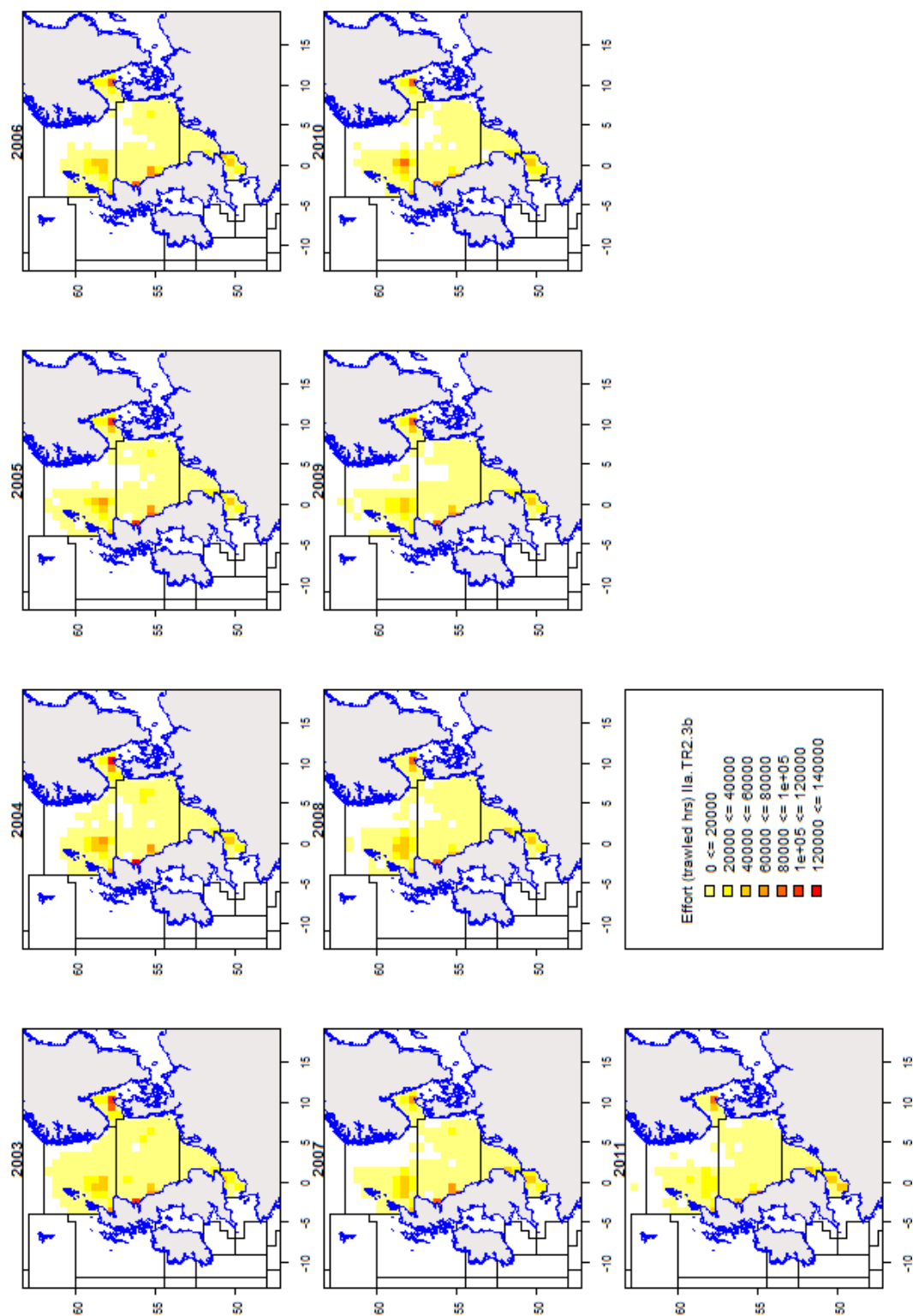


Figure A.2 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of TR2 (demersal trawls and seines with mesh size 70-99 mm) gears 2003-2011.

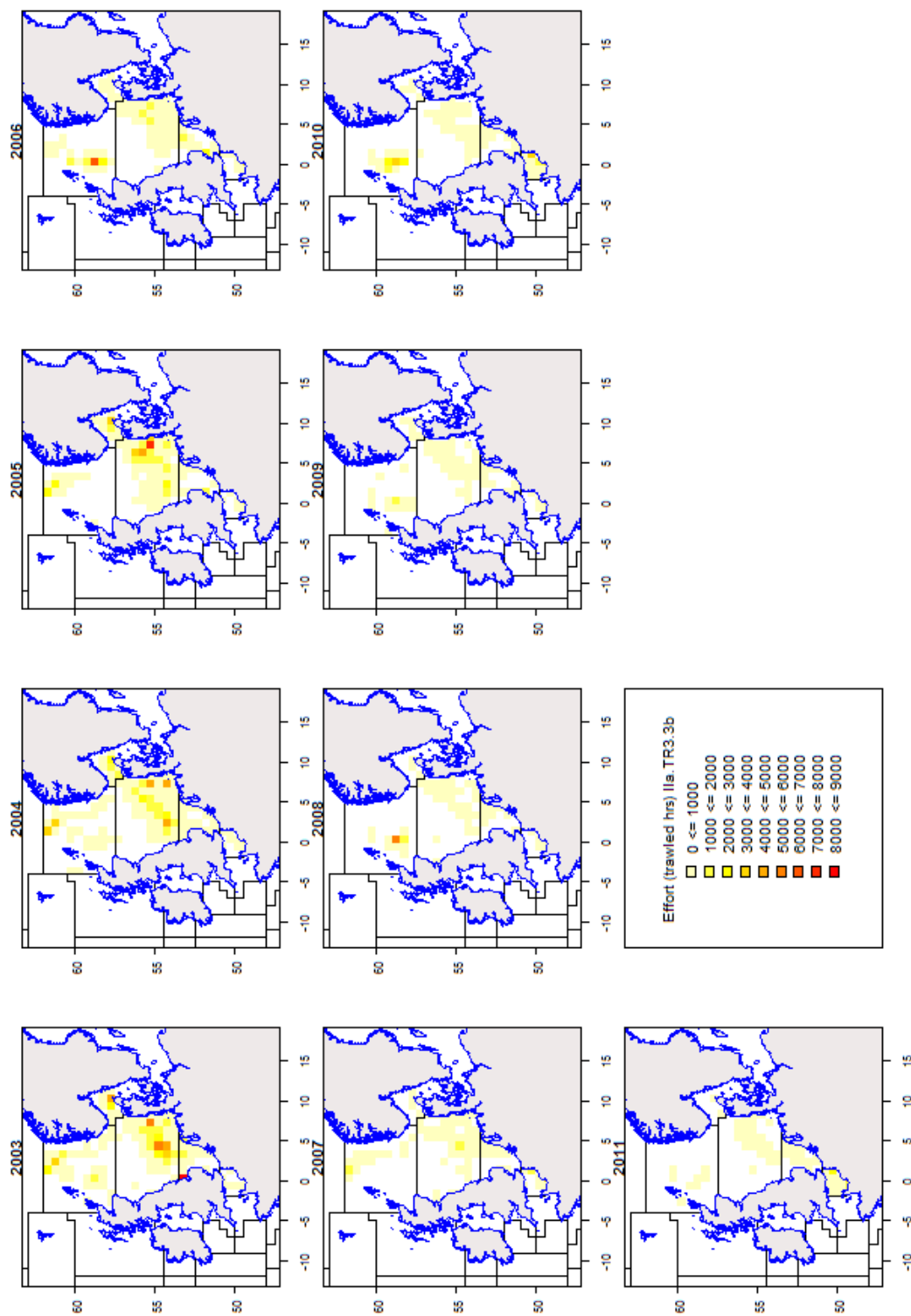


Figure A.3 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of TR3 gears 2003-2011.

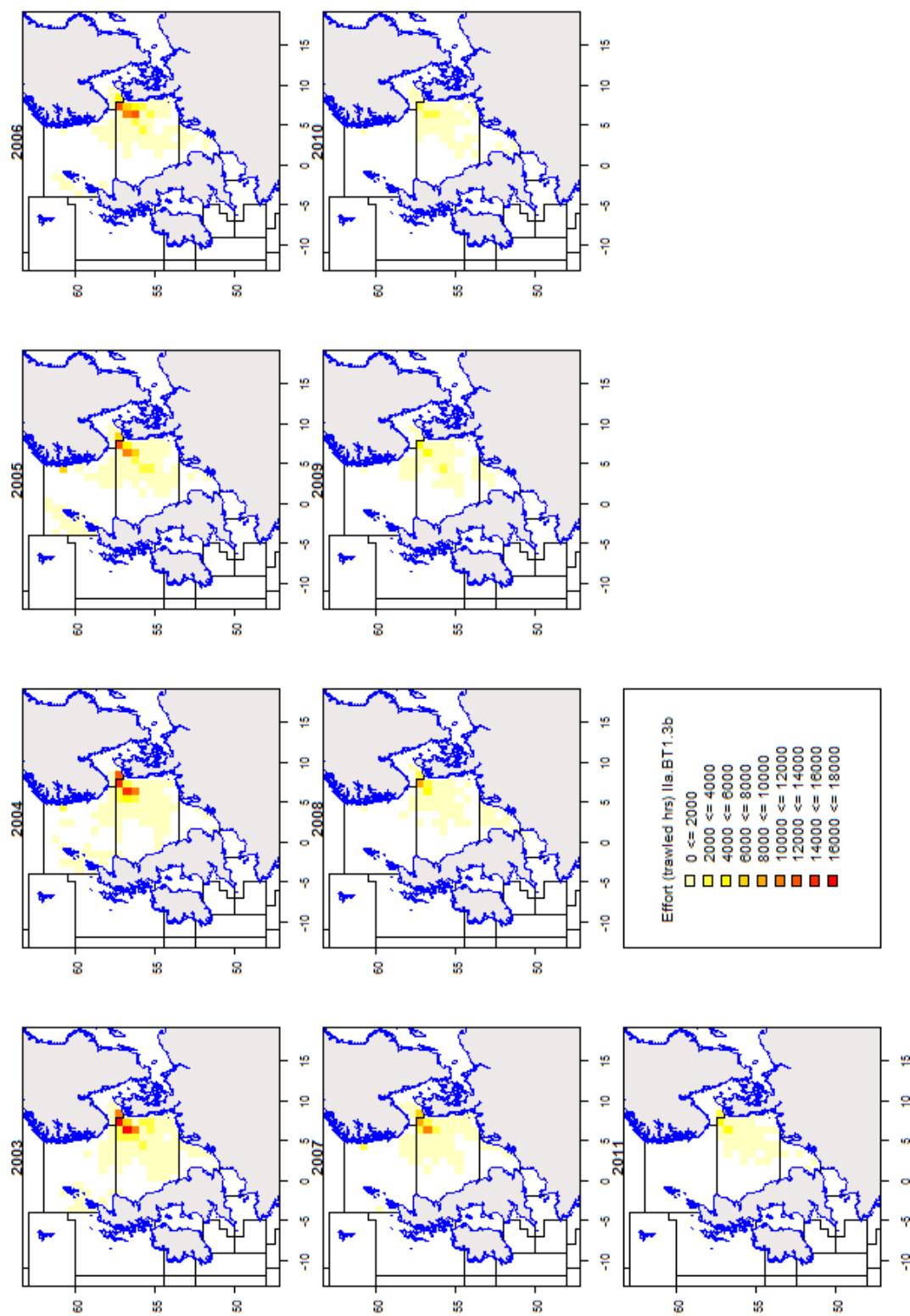


Figure A.4 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of BT1 gears (beam trawls with mesh size ≥ 120 mm) 2003-2011.

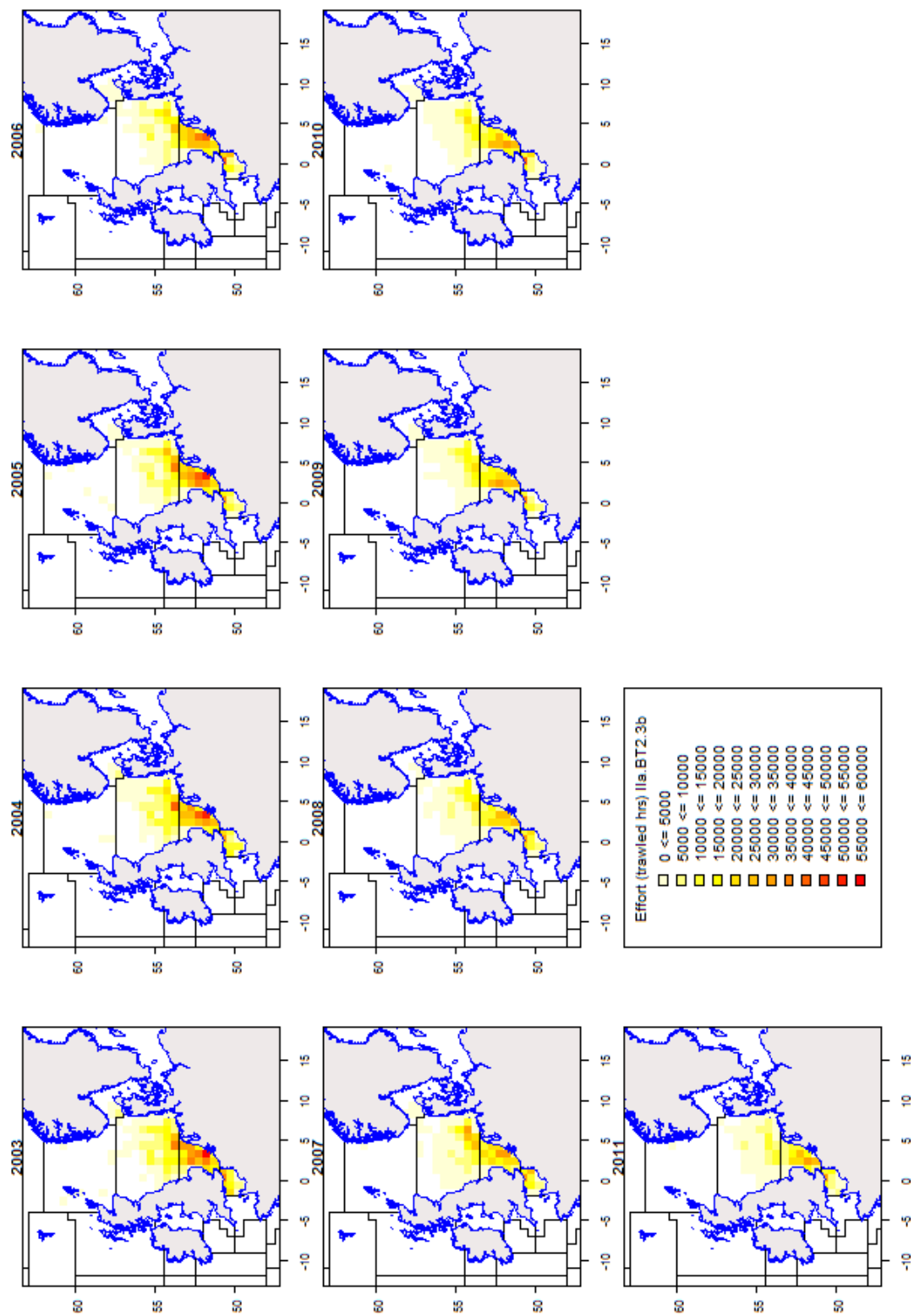


Figure A.5 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of BT2 gears (beam trawls with mesh size 80-119 mm) 2003-2011.

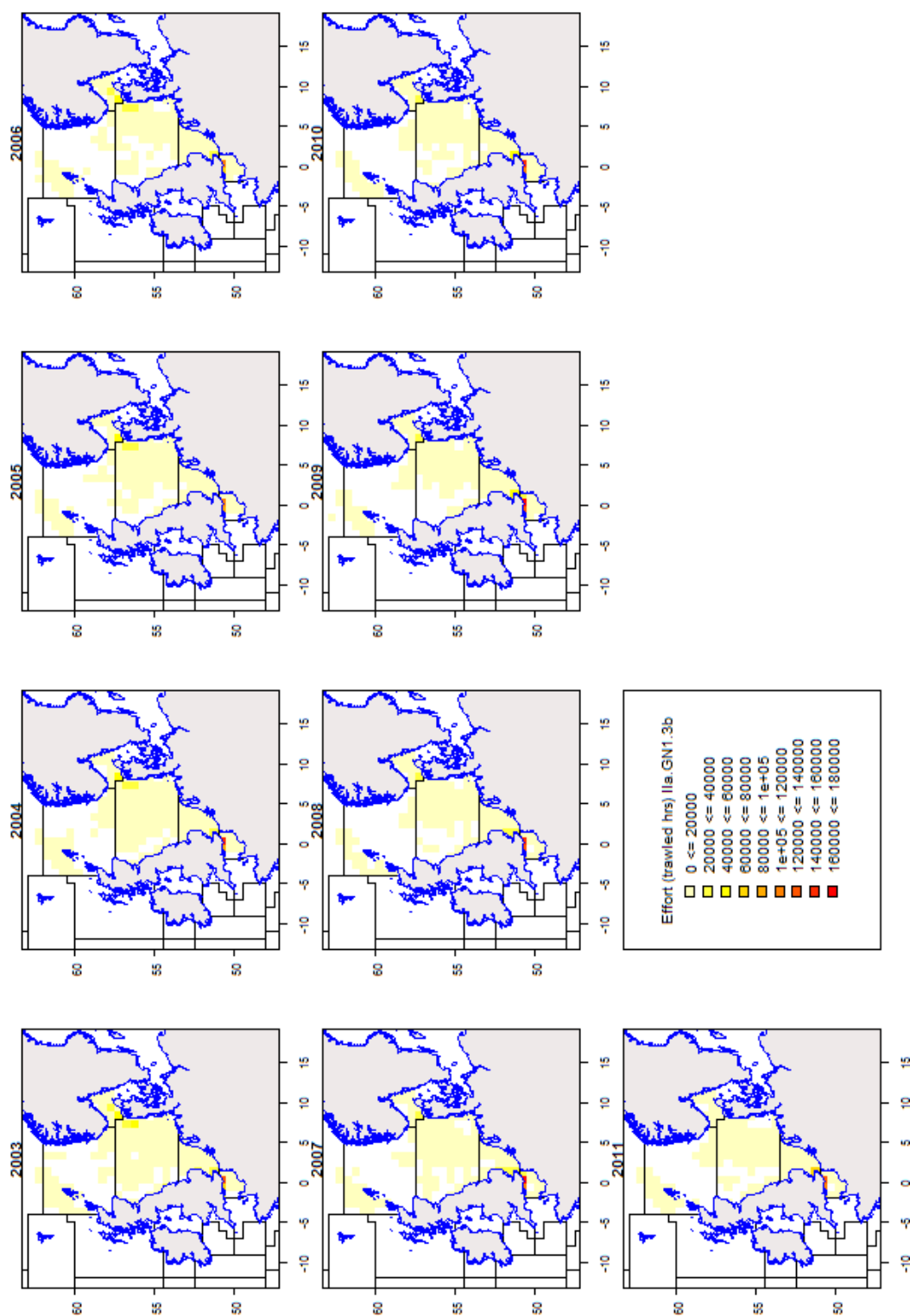


Figure A.6 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of GN1 gears (all gillnets) 2003-2011.

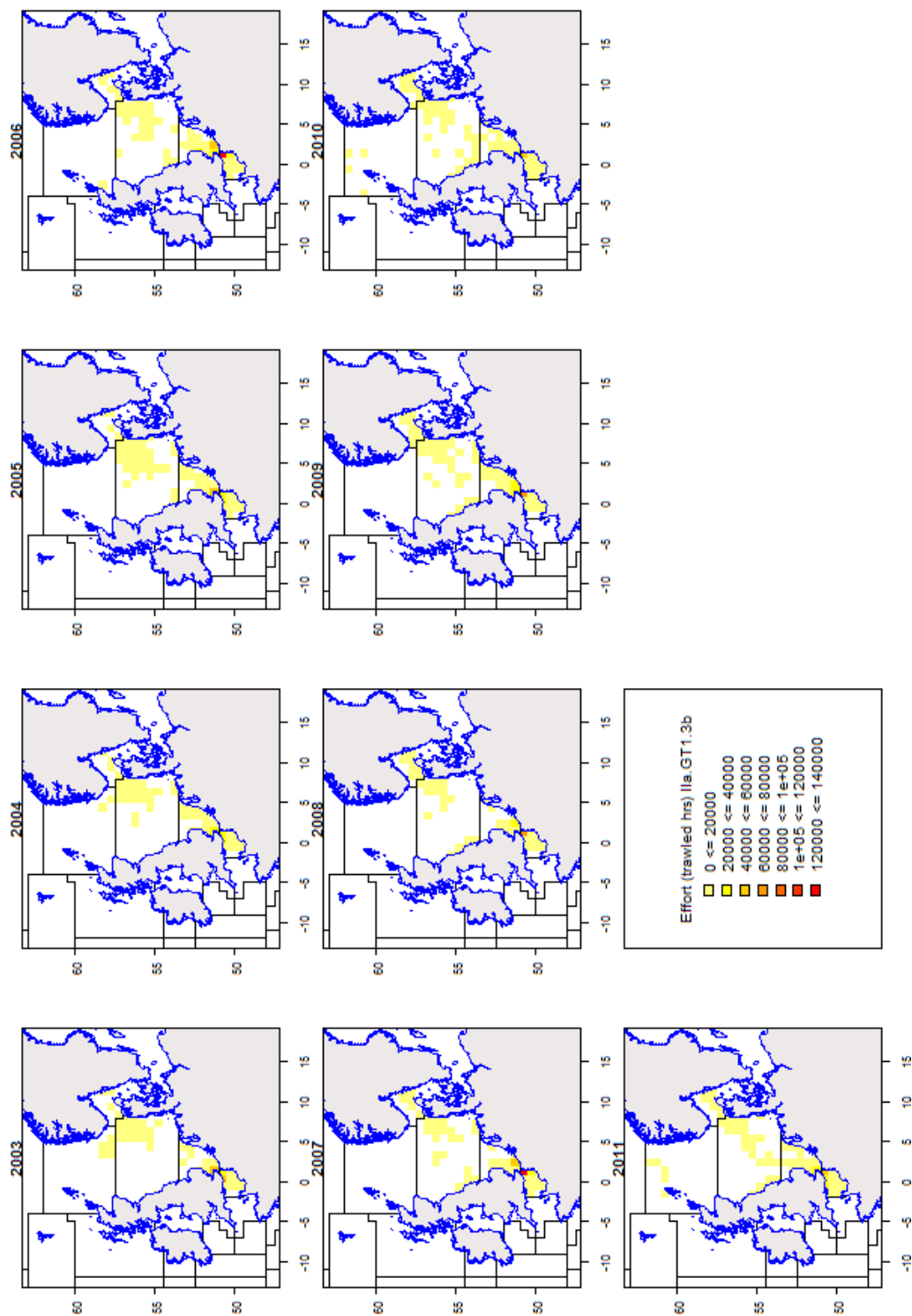


Figure A.7 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of GT1 gears (all trammel nets)2003-2011.

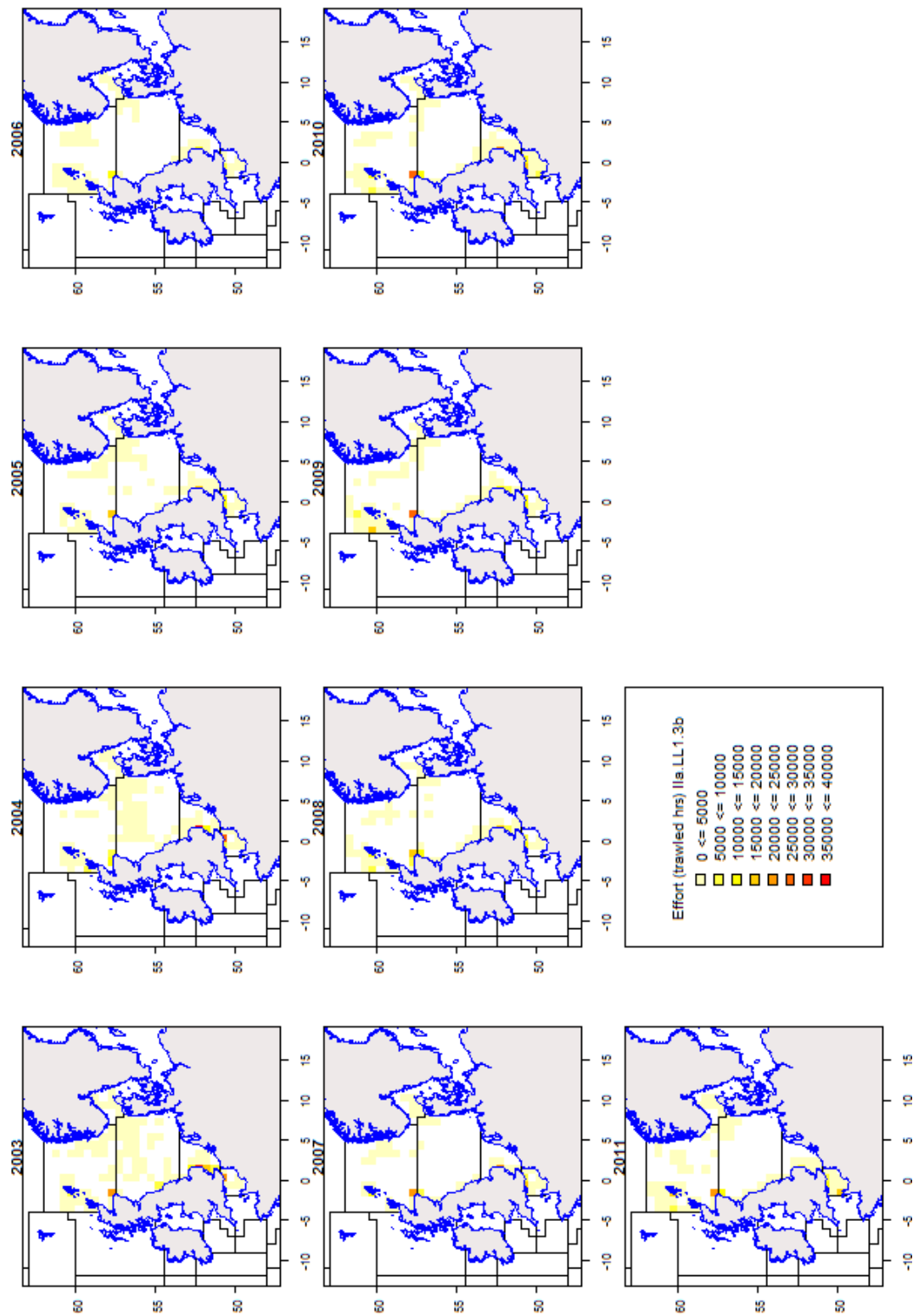


Figure A.8 Skagerrak, North Sea including 2 EU and Eastern Channel: Effective effort distribution of LL1 gears (longlines) 2003-2011.

Colophon

Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries

By J. Rasmus Nielsen, Clara Ulrich, Troels J. Hegland, Birgit de Voss, Thomas T. Thøgersen, Francois Bastardie, Leyre Goti, Ole R. Eigaard and Lotte Kindt-Larsen

March 2013

DTU Aqua, National Institute of Aquatic Resources

DTU Aqua report No. 263-2013

ISBN 978-87-7481-171-8 (print)

ISBN 978-87-7481-170-1 (web)

ISSN 1395-8216

Cover Design: Peter Waldorff/Schultz Grafisk

Cover Photo: Peter Jensen

Reference: Nielsen, J. R., Ulrich, C., Hegland, T. J., de Voss, B., Thøgersen, T. T., Bastardie, F., Goti, L., Eigaard, O. E. & Kindt-Larsen, L. (2013). Critical report of current fisheries management measures implemented for the North Sea mixed demersal fisheries. DTU Aqua Report No. 263-2013. Charlottenlund. National Institute of Aquatic Resources, Technical University of Denmark, 71 pp.

DTU Aqua reports are published by the National Institute of Aquatic Resources and contain results from research projects etc. The views and conclusions are not necessarily those of the Institute.

The reports can be downloaded from www.aqua.dtu.dk.

DTU Aqua
National Institute of Aquatic Resources
Technical University of Denmark

Jægersborg Allé 1
2920 Charlottenlund
Denmark
Tel: + 45 35 88 33 00
Mail: aqua@aqua.dtu.dk

www.aqua.dtu.dk