DYNAMIX

Decoupling growth from resource use and environmental impacts

# DYNAMIX policy mix evaluation

## Sustainable levels of fish catch in Iceland

European Commission

SEVENTH FRAMEWORK PROGRAMME

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## DYNAMIX PROJECT PARTNERS

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# 1 Resource/Issue

*Name of resource targeted (or focus of the case study, if the policy mix is broader than the specific resource(s) we have decided to analyse).*

Fisheries resources: all commercial stocks, including herring, capelin, cod and redfish. The overexploitation and resulting decline in Icelandic fish stocks, and particularly the herring stock, had serious economic and social consequences.

# 2 Geographical area of policy mix coverage

*Country name, and region or city if appropriate (if policy mix is applied regionally or locally)*

The area studied covers Iceland and more specifically the waters within its exclusive economic zone. Iceland's exclusive fisheries zone has an area of 760,000 square kilometres, seven times the area of Iceland itself (Icelandic Fisheries n.d.).[1] The cod and capelin stocks are found inside Icelandic waters. Other large stocks migrate in and out of Icelandic waters, including the Atlanto-Scandian herring stock and blue whiting, while others are situated close to the 200-mile limit, such as the oceanic redfish stock. Icelandic vessels also fish in international waters, such as Atlanto-Scandian herring stock in the northeast Atlantic managed by the North East Atlantic Fisheries Commission, and the northern shrimp fisheries on the Flemish Cap in the northwest Atlantic, managed by the North Atlantic Fisheries Organisation. For these fisheries the total allowable catches (TACs) are set by the regional fisheries management organisations, but Iceland assigns its national quota to individual vessels.

# 3 Policy context

## 3.1 Needs assessment: the environmental problem/resource challenge

*What is the environmental problem/concern (consider both quantity and quality), e.g. soil erosion, excessive use of non-renewable or renewable resources and the crossing of environmental thresholds/tipping points for impact, resource scarcity concerns?*

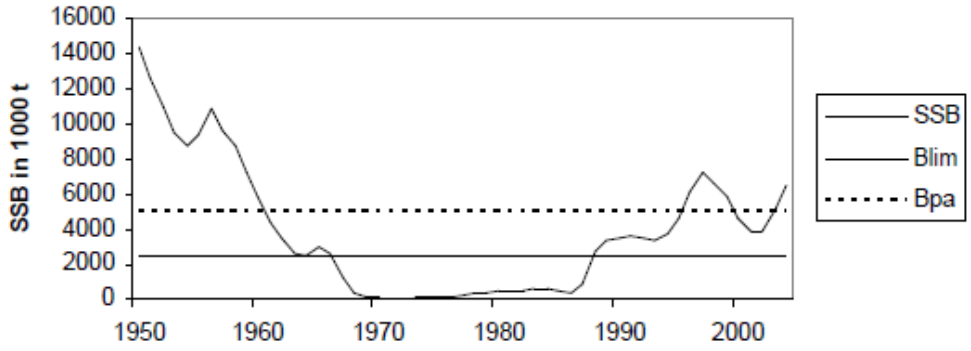
*Are there any economic or social problems related to the issue and environmental problems – e.g. is there important price volatility, (risk of) unavailability of resources for the economy or society?*

*Who is the target group affected that have been, are or will be beneficiaries of the policy response?*

During the first half of the twentieth century, Iceland, like other industrialised fishing countries, had the problem of over-exploitation of its fisheries resources. This is a classic example of the tragedy of the commons (Hardin 1968),[2] whereby the resource is shared by numerous individuals each seeking to maximise their yield, despite the fact that depletion of the common resource is contrary to the group's long term best interests. In Iceland there were numerous international (up to 1976) and domestic fishers competing for shares in the resource. This resulted in a race to fish, with fishers over-investing in their gear in order to compete. This led to increasingly excessive fishing capital and effort compared to the reproductive capacity of the fish stocks.

This over-exploitation resulted in the serious decline of fisheries resources. The herring stock had the highest catches in the mid 1960s, but this was followed with collapse as catches fell from 2 million tonnes (mt) in 1965 to 100,000 tonnes in 1969 and 10,000 tonnes in 1973 (see **Error! Reference source not found.**Figure 1) (Hamilton et al. 2005).[3] This was followed by a sharp drop in the demersal[i] stock and catch levels and capelin was seriously threatened with overfishing (Hamilton et al, 2005).[4]

**Figure 1: Spawning stock biomass of spring spawning herring**




Source: ICES. 2005. Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2005. ICES Advice. Volumes 1 - 11. p. 72.

## 3.2 Policy context and policy needs

*What policy challenge(s) did the problem pose and what policy challenges does it still pose?*

*What is the policy context related to the policy mix being evaluated? What policies have been put in place to address the issues, what policies are currently in place and which ones are already foreseen for future introduction (e.g. to address past, existing and future objectives)?*

*What sort of policy response did (and does) the problem call for?*

A very significant policy challenge faced was that prior to the introduction of the first limits on landings in 1975 (for herring only), the sector was barely regulated[ii], essentially given unrestricted access to the resource. Having had free access previously, the fishing industry clearly resisted restrictions, and even more so against paying for access. The latter is still an

[i] Demersal stocks (e.g. cod, haddock, and flat fish) live and feed on or near the bottom of seas or lakes (the demersal zone), in contrast to pelagic fish which live and feed in the open water column.

[ii] The only limits were area, gear and size restrictions.

important policy challenge met with much resistance, with debates over the appropriate level to set a tax on resource rent becoming very heated (with one side taking the position that fisheries are a public good and that therefore the public should profit, and others arguing that the fishing industry should reap the full rewards in order to maximise efficiency).

Related to this is the challenge of how to reduce and limit fishing pressure fairly as well as efficiently, i.e. who should be allocated the rights to fish. There is a tension between those who have historically had the rights of access, and those who would like to reap the benefits of the resource in the future (future entrants into the sector). Ever since the introduction of transferable quotas in 1983 there were those arguing that the initial allocation was not fair.

Another challenge still faced is the problem of discarding, as some argue that such Individual Tradable Quotas (ITQs) systems increase the occurrence of high-grading (the throwing away of specimens of the targeted species, usually because they are too small to be of much value) in mixed fisheries (Gissurarson 2000).[5] However, others argue that this is not a serious problem in the Icelandic demersal fisheries (Arnason 1993).[6]

There are numerous contextual elements which have influenced the introduction and development of the policy mix. The Icelandic economy has always been heavily dependent on fisheries. Historically, sheep farming and fisheries were the mainstay of the economy. For most of the twentieth century, Iceland's economic growth was led by the fisheries sector. Consequently, changes in the fish catch and export prices of marine products were the leading source of fluctuations in output growth. In addition to the export of fish products, many auxiliary companies have developed around the fishing industry, providing supporting services and products. In terms of employment, in 1930 23% of the population on the labour market was employed in the fisheries sector (Icelandic Fisheries, n.d.).[7] Between 1930 and 1960 the number of people working in the fisheries sector grew from 12 to 15 thousand. Then employment declined due to the collapse of the herring stocks, but increased again after 1970, with the highest number of people working in the fishing industry in the 1980´s (about 16 thousand employees). After that the number of people has declined constantly to the current level of about eight thousand (or about 4.1 %), despite catches of fish having increased throughout the 20th century.

International interest in Icelandic fisheries resources and international relations have exerted significant influence over fisheries management policy, and are likely to continue to do so. Once it became known that fishing grounds were not inexhaustible, Iceland attempted to exclude foreign fleets from its waters. It declared an Exclusive Economic Zone of 12 nautical miles in 1958, increased to 50 miles in 1972, and extended to 200 miles in 1976. Soon after the extension of the EEZ to 200 miles, a special Fisheries Act was adopted by Parliament, giving powers to the Minister of Fisheries to restrict access to fishing grounds in Icelandic waters. Without establishing its jurisdiction Iceland would have not been able to assign any form rights based fisheries management system. As Iceland is not currently a member of the European Union its fisheries are not managed under the European Common Fisheries Policy. This means that it does not have any obligation to share its waters and the fish stocks therein with other countries. It does however have agreements with neighbouring states, including the EU, over access to fish stocks that migrate through Icelandic waters, as well as certain fish stocks that swim in international waters (due to historical exploitation of such stocks by Icelandic vessels). The present dispute between the EU and Iceland and Norway over the shared mackerel stock demonstrates the problems associated with internationally managed stocks (because of unilateral quota setting, the total allowable catch far exceeds sustainable

levels of exploitation). Accession to the EU would potentially have a dramatic impact on Icelandic fisheries management; it is therefore a critical issue for Icelandic voters.

In addition to international politics, regional differences also played a large role in the development of the policy mix. During the mid-1970s, when it became apparent that a policy response was needed to respond to the depletion of the demersal stocks (a policy response had already been established for pelagic stocks in 1975), the Minister of Fisheries came from the Western Fjords region. Fishermen in this region were closest to the most fertile fishing grounds and therefore had an advantage over other fishermen when there is unlimited harvesting in a limited period of time. This explains why the Minister introduced a system of effort quotas in 1977 as opposed to catch quotas (i.e. limits on the number of days at sea, rather than limits on the total catch). The opposition to catch quotas for demersal stocks has generally come from the Western Fjords, with the most vocal support coming from the East of the country. It is important to note that introducing catch quotas in the pelagic fisheries was a much smoother process. This has been assigned to the fact that the pelagic sector is a lot more homogeneous, with similar sized vessels and similar interests, and because the pelagic stocks were in a much worse state (the sector could be described as much more desperate) (Gissurarson 2000).[8] In contrast the demersal sector was far more diverse – ranging from large freezer trawlers to rowing boats - and the threat of stock collapse was less catastrophic.

In Iceland, 1978-83 were years of weak governments, political upheavals and uncertainties (Gissurarson 2000).[9] But in the summer of 1983 a strong coalition government of the Independence Party (Iceland's conservative party, with 35-40 per cent of the votes) and the Progressive Party (with rural roots and about 20 per cent of the votes) was formed. The new Minister of Fisheries, Halldor Asgrimsson, who came from the East region, was to remain in office for the next eight years. He worked closely with the powerful Association of Fishing Vessel Owners, whose leader, Kristjan Ragnarsson, was becoming convinced that effort quotas did not work. It was the opposition of the Association of Fishing Vessel Owners to effort quotas (in the face of declining stocks and increasing overcapitalization) and their calls for catch quotas that were instrumental to the Government's partial introduction of catch quotas in the demersal fisheries in 1983.

Another sensitive issue in Icelandic politics is regional development and the migration of people to the Southwest (Reykjavik and adjacent municipalities). Some opposition to the introduction of ITQs was related to concerns that they would lead to the concentration of quota in the Southwest and this would exacerbate the migration problem. Such concerns influenced the design of the policy.

The policy response required in this case, where the exploitation of the resource was due to the open access nature of the resource, was some form of access restriction and assignment of rights. This is a well-established policy response in resource economics theory, though Iceland was one of the first countries to implement the system in practice. Those opposed to the establishment of a rights based system did so partly on ideological grounds, considering that establishing access or quasi property rights over a previously publically-held resource was privatisation. Others were opposed because they were against stricter regulation.

Some stakeholders argue that the manner in which the access rights were initially assigned was unfair, as the rights were distributed for free. They argued that it was unfair to give a public resource away for free to certain individuals and that the policy needed tweaking so that at least some of the profit derived from the exploitation of the resource (known as resource rent) could go to the Icelandic public. It was suggested therefore to capture the

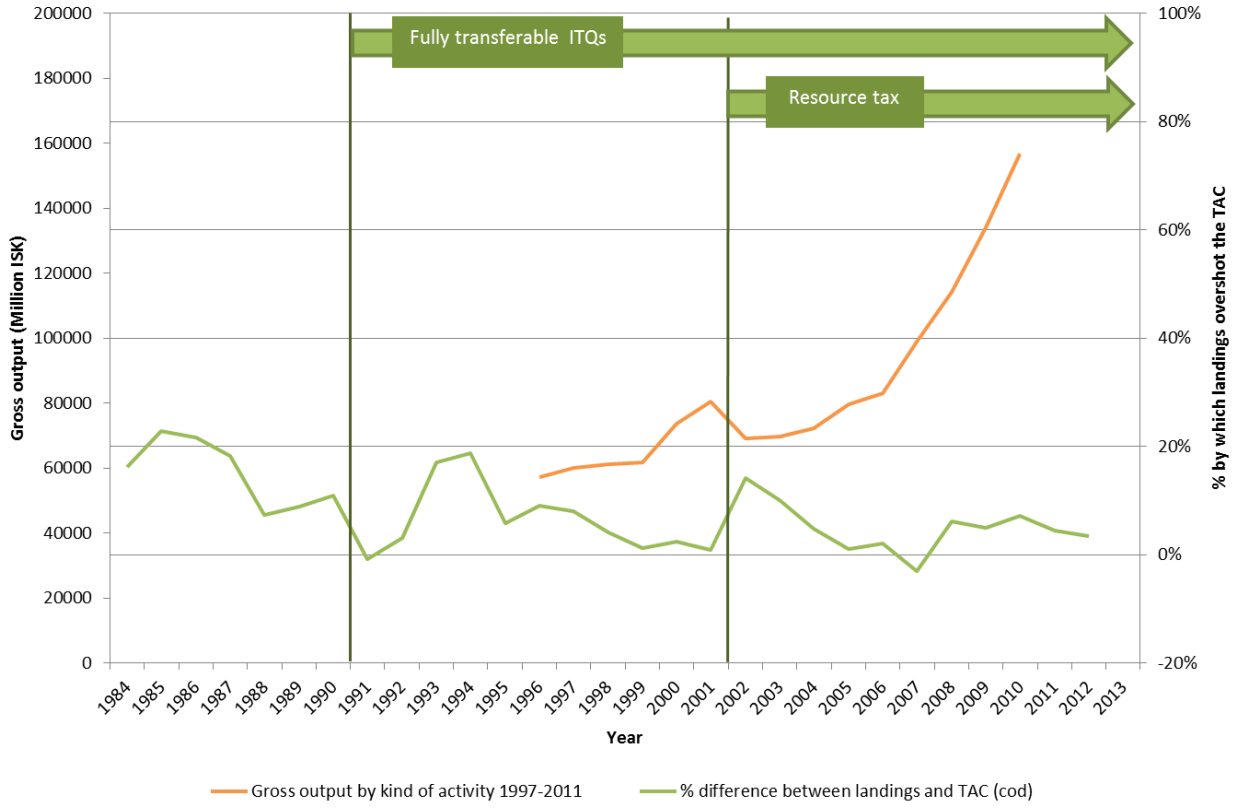
resource rent through a resource tax. This led to debate over the level at which to pitch such a tax from efficiency and equity points of view.

## 3.3 Historical performance and projections into the future: Insights on decoupling

*What has been the trend vs. GDP (or other economic performance metrics, such as sectoral growth) and what type of decoupling has been achieved?*

As fisheries are a renewable resource, the goal is to exploit stocks at levels that obtain the maximum yield whilst still maintaining the population size at the point of maximum growth rate, by harvesting the individuals that would normally be added to the population, allowing the population to continue to be productive indefinitely. The environmental problem in the fisheries case therefore is exploitation that exceeds these sustainable levels. Figure 3 presents an indicator of the 'environmental problem', in this case the overexploitation of fisheries resources, alongside an indicator of sectoral economic performance. The former is a measure of the degree to which Icelandic landings of cod (one of the most fished species) exceed the TAC set by the Icelandic government. In other words, it is the difference between landings of cod and the total allowable catch. The latter is the gross output, in millions of Icelandic Kroner, of the Icelandic fishing sector (as a whole). This figure shows that the economic performance of the sector has grown steadily and very significantly over the period. At the same time, overexploitation of the fisheries resource has shown an overall downward trend, stabilising over the past decade at fewer than 10 per cent. It can therefore be concluded that decoupling has been achieved to a large degree (absolute decoupling within limits).

**Figure 2: Performance of the policy mix in relation to gross output of fishing activity**




Source: Statistics Iceland, http://www.statice.is/?PageID=1214&src=https://rannsokn.hagstofa.is/pxen/Dialog/varval.asp?ma=SJA09005%26ti=Catch+of+Icelandic+vessels+from+all+fishing+areas+1945%2D2011%26path=./Database/sjavarutvegur/af3Fisk/%26lang=1%26units=Tonnes

# 4 Drivers affecting change: resource use/ environmental issues

*What are the drivers affecting resource use (driving demand for the resource and leading to resource overuse) or other environmental impacts?*

There were numerous factors that were driving the unsustainable exploitation of fisheries resources. A large factor was the open access nature of the fishery, which incentivised individualistic and self-interested behaviour. This continued when effort limitations were put in place for the demersal fisheries (as discussed in section 3 and 6c).

On another level, the Icelandic economy has traditionally been very reliant on fisheries, their waters being some of the most fertile in the world, and the country being otherwise relatively poor in natural resources. Fish and fish products have always constituted an overwhelming share in Icelandic exports: in the 1960s it was over 90%, falling to 75-80% when export of aluminium started in 1969 (Embassy of Iceland Ottowa n.d.).[10] In addition, a wide range of companies have developed to service the sector, and it is even more important in the regions outside the capital in terms of employment.

# 5 Situation/trend prior to introduction of policy mix

*Information on the baseline situation before the policy mix was introduced.*

As explained in section 3.1, the state of the resource prior to the introduction of the policy mix was very poor. The herring stock has been declining for decades, and collapsed[iii] in 1969, a collapse which lasted more than two decades (see Figure 2). Catches fell from 2 million tonnes in 1965 to 100 000 tonnes in 1969 and 10 000 tonnes in 1973 (Hamilton et al. 2005).[11] Estimated spawning biomass of this formerly huge stock declined from 14 million tons in 1950 to less than 2000 tons by 1972 (Hamilton et al. 2005).[12] In response to the decline in the herring stock, a commercial fishery for capelin started in the mid 1960's. This yielded 100 000 to 200 000 tonnes annually, growing to 450 000 tonnes annually by 1974 when the winter fishery expanded offshore (Vilhjálmsson and Carscadden 2002).[13] This grew to 700 000 tonnes in 1976/77, and peaked at 1 200 000 tonnes in 1978/79 (Vilhjálmsson and Carscadden 2002).[14] Following this peak, acoustic surveys showed that the fishable capelin stock had declined to very low levels in 1980, and severe catch restrictions were put in place. At the time of the first decline, many fishers contested the results of the acoustic surveys (Vilhjálmsson and Carscadden 2002).[15] However, after the fishery was halted in December 1981, a catch quota of 20 000 tonnes was allocated for the 1982 winter fishing season (Vilhjálmsson and Carscadden 2002).[16] When only 13 000 tonnes had been taken, the same fishermen abandoned the fishery when they realised that stock abundance was obviously so low that the remainder had to be left to spawn (Vilhjálmsson and Carscadden 2002).[17]

The demersal stocks were also in decline. In 1976 the Icelandic Marine Research Institute warned that the cod stock was threatened by overfishing. Fish mortality was very high, and the spawning stock was weak. The Institute recommended a total allowable catch in cod of 230 000 million tonnes for that year, while the actual total catch turned out to be 350 000 million tonnes. Unsurprisingly the stock continued to weaken and the spawning stock reached an all-time low in late 1983, estimated at only 200 000 million tonnes. The total actual catch of cod went down from 461 000 million tonnes in 1981 to 294 000 million tonnes in 1983, but despite this it still exceeded the recommended TAC by 100 000 million tonnes.

The overexploitation and resulting decline in Icelandic fish stocks, and particularly the herring stock, had serious economic and social consequences. The fishing sector experienced a long term economic decline during the post war period: the value of fishing capital increased by over 1200 per cent from 1945 to 1983, but real catch values only increased by 300 per cent (Gissurarson 2000).[18] Thus the growth in fishing capital exceeded the increase in catch values by a factor of more than four (Gissurarson 2000).[19]

For example, before the herring boom Siglufjörður on the north coast of Iceland was a small settlement that sustained a population of fewer than 100 people due to it being poorly positioned for commerce and unsuitable for farming. During the twentieth century when herring were found to be abundant off the coast, the town became the herring capital of the world: herring exports from Siglufjörður constituted more than 20 per cent of all exports from

[iii] There is no agreed definition of a fishery collapse. Pinsky et al (2011) defined a stock as collapsed if landings remained below 10% of the average of the five highest landings recorded for more than 2 years.

Iceland (Hamilton et al. 2005).[20] During 1930s to 1940s Siglufjörður became the engine behind the whole Icelandic economy and opened unprecedented economic and social opportunities (Hamilton et al. 2004).[21] After 1949 the landings began to fall, and the town's population began a long period of decline. Siglufjörður's golden reputation changed to one of unemployment and insolvency (Hamilton et al. 2004).[22] The collapse of the herring was a shock to the entire nation, with impacts not just confined to the herring towns. Unemployment increased throughout Iceland and net out-migration rose in 1969–70 to its highest levels since 1887 (Statistics Iceland 1997, cited in Hamilton et al. 2004). The East Iceland towns of Neskaupstaður and Seyðisfjörður were able to diversify through the cod and capelin fisheries following the collapse of the herring, however these were left in similar dire straits once catches in those stocks also fell.

# 6 Description of policy mix(es)

*This section presents the main policy mix that will be the focus of this ex-post assessment.*

**Lifecycle focus (point of application(s) of the policy mix):** Production

**Sector(s) covered:** Fisheries sector

**Scale of application of policy mix:** national

**Implementing body:** The Icelandic Ministry of Fisheries and Agriculture

**Objective of policy mix:** The policy mix itself does not have a stated objective as such, although the objective of the Fisheries Management Act is "to promote [exploitable marine stocks'] conservation and efficient utilization, thereby ensuring stable employment and settlement throughout Iceland".

## 6a. Supplementary context questions including elements pertinent to paradigm discussions in DYNAMIX

*Timeline for the different phases of the policy cycle (i.e. rationale and objective-setting; appraisal; implementation and monitoring).*

*Description of the government in power during each of the three following policy phases: rationale and objective-setting; appraisal; and implementation and monitoring.*

*Does the mix contain policies that are unusual or not typical of the country/ies or regional/local administration that implemented it?*

*Names of resource efficiency concepts, terms, models, ranking/classification systems, accounting methods etc. used or relied upon in each of the three phases of the policy cycle: rationale and objective-setting; appraisal; and implementation and monitoring, and how they were used (e.g.: 'waste hierarchy' – used in objective-setting to link policy objectives to more desirable uses for waste).*

The policy mix has developed over time, in an ad hoc manner in the sense that the developments have not occurred as a result of a formal policy review cycle. In short, TACs

and ITQs were introduced to the herring and other pelagic fisheries, in the mid-seventies to early eighties. These were then gradually applied to the demersal stocks, and in 1990 TACs and ITQs were obligatory for all commercial fisheries. A resource tax was introduced in 2002. Together these elements constitute the policy mix. The operational side of the policy mix has a formal cycle, in that TACs are set annually for the fish stocks for the year ahead.

See section 6c for an explanation of the evolution of the policy mix and how the governments changed over the course of its development. Note that the introduction of the ITQ system for the demersal stocks was only possible given the strong coalition between the conservative Independence Party and the centre-right agrarian Progressive Party. The influence of the socialist party was to push for the introduction of the resource tax.

Introducing property rights in fisheries was a major institutional reform, as was the introduction of a resource tax. Indeed, the introduction of ITQs was a pioneering step in fisheries management globally: Iceland was one of the first countries to try such a system (as well as New Zealand in the early eighties).

## 6b. Instruments and orientation of policy mix

*Instruments in the mix and whether one type of tool (i.e. regulatory, economic, information) is dominant.*

*For each instrument, what is its aim? What requirements does it place on relevant players (for example, phasing out a certain substance, meeting minimum recycling targets, etc.)? What reporting requirements exist?*

The policy mix in this case contains three instruments:

- TACs for all commercially exploited species;
- ITQs for the same species (with some minor exceptions);
- A resource tax.

TACs and quotas, i.e. catch limits on how much fish can be caught, can be employed as a fisheries management tool on their own. ITQs, on the other hand, are a tool that intrinsically requires TACs and quotas to be established. ITQs are a cap-and-trade mechanism, and the TAC constitutes the cap on fishing opportunities. Therefore it could be stated that TACs are the primary instrument, and ITQs are an enhancing instrument.

The Ministry of Fisheries and Agriculture issues regulations for commercial fishing for each fishing year, which includes an allocation of the TAC for each of the stocks in question. The Marine Research Institute advises the Ministry of Fisheries and Agriculture on TACs based on stock assessments. For cod, the TAC is automatically set after the annual stock assessment at 25 per cent of the fishable biomass. This rule, based on scientific recommendations, was adopted by a government decision and became effective in 1995. Following the recommendations of the Marine Research Institute, the government decided in July 2007 that the TAC for cod in the fishing year 2007/08 should be set at 20 per cent of the fishable biomass, in order to stabilise the setting of TACs between years.

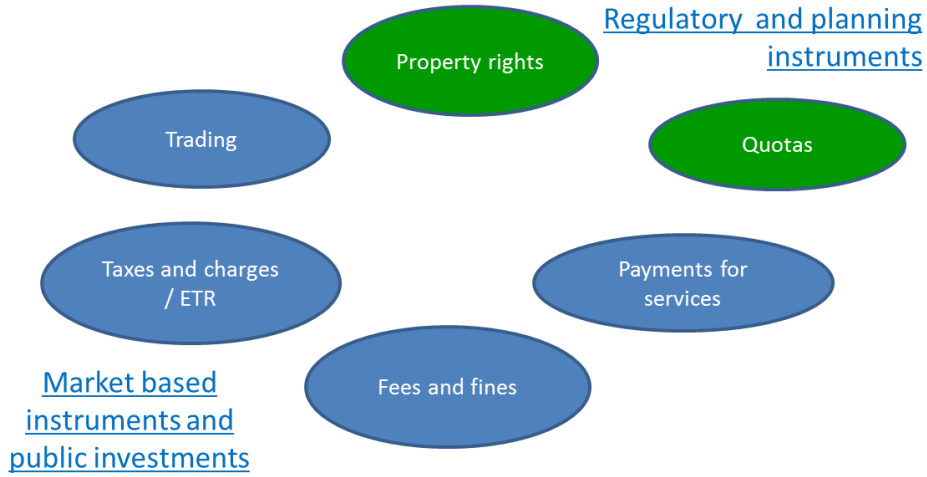
Compliance with the TAC is monitored by weighing and recording all catches of Icelandic fishing vessels at the port of landing. The port authorities record the catch in a computer that is directly linked to a centrally located database at the Directorate of Fisheries. The data is processed in the Directorate´s database and catches are subtracted from the vessel´s quotas. Based on these figures the Directorate can quickly determine whether vessels have

overfished their quotas. Excess catches can result in a revocation of fishing licenses and fines.

ITQs are shares in the TAC of a fish stock. They are issued to each vessel for an indefinite period of time. They have some of the characteristics of private property rights, in that they are exclusive, individual, divisible, transferable, and permanent. Under the Icelandic system vessel owners are issued a TAC share (expressed as a percentage of the TAC), and this is multiplied by the TAC annually to determine their annual catch entitlement. ITQs can be transferred annually and permanently: TAC shares can be permanently traded, completely freely (but under the supervision of the Directorate of Fisheries), and annual catch entitlements can be sold for that season. Fish stocks are also interchangeable, and cod is used as the common denominator. The term 'cod equivalent' refers to weight and implies the relative value of different fish species on the market compared to cod. This is set by a regulation every year. Thus, each vessel with a quota for several species may calculate the total quota in kg as cod equivalents. There are also other specific design features of the system, such as restrictions on transferring of annual catch entitlements in view of stabilising local employment, or limits on the amount of TAC shares that any one fishing firm may own, in order to prevent concentration.

The resource tax was added in the later stages of the development of the policy mix. The rationale behind it was to use the resource rent generated by fisheries as a base for government revenue. Some proponents support the fee based on social equity concerns, while others argue that higher catch fees will make the fishing industry more accessible and attractive to young entrepreneurs by lowering the price of fishing rights and thereby reducing the capital requirements for new entrants (Matthiasson 2008).[23] The tax is calculated so that it depends both on the amount of quota held by the fishing firm as well as its economic performance (Haraldsson and Carey 2011).[24] The reference period is the 12 months to 30 April in the preceding calendar year. The total catch value for that year is calculated and fuel, wages and other operating costs are then deducted (net revenue). The total tax revenue for that fishing year is set at 9.5 per cent of this amount. The tax is then calculated per cod equivalent by dividing total tax revenue by the catch in cod-equivalent kilos. This results in a tax per cod-equivalent kilo (ISK/kg) that is levied for the next fishing year. The tax is levied on all species and all catches. Calculating the tax this way takes account of fluctuations in the profitability of the industry as well as the amount of quota issued the year before, so that if the quotas are increased from the previous year, firms pay the tax per kilo on the increase as well (Haraldsson and Carey 2011).[25] In the same way, if quotas are reduced, firms pay the tax on fewer kilos. In this way the taxation takes into account fluctuations in the catch between fishing years.

**Figure 3: Toolkit of policy instruments and their relationships**




Source: Own compilation

## 6c. Evolution of policy mix

*Evolution of the policy mix throughout its existence –details of the introduction of the first policy tool(s), then all subsequent relevant tools, and related revisions/reforms (e.g. progressive increases in rates applied through economic tools, broader extension of regulation requirements, etc.).*

The policy mix has evolved over the course of four decades, with different components gradually being introduced. It started with a TAC being set for herring in 1975, which was divided equally among boat owners. The quota shares were not transferable at first, transferability was introduced in 1979 at the initiative of the boat owners. In the face of the success of the herring catch quota system, TAC shares were introduced for capelin in 1980, and these were made transferable in 1986, again at the initiative of boat owners.

1976 saw an important political development: Iceland extended its EEZ to 200 miles, thereby excluding foreign fishing vessels from its waters, and Parliament passed the Fisheries Act, granting the Minister for Fisheries powers to restrict access to Icelandic waters.

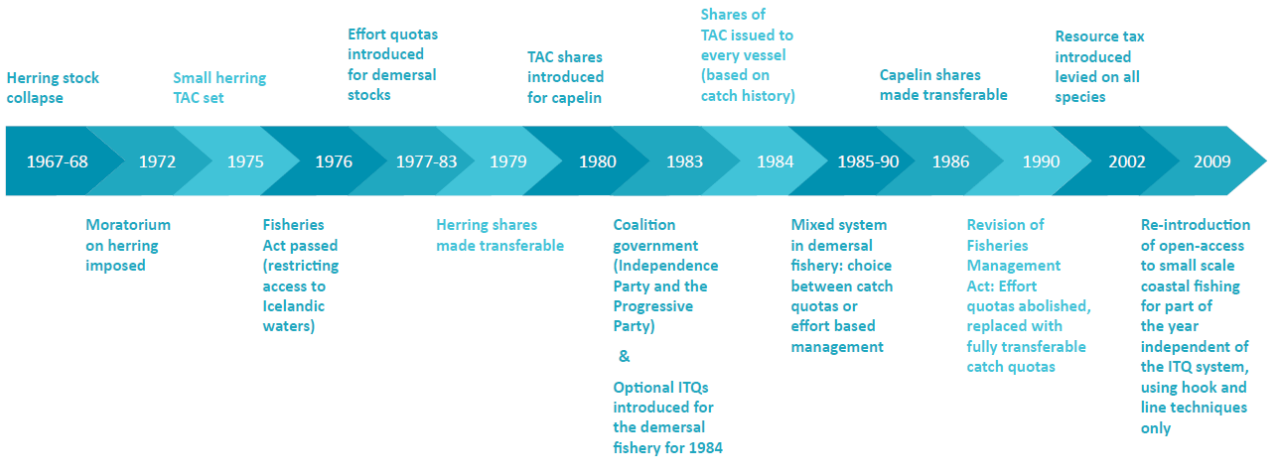
The demersal fishery took a different approach to the pelagic fisheries that was a lot more gradual and protracted. It began with the introduction of effort quotas in 1977. However this lead to Derby fishing (a race to harvest as much fish as possible during allowable fishing days), leading to over investment in the fleet and overfishing. This continued until 1983, when the Independence Party (liberal-conservative) and Progressive Party (liberal, agrarian, centre-right) formed a strong coalition government, and were able to amend the Fisheries Act to give the Fisheries Minister discretionary power to issue individual quotas for each vessel employed in the demersal fisheries for the following year. This was passed with a majority of one vote. Shares of the TAC were issued to every vessel based on their catch history over the preceding three years. Quotas were partly transferable, between vessels of the same port, or under the same ownership, and small boats (of less than 10 Gross Registered Tonnes) were exempt. In 1985 this system was renewed, however to appease opponents of the system from the Western Fjords region, a compromise deal was made so that vessel owners could

choose between vessel catch quotas and effort quotas[iv]. This 'mixed system' was written into a new law, the Fisheries Management Act, and was in place for six years until the end of 1990.

In 1990 the Fisheries Management Act was revised. Effort quotas were abolished, to be replaced with a fully transferable system of ITQs, issued for an indefinite period of time. Vessels of 6 to 10 GRT were also incorporated, but boats under 6 GRT remained exempt (and subject to effort quotas).

In 1991, a new and strong coalition government of the Independence Party and the Social Democrats was formed, and together they imposed a small 'service fee' on quota holders. This resource tax was introduced to attempt to allay criticisms, supported by the Social Democrats, that the public was not accruing any benefits from the privatisation of the resource. The revenue was used to facilitate a reduction in the fleet. In 2002 the fisheries Management Act was amended to introduce a resource tax which replaced the previous levies. It was levied as of 1 September 2004 and applies to all species.

**Figure 4: Evolution of the policy mix**




Source: Own compilation

# 7 Evaluation of policy mix: effectiveness (environmental sustainability)

*Does/did the policy mix result in a positive environmental outcome?*

*Were its stated objective(s) met? Were the instruments used sufficient to meet the objectives?*

[iv] Note that the mixed system allowed fishermen to choose between the two management options. It did not mean that fishermen were subject to both types of restrictions.

*Did other, unforeseen/unintended positive outcomes or impacts (environmental, social, economic) result? Did other such negative outcomes or impacts result?*

*Were these objectives set at a level to meet environmental needs (e.g. avoid crossing environmental thresholds/tipping points or achieve more sustainable levels of resource use/extraction (e.g. maximum sustainable yield (MSY) in fisheries)?*

*Which sectors/actors were identified as having key impacts/influences on the problem/issue? (e.g. specific industrial/ business sectors, consumers, economy as a whole?) Did any of the instruments specifically target these key sectors/actors? Was there significant take-up/implementation of (voluntary) instruments by these sectors?*

*Was the policy mix applied to a sector previously not targeted by policies on the issue under question, or in a new area/issue – thereby aiming to stimulate change?*

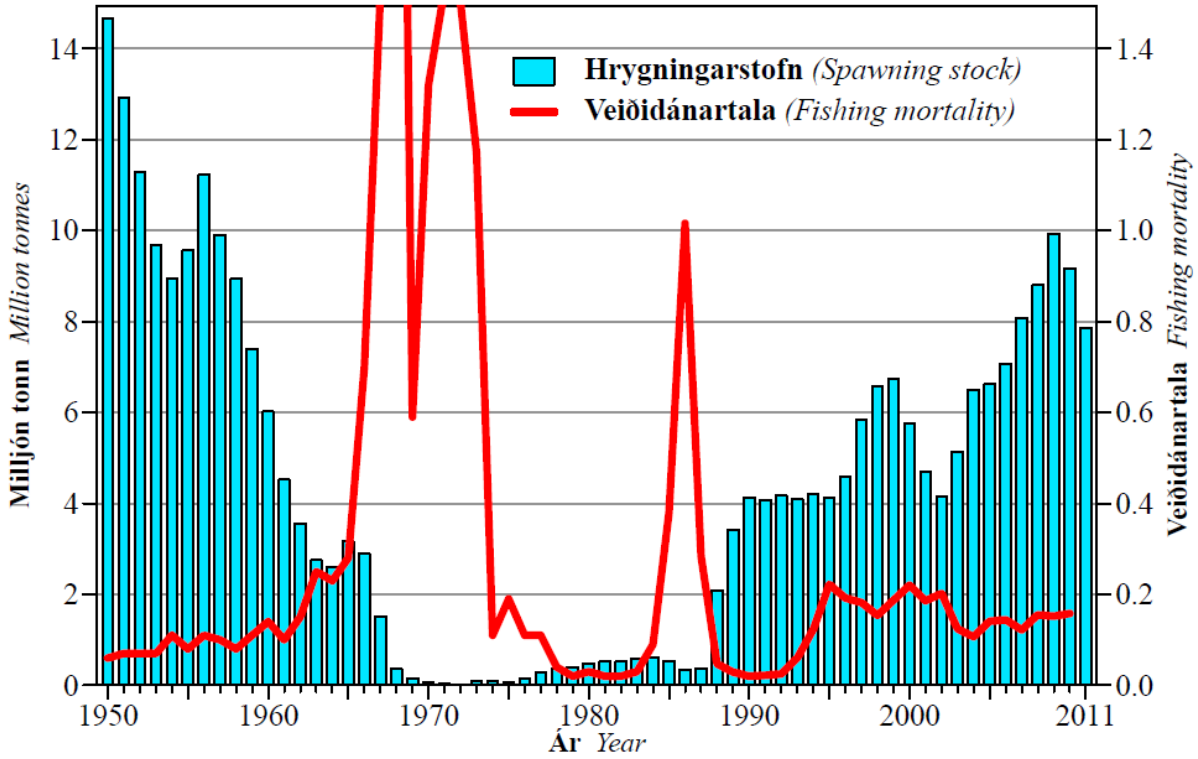
*What were the anticipated and actual outcomes, impacts and effects of the policy mix on the behaviour of sectors and actors targeted? (e.g. reductions in emissions from industry, increased recycling rates, increase/decrease in certain product purchases, etc.).*

*Relationships between the instruments, identifying positive/negative influences on the overall policy mix or on key instruments in the mix, as well as any positive or negative impacts from changes to the mix (introduction or termination of instrument(s), increase or decrease in tax/levy/charge, etc.). Level of 'connectivity' (strong, weak) between each instrument and the primary one(s).*

*Are there any indicators, monitoring systems, review processes or other monitoring mechanisms in place to track progress?*

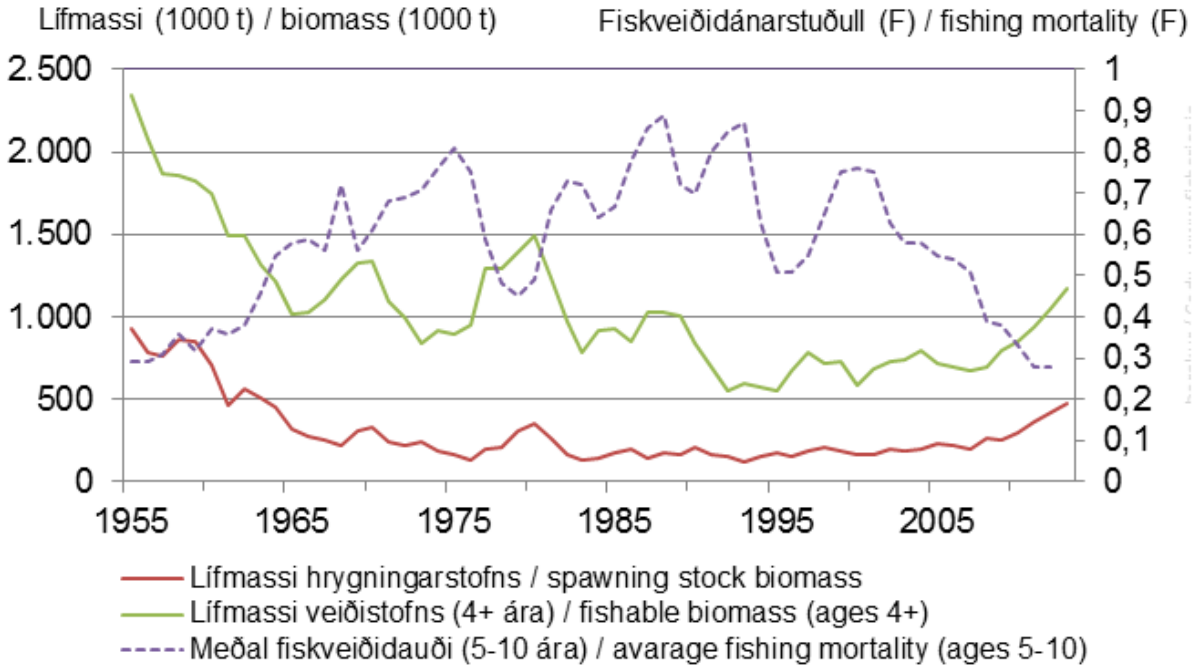
As stated in section 6a, the policy mix does not have an explicitly stated objective, but the objective of the Fisheries Management Act is "to promote [exploitable marine stocks'] conservation and efficient utilisation, thereby ensuring stable employment and settlement throughout Iceland". By referring to 'exploitable marine stocks', the Act includes marine animals and vegetation found within the Icelandic EEZ which are or may be exploited commercially. The data on stocks shows that since the introduction of the ITQ system there has been steady improvements in their state. Figure 5 demonstrates that the herring stock has rebuilt steadily since the collapse in the late 1960's. For the cod stock (see Figure 6) the evidence is less immediate, but there has nevertheless been a steady increase in the fishable biomass, from 550 thousand tonnes in 1992 to around 1.2 million tonnes in 2012. The 2013 ICES advice states that the spawning stock of Icelandic cod is increasing and 'is higher than has been observed over the last five decades'. In addition, the percentage of the fish stock removed each year by fishing (i.e. fishing mortality) has declined significantly since the early 2000's and is presently at a historical low. Some argue that the stock could have been rebuilt quicker, had the mixed system which included effort restrictions as well as ITQs not continued from 1985 to 1990, and had small vessels not been subject to various exemptions from the system until 2004 (Gissurarson 2000, Haraldsson 2008).[26,27]

**Figure 5 Norwegian Spring Spawning herring. Spawning stock biomass (million tonnes) since 1950, and fishing mortality**




Source: Marine Research Institute (MRI) (2012) State of Marine Stocks in Icelandic Waters 2011/2012

**Figure 6 Spawning and fishable (ages 4+) stock biomass (thousand tonnes) at spawning time and average fishing mortality (ages 5-10) for cod**



According to Gissurarson (2000) the ITQ system has resulted in a marked change in behaviour in vessel owners. The report argues that holders of the tradable quotas within the Association of Fishing Vessel Owners (the largest fishing industry union in Iceland) see themselves 'as custodians of the fish stocks, taking a long-term view of their utilisation, and strongly supporting a cautious approach to the setting of TACs' (Gissurarson 2000).[28] It also reports that the harvesting under the ITQ system was better organised and more market-orientated, with vessels trying to catch fish when demand is at its highest (Gissurarson 2000).[29] This is in stark contrast to the effort based management regime, which incentivised 'derby' fisheries, in which fishermen competed to fish during the limited number of allowable days at sea, irrespective of weather conditions.

The policy mix does not really address the other impacts of fisheries on the marine environment (e.g. by-catch, destruction of the sea floor). However, this is not what the instruments in the mix were designed to achieve. Other technical measures, such as gear restrictions, and permanent, temporary and seasonal area closures are in place under the Fisheries Management Act to protect juvenile fish, spawning areas, vulnerable marine ecosystems (e.g. coldwater corals), and to reduce discards of unwanted species. It is likely that these measures have also contributed to the positive state of fish stocks, although there has been little research into assessing their role precisely. One unintended (and negative) consequence of the ITQ system is that it can incentivise high-grading, as the quota price can be high compared to the landed value of the fish and this creates a considerable incentive to discard less valuable grades. However, the Icelandic government has effectively dealt with this problem by banning the practice of discarding (Kristofersson and Rickertsen 2009).[30]

# 8 Evaluation of policy mix: efficiency (economic sustainability)

*Is/was the policy mix considered cost-effective?*

*What has been the level of impact on resource use of the policy mix (the effect)?*

*What have been the costs of implementing the policy mix for target audience (e.g. business, households, etc.)?*

*What are the costs (financial, human) of implementing the policy mix for the implementing authority – i.e. the administrative/transaction costs?*

*Were sufficient resources made available to ensure an effective implementation of the policy-mix?*

*Was anything foreseen in the policy-mix to address competitiveness concerns (e.g. use of exemptions) or minimise transaction costs (e.g. thresholds below which monitoring wasn't required)?*

*Did the policy mix involve providing financial support (e.g. subsidies, low interest loans, tax breaks etc.) to key actors (e.g. sector, households, etc.)?*

*Did the measures generate revenues (e.g. in the case of taxes) and if so, was revenue recycled/re-injected into the economy, and to what levels and activities? Did revenue recycling have positive amplifying effects?*

*In synthesis - was the policy mix cost-effective?*

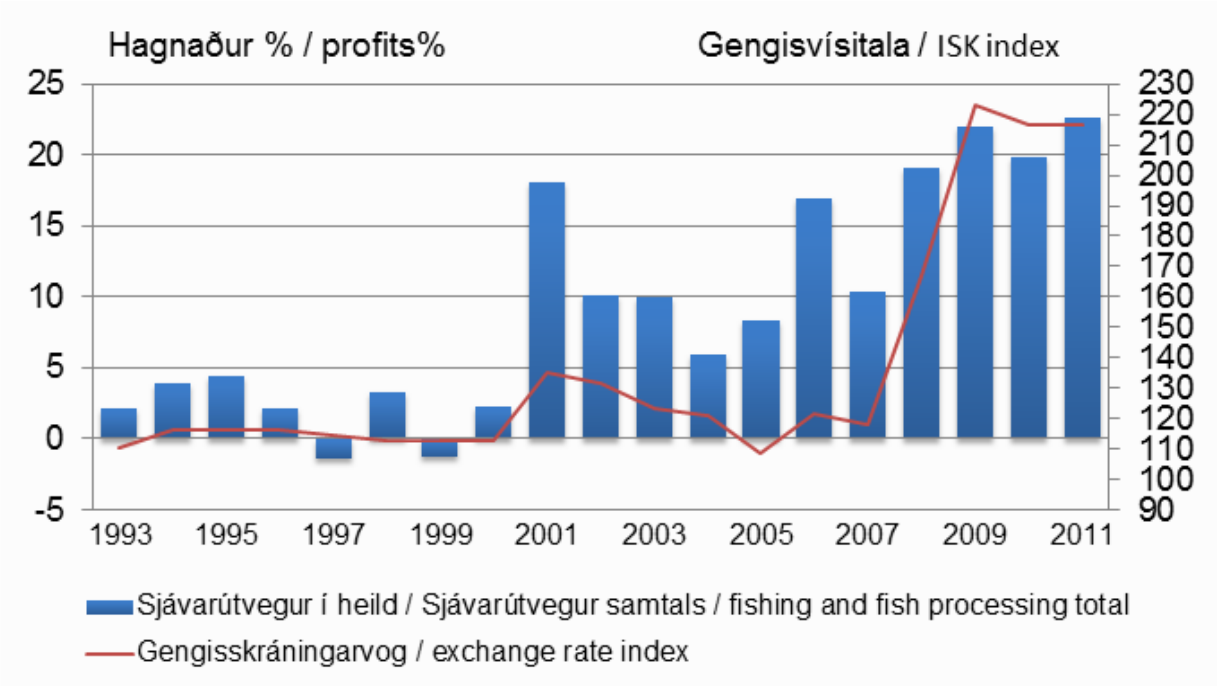
*What elements of the mix were (un)helpful in improving cost-effectiveness?*

*How was relative/absolute decoupling achieved?*

*Were resource limits or other thresholds taken into account and how were they addressed?*

At least as much as the policy mix aimed to improve environmental sustainability, it aimed to maximise the profitability of the exploitation of the resource. Before the introduction of the ITQ system, profitability of the fisheries sector was poor (see section 5) (Arnason 2008, Gissurarson 2000).[31,32] It is fair to say that ITQs turned the sector around, increasing its efficiency by reducing fishing effort and fishing capital, rebuilding fish stocks, raising the quality of the landed catch and improving coordination between supply of landings and market demand (Arnason 2008).[33] As a result the Icelandic fishing industry has been profitable since the early nineties, by on average 6.1 per cent of total revenues (Figure 7). Only in 1997 and 1999 did the industry lose money, 1.4 per cent in 1997 and 1.3 per cent in 1999. The figure indicates as well, that the profitability of the industry has been improving in recent years. The best years were 2001, when the profit of the industry was 18.1 per cent of revenues, and 2008-2011, when the profit was 19.1 - 22.6 per cent of revenues. This increased profitability is mainly due to increased productivity and higher prices. It is important also to note the important role that technological innovation (automated processing, transportation and logistics, freezer trawler technology and processing at sea, improved storage) has played in increasing profits.

**Figure 7 Net profit of the fishing industry and average value of the Icelandic króna**



In addition ITQs have generally become valuable on the market place, to the extent that they are used as collateral to obtain financial capital (Arnason 2008).[34] As a result ITQs have been used to raise financial capital to contribute to other spheres of economic activity, thereby creating new wealth (Arnason 2008).[35] There have been criticisms that the sudden wealth that the introduction of the ITQ system created played a considerable role in the burgeoning neoliberal market economy in Iceland, kicking starting the rapid growth in the financial services sector which crashed spectacularly in 2008 (Benediktsson and Karlsdottir 2011).[36] Specifically the high debts of the fishing companies generate concern. In July 2009 they were estimated to be ISK 550 billion, which was more than a third of GDP in 2008 (Havardsson 2009 in Benediktsson and Karlsdottir 2011).[37] In addition, more than 90 per cent of the total fishery debt was owned by only a third of the fishery companies.[38] However, following the financial crash the fisheries remained in a strong position (with export prices boosted significantly by the low value of the exchange rate) and they were relied upon to prop up an otherwise ailing economy (Haraldsson and Carey 2011, Benediktsson and Karlsdottir 2011).[39] [40].

Despite this success the efficiency of the system has been reduced through the existence of a number of small scale fishers were exempt from the ITQ system when it was first implemented and subject to limits on days-at-sea, mostly due to fears that they would be bought out of the industry. The evidence suggests that by leaving these vessels out of the system they were able to free-ride on the responsible behaviour and benefits of the ITQ fleet (Haraldsson 2008).[41]

# 9 Evaluation of policy mix: welfare (social sustainability)

*What social impacts have you found associated with the policy mix? E.g. jobs created, reduced health impacts, distributional impacts etc.*

*Were social aspects included in an ex-ante impact assessment of the policy mix if one was undertaken? What were these?*

*Has monitoring of social impacts been included in implementation, to identify actual effects compared to anticipated ones?*

*Was the policy mix designed to not be socially regressive? What measures were undertaken to ensure this?*

*Were equity concerns addressed and, in case of re-structuring of the economy/sector, measures in the area of reskilling of the workforce foreseen?*

*What other public acceptability elements were addressed or considered?*

Employment in the fisheries sector has declined since the introduction of the policy mix. The 1980's saw the highest number of people working in the fishing industry (about 16 thousand employees). Following this the number of people has declined constantly to the current level of about eight thousand. Given that the size of the industry was unsustainable, if it was to achieve its objectives the policy mix would be expected to lead to job losses. However, it is very likely that this decline would have been more drastic had the fish stocks continued to be

unrestricted. It is important to recognize that other factors affect employment trends in the fishing and fish processing sectors, including technological innovations and mechanization. Despite this overall trend, when the Icelandic economy crashed in 2008 the fishing companies remained stable. The national stock market lost 97 per cent of its value and more than 780 companies were bankrupted, but the largest fishing company in Iceland, HB Grandi hf, kept all 650 employees on the payroll during the financial crisis and some even received a raise (Bonzon 2010).[42]

An important social concern in Iceland is the economic balance between the Southwest (Reykjavik and adjacent municipalities) and the rest of the country. Regional development policies prior to the introduction of ITQs had failed to prevent the decline in rural villages and prevent the migration of people to the South West. Indeed, some opposition to the introduction of ITQs was related to concerns that they would lead to the concentration of quota in the Southwest and this would exacerbate the migration problem. In actual fact there is evidence to suggest that the ITQ system did not accelerate the migration problem and in fact it has managed to provide people in the fishing villages with improved economic opportunities. Analysis of the transfer of quotas appears to show that there has been a net transfer of quota from the South West to the West, North West and in particular North East (Gissurarson 2000).[43]

Another social concern was that the ITQ system would lead to concentration of quotas and social inequities. Given that the aim of the policy is to reduce the pressure on fish stocks by reducing the size of the fleet, it is to be expected that there would be a certain degree of quota concentration. However the policy does attract criticism for allegedly allowing this concentration to go too far, although the research on this topic is particularly thin. Pálsson and Helgason (2000) analysed the distribution of fishing quotas and argue that they indicate a growing inequality, with fishing rights becoming increasingly concentrated in the hands of the biggest companies. They also suggest that although some of the largest companies are owned by a large number of shareholders, there are indications that distribution of share-holdings is skewed, with a few large shareholders (such as banks and oil companies) controlling the majority of shares, as well as having shares in many different fishing companies (Pálsson and Helgason 2000).[44] They argue that this has happened largely against the will of smaller vessel owners. This is because reductions in TACs over the years lead to the devaluation of catch shares (as the TAC was reduced, the share of the TAC was smaller also, therefore less valuable), to the extent that many small companies found themselves increasingly left with insufficient catch-quotas to keep their boats active throughout the fishing year, and were therefore forced to sell their shares and leave the system (Pálsson and Helgason 2000).[45] Larger companies, with greater access to capital and with larger vessels with the ability to fish elsewhere, were better able to withstand and adapt to cuts in the TAC (Pálsson and Helgason 2000).[46] They were also able to buy up the quotas of smaller companies, which increased in value significantly once the stocks rebuilt (Pálsson and Helgason 2000).[47]

The other social concern is that the initial distribution of quotas was widely perceived to have been unfair (Haraldsson and Carey 2011).[48] This is because the resource rent from the common resource went to those with catch history, free of charge, rather than being sold off/ auctioned with revenues going to the public purse. This was done because at the time it was considered the only way to place limits on the right to fish, moving from an open access system (Haraldsson and Carey 2011).[49]

# 10 Overall assessment

*What is your overall view on the success(es) or failure(s) of this policy mix?*

*How did the policy mix enable decoupling?*

*How could it have been improved to achieve its original objective(s) and to achieve absolute decoupling?*

The implementation of the policy mix in Iceland has achieved sustainable exploitation of fisheries resources and enabled the fishing sector to become highly profitable, as explained in sections 7 and 8. It has therefore been successful in meeting the objectives of the Fisheries Management Act "to promote [exploitable marine stocks'] conservation" and "efficient utilisation". This finding is not isolated: recent reports indicate that the implementation of similar schemes worldwide ('catch shares') "halts, and even reverses,…widespread [fishery] collapse" (Costello et al. 2008),[50] and helps drive economic growth (World Bank 2008).[51]

By contrast there have been social concerns throughout the development of the policy and these remain. These relate to the initial allocation of quotas and the subsequent concentration of catch shares, with some parties arguing that this has been inequitable. There is disagreement over the importance of these concerns and the extent to which they are valid, and little research has been done, particularly in recent years to analyse these issues. However, the fact that such debates and concerns persist suggests that the policy mix has not been as successful in this regard. Nevertheless, the social element of the Fisheries Management Act objective was to promote stock conservation and efficient utilisation "thereby ensuring **stable employment and settlement** throughout Iceland". Incidentally, there is evidence to suggest that the policy mix has enabled fishing firms to remain stable while the rest of the Icelandic economy was in crisis (although the trend for employment in fisheries is downwards, this is not due to low stocks or poor returns). In addition, there are indications that the policy mix has bolstered the economy of rural villages, thereby helping to slow or reverse the trend of outmigration from these villages to the capital.

It should therefore be considered that the policy mix has had mixed results in terms of social sustainability. However, it is unlikely that certain social concerns outweigh the environmental, economic and social benefits.

# 11 Relevance to the EU and transferability

*Can the policy mix be applied at the EU level? Is it transferable to other Member States/countries?*

*What lessons are there that may be of general interest regarding policy mixes and what issues are there as regards transferability of the insights?*

TACs are already applied at the EU level under the Common Fisheries Policy (CFP) for a large number of stocks. In principle a system of transferable quotas could be applied at the EU level, however a resource tax could not, given that fiscal measures are generally within the scope of the EU's competence. The Commission proposed the introduction of mandatory tradable quotas (i.e. a system of ITQs) within all Member States with the aim of reducing

overcapacity in its proposal for the 2013 reform of the CFP; however this was very unpopular and rejected early on in the negotiations. Nevertheless Member States are free to establish tradable quotas, as some do, including Denmark and the UK, and resource taxes also.

The Icelandic example has provided numerous lessons for others attempting to overcome the tragedy of the commons in the fisheries sector. The most fundamental lesson would be that such a policy mix can be highly successful at rebuilding fish stocks. This has also been evidenced by similar schemes in other countries (Costello et al. 2008, Grimm et al. 2012).[52,53]

It also became apparent from the Icelandic example that the gradual introduction of ITQs in the demersal fisheries (i.e. the mixed system) was less effective than the much more direct and complete introduction of ITQs in the pelagic fishery. However, the rationale behind having a mixed system was to improve acceptability of the scheme, and such concerns should be taken into consideration when designed a catch share scheme. Improving acceptance of the system was also the reason behind the initial (free) allocation of catch shares, which has since been criticised. Thus a balance needs to be struck between improving acceptance of such schemes and compromising on efficiency and effectiveness.

The Icelandic example also demonstrated that it was easier to introduce the policy mix to a sector of the fishing industry that was more homogeneous (Gissurarson 2000).[54] In the herring fishery, vessels were similar in size and had recently experienced the collapse in the fishery, and this is thought to have helped the sector to come to a consensus on property rights (Gissurarson 2000).[55] In the cod fishery, there were important differences between fishing regions, and the fleet was more diverse in terms of size. Consequently it was more difficult to get agreement in these circumstances (Gissurarson 2000).[56] This could be of interest to other administrations seeking to design and introduce a catch share system.

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