Nota on the analysis of alternative measures for fisheries management

Jan Jaap Poos, Erik Buisman, Martin Pastoors

Report number C070.11

IMARES Wageningen UR

(IMARES - Institute for Marine Resources & Ecosystem Studies)

Client: Ministry of Economic Affairs, Agriculture and Innovation
Bezuidenhoutseweg 30
2594 AV Den Haag

BO-12.07-007-006

Publicatiedatum: 9 June 2011

IMARES
WAGENINGEN UR

IMARES is:

- an independent, objective and authoritative institute that provides knowledge necessary for an integrated sustainable protection, exploitation and spatial use of the sea and coastal zones;
- an institute that provides knowledge necessary for an integrated sustainable protection, exploitation and spatial use of the sea and coastal zones;
- a key, proactive player in national and international marine networks (including ICES and EFARO).

P.O. Box 68
1970 AB IJmuiden
Phone: +31 (0)317 48 09 00
Fax: +31 (0)317 48 73 26
E-Mail: imares@wur.nl
www.imares.wur.nl

P.O. Box 77
4400 AB Yerseke
Phone: +31 (0)317 48 09 00
Fax: +31 (0)317 48 73 59
E-Mail: imares@wur.nl
www.imares.wur.nl

P.O. Box 57
1780 AB Den Helder
Phone: +31 (0)317 48 09 00
Fax: +31 (0)223 63 06 87
E-Mail: imares@wur.nl
www.imares.wur.nl

P.O. Box 167
1790 AD Den Burg Texel
Phone: +31 (0)317 48 09 00
Fax: +31 (0)317 48 73 62
E-Mail: imares@wur.nl
www.imares.wur.nl

A_4_3_2-V12

Contents

Summary

The core of the current European fisheries management is based on managing the commercially important fish stocks using Total Allowable Catches (TAC). However, in practice the fisheries management in the recent years has shifted towards using a multitude of management measures simultaneously. In the vision of the Dutch Ministry of Economic Affairs, Agriculture and Innovation (EL&I), the Common Fisheries Policy (CFP) could be simplified by choosing for a single type of management measures. For the Netherlands, sustainability, transparency, and enforceability are dictating the choice for future choices of management systems. In this study, we attempt to analyse the potential effects of different fisheries management systems if they would be applied in isolation. We assess if they would bring a simplification to the management system and achieve the objective of sustainable exploitation of natural fish resources.

The analysis leads to the conclusion that it is questionable if there is *one single* situation that needs to be addressed for all fisheries in Europe. The fishing fleets are very diverse. In the Netherlands, fisheries become ever more diversified and what may work for one fleet does not necessarily work for others. Second, the outcomes of management decisions depend on the implementation. Studies on the effects of management generally have to assume specific implementation details. Subtle deviations from the implementation assumed in studies may have substantial consequences on the outcomes. Finally, the behavioural changes that are expected from some of the innovative management measures are too complex to predict reliably. Moving beyond descriptions of how these management measures have worked elsewhere is probably unfeasible.

If one wants to switch to a single simple system for management, overcoming the disadvantages of the management system probably requires very stringent measures. This can be seen as a trade-off between the simplicity of a system and the costs of the system. For example, if one wants to rely on an effort control system only, without additional safeguards for some vulnerable species, one probably needs to substantially reduce the fishing effort, to ensure that the vulnerable species do not become overexploited. This is true for any simple management system.

For the important fisheries in the Netherlands, different management systems could be preferred for different fisheries. However, some kind of mitigation measures would be required to have a fully functioning fisheries system where all objectives of the CFP are met. Consulting stakeholders in this process is essential to reveal expected preferences and potential support for management regimes.

1. Introduction

The core of the current European fisheries management is based on managing the commercially important fish stocks using Total Allowable Catches (TAC). However, in practice the fisheries management in the recent years has shifted towards using a multitude of management measures simultaneously.

In the vision of the Dutch Ministry of Economic Affairs, Agriculture and Innovation (EL&I), the Common Fisheries Policy (CFP) could be simplified by choosing for a single type of management measures. This can for example be an input management like effort control or spatial allocations, or an output management based on catch quota. Also, a spatial zonation of fishing rights is a possibility that should be examined. According to the Ministry of EL&I, the optimal preferred management system can differ per region and per fishery. Therefore the choice of the management system can best be made on a regional level. For the Netherlands, sustainability, transparency, and enforceability are dictating the choice for future choices of management systems.

2. Assignment

In this study, we attempt to analyse the potential effects of different fisheries management systems if they would be applied in isolation. We assess if they would bring a simplification to the management system and achieve the objective of sustainable exploitation of natural fish resources. This research is performed within EL&I program Beleidsondersteunend Onderzoek (BO12-07).

The first section will be a description of the current management system in Europe and in the Netherlands. Then there will be sections dealing with output management, input management, spatial management and other types of management. We conclude with a synthesis and conclusion section.

3. Current situation

National fisheries regulations in the European Union are embedded in the EU Common Fisheries Policy (CFP) framework. It was established in 1983 (Council of the European Communications, 1983). The CFP aims at conservation of fish stocks, a sustainable development of the fishing industry, and a steady supply of fish products (Holden, 1994). Conservation of living aquatic resources is one of only five policy areas that is under the exclusive competence of the EU. Yet, the EU member states have to implement and operationalize the policy (van Hoof, 2010).

Since 1983 the CFP has undergone revisions every ten years: in 1992/93 and in 2002. Over the years the focus of the CFP has shifted from ensuring efficient fishing fleets and well-functioning markets for fish products to that of conserving the resource base (Gezelius et al, 2008). The next reform is scheduled for 2012. In the debate towards the revision of the CFP in 2012 there seems to be a consensus that the current CFP is not reaching its goals (van Hoof, 2010).

One of the pillars of the current CFP is the landings quota system. This system sets "Total Allowable Catches" (TACs) which should limit the landings of fish stocks. By limiting the landings, fishing mortality should be regulated such that the CFP goals are met. Other pillars of the CFP are the technical measures, the market regulation and the European Fisheries Fund.

Across the European Union a variety of Rights Based Management systems is being deployed in addition to the TAC system (see Box 1). Limited licensing is now a common feature in EU fisheries management. For stocks managed by TACs, member states have implemented a variety of individual non-transferable catch quotas, Individual Transferable Quotas (ITQs) and vessel catch limits (van Hoof, 2010). In the Netherlands, the catch quotas are divided in ITQs.

BOX 1: Property rights in fisheries management

Putting property at the centre of fisheries management revolves around privatisation - the creation of private property rights - and marketization - leaving the distribution of rights to the rationale of the market (van Hoof, 2010). Individual or community quota are all forms of privatisation: rights formally held by society in general (open access common property resource) or by the state are transferred to private rights. ITQs also are a form of privatisation and marketization: the private rights are made tradable. The introduction of property rights is expected to create market incentives that will decrease capacity and increase efficiency and encourage conservation because each individual or group knows they can profit from the fish as much tomorrow as today.

The Netherlands is one of the countries where ITQs were introduced more than 20 years ago, expecting compliance to quota would be facilitated by making quota individual property in the context of management groups. The aim of these groups was first to arrive at an effective and efficient system of quota compliance that is supported by the fishers, and second to improve economic performance within the quota restrictions (van Hoof, 2010). Individual group members take their individual rights to be managed within the confines of the group. Hence, decisions which otherwise would be adopted by Government, such as the fishing season planning, to be undertaken within the management groups. In addition, group members can constantly modify their initial right allocation through sale or rent. (Davidse, 2000).

The Common Fisheries Policy has been diagnosed by many (e.g. Symes 2009, Sissenwine and Symes 2007, Osterblöm et al 2011, Van Hoof and Tatenhove 2009) as a problematic policy in the sense that it involves complex regulations, is difficult to control and is unclear whether objectives are achieved. The EU Green Paper on the CFP raised a plea for simplification of the policy (EC 2009). How could this be done? The current CFP is a mixture of input and output measures. The main question to address here is: how would a system based on a single management approach perform compared to the current mixed system?

4. Input and output management

As described above, the present CFP contains elements of input and output management, with output management being most prevalent and leading. In this section the management systems will be characterized with their advantages and disadvantages. For this purpose these management systems will be considered in isolation. However it must be stressed that implementation details determine the outcome of any management system, and that most real world fisheries management systems contain elements of the two approaches.

Output management

Output management or management by output controls can be defined as managing the fishery by establishing limits on how much fish can be taken out of the water (management of catch or output controls; Cochrane, 2002). In the EU, output management is implemented by setting TACs using scientific advice. Each member state has a steady share in these TAC's and is responsible for the national implementation of the quota system. In most member states this is done by some form of transferable or non-transferable individual quota.

A relative new innovation in output management is the introduction of catch quota in combination with "fully documented fisheries" (Kindt-Larsen et al. in press). A catch-quota is a quota that accounts for the mortality of all fish caught, rather than just fish landed at port. This means that all catches, above or below the minimum landing size (MLS), are deducted from the quota. In theory a catch-quota system will provide fishermen with incentives to reduce discarding because less discards means more quota for marketable fish above MLS and hence increased revenues.

When transferring from traditional landings quota to a catch-quota, it is optional to increase the quota to include the estimated mortality in a fishery (e.g. landings mortality plus estimated discard mortality). This may or may not be combined with compulsory landing of all (fish) catches (discard ban). In order to introduce a catch-quota system effectively, this would have to be combined with "fully documented fishery". In a fully documented fishery all catches on a vessel are being monitored with Remote Electronic Monitoring (REM) equipment, in order to verify the catch-quota system. Catch-quota pilots are being carried out in the UK and Denmark. The objective is to improve selectivity of the fishery, to reduce discards and to reduce stock mortality.

TACs and landings quotas	
Advantages	Disadvantages
• Simplest and most clear for the fishing sector • Individual quota break "tragedy of the commons" • Limits capacity for species with quota (because there are escape routes such as shrimps, species without quota) • Based on stock biomasses and the amounts of fish that can be removed • The biological criterium of fishing mortality translates well to catch prognoses cq TACs • Support of other Member States • Support of the fishing sector, also because of large investments in quota	• Because of limited control, inspection and enforcement of the European TAC management does not function well • Current instrument (single species) does not fit well with mixed fisheries (discards problems), stimulating high-grading in order to use quota as efficiently as possible • Stimulates discarding if quota of one species is fully utilized but not for other species, or when the remaining fishing time is used to catch species without quotas (Buisman et al. 2001) • In countries with long coastlines and many harbours, compliance with quota management is difficult to enforce • Large annual fluctuations of TACs confront the fishing industry with a high level of uncertainty. This makes decisions about long term investments problematic

How could disadvantages of output management (landings quota) be overcome? There are two main routes:

1. rights based management: take away the race for fish
2. catch quota: take away underutilization of discards

Rights based approaches allocate a right to a fisheries resource. There are many forms of rights based management. In the Netherlands, the ITQs are considered a rights based approach. According to economic theory, rights based approaches promote efficiency through the pursuit of economic self-interest.

Rights based management can have some drawbacks. One drawback is that they tend to lock fisheries systems because property rights are difficult to take away once granted. Some ITQ systems try to overcome the disadvantages by granting quota only for a limited amount of time (creating the problem that these quota then are not perceived as being "owned", counteracting on the very idea that are supposed to make rights based management work).

A special kind of rights based management is the formation of "group rights". Here, community groups manage the quota allocations by creating an internal ITQ system. This kind of management thus combines rights based management with participatory governance.

Input management

Input management or management by input controls can be defined as managing the fishery by limiting the total intensity of use of the gear fishers put into the water in order to catch fish (Cochrane, 2002). Most commonly input restrictions refer to restrictions on the number and size of fishing vessels (fishing capacity controls), the amount of time fishing vessels are allowed to fish (vessel usage controls) or the product of capacity and usage (fishing effort controls).

Fishing effort can be defined as fishing capacity multiplied by the time that this capacity is used. For mobile gears this leads to measures of fishing effort like days at sea (per vessel) or hp / kw-days. For fixed gears fishing effort can be defined as the number of nets that can be used simultaneously. In the following, however, we will focus mostly on mobile gears.

In the long term inputs can be managed by limiting fishing capacity (number of vessels, horse power or gross tonnage). In the short run this can be complemented with managing the use of fishing capacity (effort management) by limiting the number of days at sea (or hp-days, kw-days). This can be extended further by specifying allowed fishing effort by geographical area, by season, by fishing gear or by a combination of these.

This leads to the following variants of effort management:

- Generic restriction of days at sea, hp-days or kw-days
- Generic restriction of fishing gear
- Specific restriction of days at sea, hp-days or kw-days per area (including closed areas)
- Specific restriction of days at sea, hp-days or kw-days per season (including closed seasons)
- Combinations of generic and specific restrictions

Input management is multi-species management. It doesn't restrict the catches of individual species, which is unpractical in multi-species fisheries where the effort cannot be directed specifically towards one or more of the target species. The fishery is managed in a less detailed way than in the case of quota management. This also means that individual species don't get the specific protection that they get in quota management, although in some cases this can be arranged by specific restrictions of effort by area, season and fishing gear.

Targeting of individual species in a multi-species fishery under effort management will be determined by economic mechanisms. The effort will be directed at those species with highest catch (value) per unit of effort. As species get scarcer and Catch Per Unit Effort (CPUE) goes down, the effort will be directed away from these weaker stocks and these stocks will have a chance to recover. However, if prices rise with scarcity, this mechanism might work in the wrong direction, inducing overfishing of the weaker stocks.

Input management (fishing effort)	
Advantages	Disadvantages
• Instrument that fits well with mixed fisheries • Control and enforcement easier • Fishing effort control works in the advantage of fisheries that produce efficiently (economy) • Prevents high levels of high-grading and discarding	• Less specific protection of individual species • Difficult to define "measure of effort", therefore difficult to regulate and manage • Little support with other Member States and the fishing sector • Fishing effort control works in the advantage of fishers who produce efficiently • It stimulates the "race for fish" • Release of "latent" (over)capacity • Difficult to find good methods to translate quota to days at sea in transition

How could disadvantages of input management be overcome? Specific protection to individual species could be given by introducing a system in which fishing areas and seasons are "valued" differently in terms of their effort input. This is the idea behind the system in Rijnsdorp et al. (2007). Applying fishing effort in areas and seasons with high catchability for species that require low fishing mortality would be more "costly" in terms of allowed fishing effort.

One of the main problems with defining a "measure of effort" is the *technological progress* that causes the fishing capacity associated with easily measurable effort units such as 1 GT or 1 kW to increase. That means that technological change will have to be monitored closely, in order to manage effort and capacity effectively. Allowed fishing effort will have to be adjusted periodically on basis of technological progress. This is also true for restrictions on engine power because of the problems related to measuring of engine power.

5. Spatial management

Spatial management involves the allocation of certain areas to (certain types of) fishing and closing other areas for fishing. It can be seen as a form of effort control, restricting effort in certain areas. With the exception of certain areas closed for spawning or recruitment behaviour of certain fish species (plaice box, sandeel box, mackerel box), spatial management has not been widely implemented in EU fisheries. Current developments of Natura2000 at sea and offshore wind-energy will require a re-evaluation of spatial management also with the aim to manage fisheries and healthy fish stocks. One of the criticism is that the protection is limited to relatively stationary species and that they do little to protect migratory species. However, if the aim is to protect habitats or specific ecological features, spatial management can be an appropriate policy.

One of the main disadvantages of the use of spatial management for fisheries management is that the size and location of open and closed areas required to achieve the goals of fisheries management is not yet well studied, especially if goals are phrased in terms of fishing mortalities.

Spatial management	
Advantages	Disadvantages
• Simple method of protection of fish and ecosystem, easy to control • On longer term also has advantages for the fishery • On longer term easier fisheries management because of improved state of fish stocks • With full closure also gives rest/room for ecologically vulnerable species	• Strong resistance with fishing sector • Weak support for selection of areas and full closure • Plaice box has learned that response of nature to zoning is unpredictable • Fishing effort outside the closed areas will increase. This means that the closed area has to be very special compared to surrounding areas in order to justify the closure)

6. Other systems

The two other management systems considered in this report are: 1) participatory governance and 2) decision rule systems. These two systems share the characteristic that they are most likely elements of an overarching management system and cannot form the single management systems that is looked for in the Dutch vision on the new CFP.

Participatory governance

Participatory governance is the participation by fishers and other stakeholders in making management decisions. It can provide a crucial source of legitimacy of management. Participatory governance mobilizes several assets to aid effective management, listed in (Hauge and Wilson, 2009): (i) facilitated access to information including aid in the enforcement of fisheries regulations (Pinkerton, 1989), (ii) increased transparency in decision-making (Jentoft, 1989), (iii) greater accountability for officials (Magrath 1989) and (iv) increased sensitivity to local perspectives (Pomeroy and Carlos, 1997).

Evidence from global experiences indicates that participatory governance makes management more effective. However, there is a complicated relation between participation and management. First, there is the question who legitimately participates (Wilson and McCay, 1998, Hauge and Wilson, 2009). Also, unbalanced selection of stakeholders in the governance process may decrease the legitimacy in the eyes of some. Institutionalization of participatory governance is therefore difficult because of the tension between the participation of stakeholders and the legal principle that management should be carried out on behalf of the society as a whole, not for the benefit of user groups. Finally, participation alone is no guarantee for an increase in satisfaction with policies. For example, culture gaps between experts and stakeholders can lead to communication breakdown, increasing mistrust between the different parties (Kaminstein 1996, Hauge and Wilson, 2009). To conclude, participatory governance has proven effective in cases around the world. However, as always, the effectiveness depends critically on design and implementation.

Decision rule systems

The CEVIS project (Hauge and Wilson, 2009) examined two forms of decision rule systems: harvest control rule (HCR) systems and non-predictive adaptive systems. The first aims at reducing the reliance on political processes in decision-making on management measures, while the second aims at reducing reliance on predictions on stock dynamics. In the EU, harvest control rules have been increasingly used in management and recovery plans.

These plans have set rules on quota and effort levels, related to predictions of stock dynamics. Non-predictive adaptive approaches focus on monitoring the system as a whole, adapting to changes which are discovered by means of generally agreed indicators of the state of different elements in the system (Hauge and Wilson, 2009). A well-known example is the "traffic light method" applied in Canada. This method uses a broad range of indicators representing estimates of attributes of the fish stock and the fishery. The indicators must be carefully described, validated and generally accepted by the concerned interests (Hauge and Wilson, 2009). The CEVIS project found that the implementation of the traffic light approach in Canada had been difficult. The main criticisms were the oversimplification of the results, the loss of information and the need for more formal and causal mechanisms. In other cases where the method was successfully used, this could partly be explained by a strong relationship of trust between the industry and the scientists.

7. The Dutch situation

The effects of using the management measures for the Dutch fisheries critically depends on implementation details, as was outlined above. Several studies on the Dutch beam trawl fleet have yielded results that can be used to highlight quantitative aspects of different forms of management. Below, we list some of the main Dutch fisheries and reflect on the possibilities of different management systems, drawing from the results in the previous paragraphs.

	Input management	Output management	Spatial management	Mitigative measures
Pelagic fisheries	Pro: none	Pro: Fishing effort can be targeted to a single species, and overquota discarding likely limited. precondition: controllability of species composition of catches.	Pro: none	If output control, then discards ban links landings to catches, given sufficient compliance
	Con: Effort has poor link to fishing mortality because of targeting (Potier et al. 1997; Hancock et al. 1995).	Con: large fishing areas spanning multiple management areas make control difficult.	Con: For for highly migratory species very large areas have to be closed for management to be effective (Claudet et al. 2008; Jennings 2001).	
Beamtrawl fisheries	Pro: Limiting input reduces over-quota discarding and high-grading in mixed fisheries.		Pro: effects of bottom contact gears confined to open areas. VMS facilitates enforcement.	Fully Documented Fisheries (FDF) may allow monitoring all species caught in mixed fisheries (Dalskov and Kindt-Larsen 2009); FDF may be combined with discard ban in order to link landings to catches.
	Con: Input substitution and technological creep. Input management allows combining gears and areas. No specific protection of individual species.	Con: discards of over-quota species in mixed fishery. High-grading occurs, especially when landings are constrained rather than catches (Copes 1986; Squires et al. 1998; Anderson 1994; Arnason 1994).	Con: effects of fishing on "sedentary" species in open areas? No incentive to increase selectivity. Fishing effort will increase in open areas if no additional input management.	
Demersal trawl fisheries in the North Sea (Nephrops, cod, dab)	Pro: Input measures provide flexibility for targeting the most abundant (or most profitable) species at any point of time.	Pro: Because there is temporal and spatial structure in catchability, output management is feasible.	Pro: These fisheries are generally well confined to smaller areas. Lessons could be learned from the Management plan for sandeel in the North Sea (ICES, 2011)	Some form of multi-species quotas could work here (quota proportionality geared towards Nephrops fisheries)
	Con: Danger of overfishing of most profitable species			

8. Synthesis and discussion

The question if a simplified management system addresses the failures of the current management system is not easy to answer. Fisheries management has multiple objectives (e.g. optimal exploitation of commercial fish stocks and protection of ecosystems) and in most cases these cannot be reached with a single management instrument. First, it is questionable if there is *one single* situation that needs to be addressed for all fisheries in Europe. The fishing fleets are very diverse. In the Netherlands, fisheries become ever more diversified and what may work for one fleet does not necessarily work for others. Second, the outcomes of management decisions depend on the implementation. Studies on the effects of management generally have to assume specific implementation details. Subtle deviations from the implementation assumed in studies may have substantial consequences on the outcomes. Finally, the behavioural changes that are expected from some of the innovative management measures are too complex to predict reliably. Moving beyond descriptions of how these management measures have worked elsewhere is probably unfeasible.

If one wants to switch to a single simple system for management, overcoming the disadvantages of the management system probably requires very stringent measures. This can be seen as a trade-off between the simplicity of a system and the costs of the system. For example, if one wants to rely on an effort control system only, without additional safeguards for some vulnerable species, one probably needs to substantially reduce the fishing effort, to ensure that the vulnerable species do not become overexploited. This is true for any simple management system.

For the important fisheries in the Netherlands, different management systems could be preferred for different fisheries. However, some kind of mitigation measures would be required to have a fully functioning fisheries system where all objectives of the CFP are met. The effects of the specific management regime on specific fisheries are difficult to predict. Consulting stakeholders in this process is essential to reveal expected preferences and potential support for management regimes.

9. Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

10.References

Anderson, L.G. (1994) An economic analysis of highgrading in ITQ fisheries regulation programs. Marine Resource Economics 9:209–26.

Arnason, R. (1994) On catch discarding in fisheries. Marine Resource Economics 9:189–207.

Buisman, F. C., J. W. De Wilde, R. Cappell, G. Borel, Y. Giron and F. Vibier (2001) Economic aspects of discarding. Agricultural Economics Research Institute (LEI), The Hague. Report to EC, July 2001.

Claudet, J., C.W. Osenberg, L. Benedetti-Cecchi, P. Domenici, J.-A. García-Charton, A. Pérez-Ruzafa, F. Badalamenti, et al. (2008) Marine reserves: Size and age do matter. Ecology Letters 11; 481-489

Cochrane, K.L. (2002) A fishery manager's guidebook. Management measures and their application. FAO Fisheries Technical Paper. No. 424. Rome, FAO. 2002. 231pp.

Copes, P. (1986) A critical review of the individual quota as a device in fisheries management. Land Economics 62: 278–91.

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. Official journal of the European Communities. L024: p. 1-13.

Davidse, W. P. (2000) The effects of transferable property rights on the fleet capacity and ownership of harvesting rights in the Dutch demersal North Sea fisheries. In: Use of property rights in fisheries management, FAO fisheries technical paper 404/2. Ed. R. Shotton. p. 258-266.

EC (2009). Green paper: reform of the common fisheries policy. COM(2009) 163.

Gezelius, S.S., T.J. Hegland, H. Palevsky, and J. Raakjaer (2008) The politics of implementation of resource conservation: comparing the EU/Denmark and Norway. In: Making fisheries management work. Implementation of policies for sustainable fishing. Ed. S.S. Gezelius and J. Raakjaer. Springer. p. 208-229.

Hancock, J., P.J.B. Hart, T. Antezana (1995) Searching behaviour and catch of horse mackerel (Trachurus murphyi) by industrial purse-seiners off south-central Chile. ICES Journal of Marine Science 52; 991-1004.

Hauge, K.H., and D.C. Wilson (2009) Comparative evaluations of innovative fisheries management, global experiences and European prospects. Springer science + business media, 272 pp.

Holden, M. (1994) The Common Fisheries Policy: origin, evaluation and future. Fishing News Books, 274 pp.

Jennings, S. (2001). Patterns and prediction of population recovery in marine reserves. Rev. Fish Biol. Fish. 10, 209–231.

Jentoft, S. (1989) Fisheries co-management. Marine Policy 13, 137-154.

Kaminstein, D. S. (1996) Persuasion in a toxic community: rhetoric aspects of public meetings. Human Organization 55, 458-464.

Kindt-Larsen, L., E. Kirkegaard, and J. Dalskov (in press) Fully documented fishery: a tool to support a catch quota management system. ICES Journal of Marine Science, doi:10.1093/icesjms/fsr065

Magrath, W. (1989) The challenge of the commons: the allocation of nonexclusive resources. World Bank: environmental department working paper 14. The World Bank, Washington.

Osterblom, H., M. Sissenwine, D. Symes, M. Kadin, T. Daw, C. Folke (2011) Incentives, social–ecological feedbacks and European fisheries. Marine Policy, 35: 568-574.

Pinkerton, E. (1989) Attaining better fisheries management through co-management – prospects, problems and propositions. In: Co-operative management of local fisheries. Ed. E. Pinkerton. Vancouver: University of British Columbia Press. p. 3-36.

Potier M., P. Petitgas, and D. Petit (1997) Interaction between fish and fishing vessels in the Javanese purse seine fishery. Aquatic Living Resources, 10: 149-156.

Pomeroy, R.S., and M.B. Carlos (1997) Community-based coastal resource management in the Philippines: A review and evaluation of programs and projects 1984-1994. Marine Policy 21, 445-464.

Rijnsdorp, A.D., N. Daan, W. Dekker, J.J. Poos, W.L.T. Van Densen (2007) Sustainable use of flatfish resources: Addressing the credibility crisis in mixed fisheries management. Journal of Sea Research 57, 114–125.

Sissenwine, M. and D. Symes (2007). Reflections on the Common Fisheries Policy, Report to the General Directorate for Fisheries and Maritime Affairs of the European Commission. 75 pp.

Symes, D. (2009). "Reform of the European Union's Common Fisheries Policy: Making Fisheries Management Work." Fisheries Research 100(2): 99-102.

Squires, D., H. Campbell, S. Cunningham, C. Dewees, R.Q. Grafton, S.F.J Herrick, J. Kirkley, S. Pascoe, K. Salvanes, B. Shallard, B. Turris, N. Vestergaard (1998) Individual transferable quotas in multispecies fisheries. Marine Policy 22:135–59.

van Hoof, L. J. W. and J. P. M. van Tatenhove (2009). "EU Marine policy on the move: The tension between fisheries and maritime policy." Marine Policy 33(4): 726 - 732.

Van Hoof, L. (2010) Who rules the waves? Governance and new institutional arrangements in Dutch fisheries management in the context of the European Fisheries Policy, PhD thesis, Wageningen University, 179pp.

Justification

Rapport C070.11

Project Number: 4308101022 (BO12-07)

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Harriet van Overzee, MSc.
Researcher

Signature:

Date: 9 June 2011

Approved: Tammo Bult
Head of fisheries Department

Signature:

Date: 9 June 2011