Pêches et Océans Canada | Fisheries and Oceans Canada

Ministère de l'Agriculture, des Pêcheries et de l'Alimentation Québec

TOWARDS A RECOVERY STRATEGY FOR GULF OF ST. LAWRENCE COD STOCKS

4T4Vn (November-April) and 3Pn 4RS

Canada-Quebec Cod Recovery Committee

September 2005

1. INTRODUCTION

1.1. Perspective

Cod fishing is one of the main reasons for the colonization of Eastern Canada by the Europeans beginning in the 16th century and was responsible for the establishment and survival of many coastal communities. Until the end of the 1940s, when the otter trawl prohibition was lifted, cod was mostly harvested with fixed gear. From the middle of the 19th century up to the Second World War, catches in Atlantic Canada varied between 300 and 600 000 tons, mainly for French, English and Spanish fleets. With the arrival of numerous foreign fleets at the end of the 1950s and the growing use of trawls, cod landings increased significantly, exceeding 1.4 million tons in 1968. The northern cod stock (2J3KL) presented the most spectacular growth in total tonnage, but all other stocks had impressive increases in landings. A first cod stock collapse occurred in the early 1970s, but the combination of the decreased fishing effort, by excluding foreign fleets, and the production of strong age classes, thanks to favorable environmental conditions, produced spectacular cod stock rebuilding. This faster-than-anticipated rebuilding had two significant consequences: the rebuilding capacity observed in the 1970s was believed to be characteristic of cod stocks, and the positive effect of the fishing effort reduction was overestimated. The management system put in place at the time of the extension of fisheries jurisdiction to 200 nautical miles in 1977 was believed to be responsible for the rapid rebuilding and that it was possible to vary stock size at will. It was also thought impossible for a fleet of small Canadian vessels to engage in as high a fishing mortality as the one engaged by the large trawlers of foreign fleets supplying factory ships. Reality proved otherwise. The renewal of the Canadian fleet by highly effective units (which, in fact, replaced the foreign fishing effort), combined with an almost unlimited demand caused by the increased number of processing plants, has resulted in an increase in fishing mortality beyond the one generated by foreign fleets in the early 1970s. The combination of high fishing mortality, adverse environmental conditions and a possible increase in predation resulted in a second collapse in less than 20 years, which proved to be much more severe and persistent than the first one for many stocks.

The crisis resulted in the enforcement of moratoria, which did not include specific action plans. No one knew how to, or could, take advantage of this period to reconsider the full spectrum of the fisheries and management situation. In fact, these moratoria did not meet the industry and DFO's expectations. It is thus desirable that this strategy will entail the recovery of cod fishing, thus contributing to the economy of the coastal communities

1.2. Canada-Quebec Committee

It is within this context that, in September 2003, a Canada-Quebec Committee on cod recovery was established in order to develop and implement a cod recovery strategy with the goal of assisting in the recovery of 3Pn4RS and 4T-4Vn stocks and the sustainable management of the fisheries that exploit them.

Bilateral committees with similar objectives have also been created with other Atlantic provinces interested in these same fisheries. A Canada-Newfoundland and Labrador Committee is already carrying out work to this effect for diverse cod stocks, including that of the northern part of the Gulf (3Pn4RS), and a Canada-Maritimes Committee assembling the provinces of New Brunswick, Prince Edward Island and Nova Scotia has also initiated work aimed more specifically at the southern Gulf stock (4T-4Vn (November-April)).

The Canada-Quebec Committee is concerned with defining the position of Quebec's stakeholders for the rebuilding of cod stocks in the Gulf of St. Lawrence. This position will be developed in keeping with the work of other committees and the reports from the three committees will be integrated into a strategic global vision for all of Atlantic Canada.

Given that the Committee's mandate is to develop a strategic direction, it does not intend to define a short-term management plan and precise TAC rules. It is more interested in integrating remarkable elements that result from joint industry-DFO work and would support a long-term strategy. Also, the Committee works independently of COSEWIC's activities, without however neglecting the information that would prove useful for drafting a recovery plan for both cod stocks.

The main objective of the Canada-Quebec Committee for the recovery of cod is to prepare a strategy that will maximize the speed of cod stock rebuilding in the Gulf of St. Lawrence when the biological and environmental conditions will allow it and to establish the mechanisms that will allow the sustainable management of groundfish fishery in the Gulf.

The Committee has tried to meet the following sub-objectives:

- establishing a report on cod stock status in NAFO's 4T-4Vn area (November to April), in the southern part of the Gulf, and 3Pn4RS, in the northern part of the Gulf,
- assessing this situation with respect to the *Species at Risk Act*,
- defining threats to stocks,
- suggesting desirable and realistic objectives for stock recovery as part of a precautionary approach,
- suggesting threat mitigation measures and orientation towards shared management.

The Committee joined an advisory committee made up of representatives from Quebec's fishing industry. The report presented here was drafted in multiple steps:

- a first strategic orientation document was prepared and submitted to the advisory committee,
- this strategic orientation document was adapted based on the comments received and a consultation paper was then prepared,
- both documents were distributed to other cod recovery committees (Canada-Newfoundland and Labrador, Canada-Maritimes) and to most of the fishing industry's groups and associations, and a series of consultation meetings were held in June 2005 in all of Eastern Quebec.

This report arises from this process. It gathers data from the work carried out by biologists, information provided by the Department of Fisheries and Oceans' management branch, MAPAQ (Ministère de l'Agriculture, des Pêcheries et de

l'Alimentation du Québec) as well as comments and advice gathered during the consultation sessions.

At this stage, it is still a working paper that was updated in September with the comments received from the industry in response to the consultation in June and after validation by the advisory committee.

2. MAJOR ISSUES FOR QUEBEC'S FISHERIES

The crisis of the groundfish stock collapse on Canada's Atlantic coast affects the coastal communities in a more or less severe fashion depending on their diversification and dependence on groundfish. This crisis reveals many issues that communities, the fishing industry and the management system must face.

2.1. Issues Related to the Resource

Compared with the previous collapse in the early 1970s, 1990s' collapse affected a greater number of species, and cod stocks were not evenly affected. The northern cod stock (2J3KL), that of the northern part of the Gulf (3Pn4RS) and that of the Eastern Scotian Shelf have experienced more severe collapses than those in the 1970s. The collapse of the southern Gulf stock (4T-4Vn (November-April)), that of the St. Pierre Bank (3Ps) and that of southern Nova Scotia (4X) were similar to the one in the early 1970s. Of all the cod stocks of Canada's eastern coast, only the 3Ps stock seemed to have recently recovered in a significant manner according to the 2004 scientific assessments. No substantial increase is expected in the very short term for other stocks. Changes observed in the ecosystem during the last decade (water temperature, decrease in oxygen concentrations, change in predator-prey relations, etc.) contribute to the somber prognosis in the short- and medium-term. The fact that the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommends placing many Atlantic cod stocks on the list of species at risk, either as endangered, threatened or special concern species adds to the uncertain future of these fisheries, if not of the stocks themselves.

2.2. Social and Economic Issues

Geographically, the Quebec Region is the only Atlantic province for which coastal communities are adjacent to both cod stocks from the Gulf of St. Lawrence. This situation makes many of them sensitive to the fate of cod and groundfish that historically constitute the driving element of their development. It is even more critical since many segments of Quebec's fishing industry have no resources other than groundfish.

Like many maritime regions in Atlantic Canada, cod fishing has been the backbone of Quebec's fisheries as much in the Gaspé Peninsula as in the Magdalen Islands and the North Shore. Communities have thus developed a strong dependency on these resources. Moratoria and TAC decreases have significantly affected these communities. In 1985, in Quebec, there were nearly 1 700 groundfish fishing licenses. There were more than 3 300 active[1] cod fishers and fisher's helpers. At that time, cod landing values were in the order of $18 million. In 2002, there were less than 1 000 groundfish licenses. Overall, for Quebec as a whole, the number of active cod fishers and fisher's helpers was estimated at 1 150 in 2002 for landings of a total value of $3 million. Nearly half of these fishers are found in the Gaspé Peninsula while a little over one third comes from the North Shore, primarily the Lower North Shore.

The sustainability of many coastal communities, which depend on fishing, is currently threatened. The existence of lucrative fishing, for only a limited number of participants, results in tensions as much within the communities as between communities and fishery management agencies. Temporary crab and shrimp allocations granted to struggling fishers compensate for part of the lost cod fishing income, but remain uncertain from year to year.

The situation is of particular concern on the Lower North Shore where crab fishing in area 13 is closed and where cod fishing is significantly limited. This region’s economy is not very diversified and fishing is still the driving economic activity. These communities are heavily dependent on the fishing industry. Indeed, more than 80% of the population over 15 years old works in the primary fishing industry. Adding the secondary sector, this

[1] Active: Having made at least one cod landing.

proportion reaches 88%. Outside this sector, it appears that this region offers little alternative employment.

Other regions in the Gaspé Peninsula, such as Gaspé East and South, where a good proportion of cod landings occur, (60% in 2002) also depend on this fishery. Processing of cured cod fish ("Gaspé cured") has been an important activity for these regions for a long time. Moreover, the first moratoria have hurt this industry. More than 67% of the population over 15 years old work in the primary fishing industry in Gaspé South. In the secondary sector, this proportion reaches 70%. In these regions, employment outside the fishing industry is currently limited since the mining and forestry sectors are experiencing definite difficulties.

Although lobster takes up a significant part of marine product landings in the Magdalen Islands, the collapse of cod, associated with that of redfish, has affected many fishers and factory workers.

This observation shows that the collapse of cod fisheries involves important socioeconomic issues for these maritime regions. Indeed, these regions' communities, for historical and geographical reasons, are extremely dependent on fishing as the employment opportunities in other fields are almost non-existent.

A cod recovery strategy (and more generally of groundfish stocks) will involve decisions on the reorganization of the fishing industry that might prove difficult.

2.3. Institutional Issues

It is common knowledge that the perception of the stock status by some fishers differs from that of biologists, even if some associations have put that in perspective during the Committee's consultations. Sometimes, these differences may be more artificial than real. During their presentation of stock assessment results, biologists describe the previous year's stock status, i.e. usually six months ago or more and on the entire distribution, while fishers talk about their current experience, in their accessible environment. The relations between the scientists and the fishing industry had gotten better in the early 1990s after the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) was dismantled. The creation of the Fisheries Resource Conservation Council (FRCC)

and the implementation of regional processes open to the public for peer review have also contributed to this improvement. Since then, perception of cod stock conditions has changed and relations seem to have deteriorated once more. Despite their active involvement in the peer review and data collection processes, fishers feel that they have little power over the scientific councils created and resulting decisions. They also feel that they are not being heard and that their advice is ignored. Consultations sometimes seem, if not biased, at least not very productive. Certain decisions seem illogical or contradictory and the control and monitoring system is thought of as minimal.

The "shared management" principle, defined in the Policy Framework for the Management of Fisheries on Canada's Atlantic Coast, aims at changing this perception even if it still meets with much scepticism. Joint committees on "annual TAC establishment decision rules" were a step in this direction, but the feeling is that they had little effect on the decisions actually taken.

It is therefore too soon to assess the concrete effect of this strategic framework on fisheries management.

These institutional issues affect the environment in which possible rebuilding of groundfish stocks, cod in particular, may or may not happen. They constitute a major constraint to stock recovery that will be imperative to consider.

3. INSTITUTIONAL FRAMEWORK

Numerous statutes govern fisheries in Canada. Three of these are more directly involved with a cod recovery strategy. Many strategic documents arise from these laws and give important directions for the definition of this strategy. Moreover, in accordance with various rulings made by the Supreme Court (Sparrow, Marshall, Taku Haida), the obligation to consult Aboriginal communities has become imperative in order to respect acknowledged rights or rights that could potentially become acknowledged.

3.1. *Fisheries Act*

The *Fisheries Act* is the legal document determining the harvesting activity itself. It defines, among other things, the adjudication of fishing rights, activity control mechanisms and regulations on habitat protection.

3.2. *Oceans Act*

This Act provides for the promotion of knowledge of marine ecosystems, their conservation and the enforcement of a precautionary approach.

3.3. Acts Concerning Species that are Vulnerable, Threatened or at Risk

3.3.1. *Species at Risk Act*

The *Species at Risk Act* (SARA) was created to prevent the disappearance of wild species. The Act protects species at risk and their critical habitats. SARA also includes provisions to help manage species of special concern to keep them from becoming threatened, endangered or extinct. The COSEWIC recommends the species to be designated “at risk". The Federal Cabinet then decides if these species deserve protection under the *Species at Risk Act*. This decision is taken after stakeholders and other interested groups have been consulted.

Once a species is considered extinct, endangered or threatened and obtains protection under the *Species at Risk Act*, it becomes illegal to kill, harass, capture, or harm this species. Critical habitats are also protected against all forms of destruction. The Act, for all species on the list, provides for recovery strategies, specific action plans and management plans minimizing threats related to fishery. These various plans will be managed based on a strict schedule already set out in *the Species at Risk Act*.

3.3.2 *Loi sur les espèces menacées ou vulnérables du Québec*

The Government of Quebec has its own legislation with regard to threatened species, the *Loi sur les espèces menacées ou vulnérables*, which protects species in danger on its territory.

Moreover, projects that could affect aquatic habitats in Quebec are subject to the provisions of the *Loi sur la conservation et la mise en valeur de la faune* and the *Loi sur la qualité de l'environnement.*

The governments of Quebec and Canada are elaborating a cooperation agreement to avoid legislative duplication and clearly establish a strategic intervention framework with regard to the conservation of fishery resources in Quebec while respecting the respective government's fields of jurisdiction.

3.4. Canada's Oceans Strategy

This strategy stems from the *Oceans Act*. This is the government of Canada's policy statement on the management of oceans. It reaffirms its commitment to manage its oceans in agreement with other levels of government, Aboriginal associations, communities, businesses, non-governmental organizations, the academic world and the general population.

3.5. Sustainable Development

3.5.1. The Federal Sustainable Development Strategy

It provides guidance to the Department's actions according to four themes:

- new forms of governance and shared management,
- knowledge and technologies for sustainable development,
- sustainable activities,
- management aiming at progress and efficiency.

3.5.2. Sustainable Development and the Bio-Food Industry

Quebec, through its *Ministère de l'agriculture, des Pêcheries et de l'Alimentation*, has given itself the mission of influencing and supporting the expansion of the Quebec bio-food industry from a sustainable development viewpoint. As outlined in its strategic plan, the *ministère*'s economic aim is a balanced intervention that reconciles economic

development with societal values such as resource and environmental protection, regional development and food quality and safety.

As such, Quebec has an issuing and renewal policy for marine product processing licenses that falls within the framework of this mission. Its specific objective is the optimal use of the available fishery resource with respect for sustainable and regional development.

Sustainable development implies:

- resource durability,
- long-term business viability and profitability,
- job durability and stability.

Furthermore, in the context of the fishing industry, regional development primarily seeks benefits for the coastal communities in Quebec's maritime regions.

3.6. Policy Framework for the Management of Fisheries on Canada's Atlantic Coast

The Policy Framework for the Management of Fisheries on Canada's Atlantic Coast, submitted in March 2004, introduces four interrelated objectives:

- conservation of resources and marine habitats as well as rebuilding of resources and habitats as needed. Within the limits of available knowledge, any fishing activity will be managed while ensuring the sustainable use of resources;
- self-sustaining fisheries,
- access to fishery resources and a more steady and foreseeable distribution,
- shared stewardship. Participants will take active part in the fisheries management decision-making process at appropriate levels. They will bring specialized knowledge and experience and share responsibility for the results. The Framework takes a more inclusive approach to strategic planning by allowing resource users to play a greater role in operational decisions, by facilitating the participation of Aboriginal people in strategic planning and decision-making, and

by supporting the establishment of the resource users' capacity to take on new responsibilities.

3.7. Precautionary Approach

3.7.1. General Considerations

The *Oceans Act* reaffirms that Canada promotes the enforcement of the precautionary approach as it applies to the conservation, management and exploitation of marine resources aiming at protecting these resources and preserving the marine environment. This Act also includes a managerial philosophy based on the sustainability of ecosystems.

According to the Framework for the Application of Precaution in Science-based Decision Making About Risk, prepared by the government of Canada, "the application of 'precaution', 'the precautionary principle' or 'the precautionary approach' recognizes that the absence of full scientific certainty shall not be used as a reason for postponing decisions where there is a risk of serious or irreversible harm. The application of precaution is distinctive within science-based risk management and is characterized by three basic tenets: the need for a decision, a risk of serious or irreversible harm and a lack of full scientific certainty."

Management complying with the principles of the precautionary approach must carefully anticipate in order to avoid unacceptable or undesirable situations. It must consider that changes in fishing systems are slow to reverse, difficult to control, not very well understood and subject to evolution with relation to environment and human values.

The precautionary approach explicitly requires taking into account undesirable and potentially unsatisfactory results and defines plans to avoid or mitigate these results. Unsatisfactory results include the overexploitation of the resource, exaggerated development of harvesting capacity, loss of biodiversity, major disruption of sensitive habitats, and social or economic disorganization.

The precautionary approach involves:

- identifying long-term objectives, both biologic and socioeconomic, as a prerequisite to such an approach,

- establishing a decision process, including reference points (limits and targets), derived from an approved scientific procedure,
- taking into account uncertainties regarding stock status, the impact of fishing activities, and environmental, social and economic conditions,
- developing research and data acquisition programs.

3.7.2. Practical Considerations

In concrete terms, the precautionary approach requires the following elements:

- defining one (or more) limit reference point, which is the boundary beyond which severe damages to the considered stock are very likely,
- defining management targets, which are the objectives that need to be carried out through decision rules. These rules trigger actions allowing to prevent the stock from reaching the serious damage area or, if applicable, getting out of it,
- establishing decision and action rules, agreed in advance, that trigger when approaching thresholds or when they are reached. These rules must be determined in advance.

To be able to apply the precautionary approach to a given stock, the biological status of this stock should be assessed according to three "areas": the health area, the precautionary area and the critical area. These three areas represent regions where biological and ecosystemic considerations, on the one hand, and social and economical considerations, on the other hand, change in relative priority. Correspondingly, actions shall be different in each of these areas:

- health area – this is the situation desired for the stock. Decisions take into account both socioeconomic and biologic objectives. It is possible to allow an exploitation rate that is slightly higher in order to meet social or economical needs,
- precautionary area – if the assessment and follow-up indicate major changes in the chosen indicators (e.g. biomass decrease), priority is given to rectifying negative trends by reducing the exploitation rate if necessary. Alertness is raised to prevent the stock from reaching an "unacceptable" critical situation,

- critical area – this is the area where stock is in an "unacceptable situation." Biological conservation needs become a priority. In this area, mortality caused by directed fishery must be forbidden and maintained at the lowest level possible for bycatches caused by other fisheries and if these bycatches do not contribute to worsening the stock status in the critical area.

The limit reference point is consistent with the boundary between the precautionary and the critical areas. It is determined based on the best information available. Typically, this limit is expressed in terms of biological indicators: reproductive biomass, mortality rate, abundance or other productivity criteria (recruitment, growth rate, condition index, geographical distribution, age structure, etc.). The limit definition must go hand-in-hand with previously established corrective and rebuilding rules.

As part of a precautionary approach, potential negative risks must be clearly identified and steps must be specified in order to avoid these risks. It is also necessary to first establish a set of clear objectives that the recovery strategy will have to reach with a schedule allowing to assess the success of the strategy.

The technical tools allowing to reach the objectives are traditional management tools:

- definition of total allowable catches (TACs) and harvesting control,
- control over fishing effort (in absolute value, in time and in space),
- control over harvesting capacity,
- implementation of fishing seasons and closures of geographical areas.

As part of a precautionary approach, an effort is made to enhance the understanding and definition of essential or critical habitats (critical: reproduction, food, migration, etc.).

The above description is primarily focused on the protection of the exploited species' breeding capacity. Nevertheless, the precautionary approach was first suggested within the context of sustainable development, and theorists, as well as applied scientists, in sustainable development agree that the concept include at least four components: a bio-ecological component, an economical component, a social component and an institutional component. It is also admitted that, to increase the probabilities of reaching sustainable development, there must be a reasonable balance in the emphasis given to each

component. With this in mind, the Canada-Quebec Committee has devoted part of its work to ponder possible improvements from an institutional perspective (decision-making mechanism, data acquisition and interpretation, control and monitoring) rather than limiting itself to the bio-ecological aspect.

4. STOCK CONDITION

4.1. 4T-4Vn Stock (November to April)

4.1.1. Historical Background

Cod has been commercially exploited in the southern part of the Gulf at least since the 16th century. Landings, compiled since 1917, have varied between 20 000 and 40 000 t from 1917 to the mid-1940s. The introduction of otter trawls, but especially a spectacular increase in cod growth attributed to the availability of herring, then a victim of epizooty, has driven landings to over 100 000 t in 1958. Landings have then varied without any given trend between 40 000 and 70 000 t, except in the mid-1970s when they dropped to nearly 20 000 t. The collapse of the mid-1970s was short-lived and the stock recovered much faster than expected, which caused friction between fishers and fishery scientists at the end of the 1970s and early 1980s. In the 1980s, the share of fixed gear landings progressively eroded in favor of the mobile gear fleet. In the early 1990s, the vast majority of catches were carried out with mobile gear. Fishing was closed in 1993, a sentinel fishery of 3 000 t was authorized in 1998, and a TAC of 6 000 t was established in 1999. Directed fishery was closed in 2003, but was reopened in 2004 with a TAC of 3 000 t. In 2005, a TAC of 4000 t was established.

4.1.2. Resource Status – Biologists' Point of View

According to the stock status report 2005/007, no stock size indicators point to a major change in stock status. The sequential population analysis (SPA) shows a slight decrease in the reproductive biomass, but the first preliminary estimates for the 2002 age group suggest that it could be stronger than average. Reproductive biomass estimates go back to

1950. According to the assessment, the reproductive biomass almost doubled from about 250 000 t in 1950 to more than 400 000 t in 1956 before starting to decline irregularly on a twenty-year period to reach 75 000 t in the mid-1970s. The reproductive biomass then increased, very quickly at first and then more progressively, up to a peak of more than 350 000 t in 1986. The reproductive biomass then decreased just as fast and has stabilized around 80 000 t since 1992. The absence of stock recovery since the early 1990s is likely due to average or below average recruitment and to increased natural mortality compared with the 1970s and early 1980s. The exploitation rate has typically been equal to or lower than 10%, and most often below 5%, since the first moratorium in 1993.

4.1.3. Resource Status – Industry's Point of View

During consultations, the Committee observed that there exists a certain consensus on the currently low potential of this cod population. However, some fishing industry stakeholders consider that the biologists' vision is too pessimistic and that the stock could support higher harvesting rates. Others think that the biologists' vision is realistic and that the allocated TAC for 2005 may be too high.

Telephone surveys carried out after the fishing season indicate a progressive improvement of harvesting rates over the last few years.

4.1.4. Scientific Uncertainties

The cod stock assessment in the southern Gulf is one of the most reliable in North Atlantic, due in part to a reliable scientific survey. Unfortunately, logistical problems in 2003 have kept the bottom trawl survey from being completed and, in 2004, the survey was carried out on a different and ungraded ship, which increases the uncertainties as to the actual stock size and recruitment opportunities.

No false claims are believed to have been made on a large scale before the 1993 moratorium, but, as for the majority of the cod stocks in the Gulf, Newfoundland and eastern Cape Breton, it is feared that throw-backs might have been quite significant between 1988 and the 1993 moratorium (growth rates in NAFO's 4X and 5Z areas are higher and cod rapidly reaches commercial size, thus minimizing throw-back possibilities). A low cod growth rate (except at the end of the 1950s) in the southern part

of the Gulf, combined with the mesh size used in trawls, has almost always made throw-backs a problem. The assessment method used largely depends on the reliability of harvesting data. If the data is erroneous, the assessment results will also be erroneous.

Longline sentinel surveys began in 1995 whereas reliable and synoptic trawl sentinel surveys only began in 2003.

Southern Gulf cod is a good example of the interaction between stock migration and fleet behavior. From 1960, when the management unit was defined, to the mid-1980s, allocating cod catches in the 4Vn area from January to April to the southern Gulf stock seemed appropriate. However, beginning in the mid-1980s, more widespread migrations and changes in fleet behavior have caused catches in the 4Vn area from November and December to be allocated to the southern Gulf stock. For given years, northern 4Vs area catches were also attributed to this stock. Since fishing in the 4Vs area has remained closed since the early 1990s, interactions between the southern Laurentian Channel's adjacent stocks do not have the same implications as those supposedly in the northern part of the Laurentian Channel between the 3Ps and 3Pn4RS areas.

The structure of the southern Gulf cod stock cannot be accurately determined, but available data suggests the existence of a few possibly distinct reproductive units in the Shediac Valley and Magdalen Islands.

Cod has shown a high mortality rate after age three since the mid-1980s. Factors at issue are believed to be adverse environmental conditions (such as low temperatures and decrease in oxygen concentrations), poor fishing practices and increased predation by seals. However, analyzing seal diet shows that they mainly consume juveniles. Stomach content study could however underestimate the real consumption since seals also feed on "soft" portions of fish (stomach, liver, etc.), which do not appear in the alimentary bolus.

As opposed to the northern part of the Gulf, where capelin occupies an important place in cod diet, in the southern part of the Gulf, the diet is more diversified, made up of krill, shrimp, small fish, mostly herring, American plaice and capelin.

4.2. 3Pn4RS Stock

4.2.1. Historical Background

In the 1964-1985 period, landings were averaging 82 200 t. During this period, no annual landings recorded were lower than 65 000 t. Catches even reached a peak of more than 100 000 t in 1970 and in the early 1980s. These last peaks were followed by a rapid decrease that led to a three-year moratorium from 1994 to 1996.

Directed commercial fishery was reopened in 1997, with a modest TAC of 6 000 t. The TAC was raised and maintained at 7 000 t in 2000, 2001 and 2002 for landings of 6 834, 7 150 and 6 338 t, respectively. A second one-year moratorium was introduced in 2003. Commercial fishing was reopened in 2004 with a TAC of 3 500 t. In 2005, a TAC of 5000 t was established.

The harvesting activity profile has significantly changed since 1994. Before this date, mobile gear fleets conducted winter fisheries and were responsible for more than 60% of landings. Since 1997, the fishery is exclusively made up of fixed gear (gillnets, longlines and hand lines). Fishing essentially occurs during the summer and fall with monthly allocations distributing catches along the coast. These same fleets have been benefiting from an additional management tool, regional shares, since 2005. This management measure provides the industry with an additional adaptation to its harvesting plan and makes users more aware of their responsibility to respect the allocations.

4.2.2. Resource Status – Biologists' Point of View

According to data generated by biologists during the 2005 assessment (stock status report 2005/003), the total average biomass for the 1974-1985 period was in the order of 467 000 t, whereas it was down to only 50 000 t for the 1995-2005 period, which meant an average decrease of 89%. For these same periods, the average reproductive biomass is said to have gone down from 258 000 to 38 000 t, for an average decrease of 85%. The projected reproductive biomass for the beginning of 2005 was 38 500 t, which is relatively steady compared with 2004 (38 378 t), but an increase when compared with 2003 (24 900 t).

The 2005 projected estimate for recruitment at age three is the lowest of the historical series. It represents only 4% of the average recruitment value for the 1974-1985 period.

A 2000 recruitment workshop estimated that the recruitment rate (ratio between the number or recruits and the biomass that produced them) had increased since the early 1990s and that it could be considered good. It has nevertheless decreased since 2000.

Fish condition was considered poor between 1989 and 1994. It later improved and is currently at the level observed in the early 1980s.

Natural mortality was abnormally high at the end of the 1980s, around 34% per year (as opposed to a historical value of 18%). It seems to have returned to normal values since the early 2000s.

Fishing mortality was very high before the 1994 moratorium, well over the target value of 18% (54% and 53% for 1992 and 1993). After reopening in 1997, it varied around 20%. It was about 10% in 2004 (it should be noted that this exploitation rate is calculated on fully-recruited ages and that it is not the percentage annually removed from the biomass).

The geographical distribution has been modified since the end of the 1980s and during the 1990s. Cod stock of the 3Pn4RS area now migrates "sooner and farther." It was traditionally harvested in the northern part of the Gulf, all the way to the western part of Anticosti Island. In 1985, there were 2 748 t of cod landings in the Sept-Îles/Pointe-Parent area. These landings later dropped (437 t in 1990, 92 t in 1993) to become marginal (less than 20 t) after 1997. Currently, sentinel fisheries and scientific surveys show that cod is essentially concentrated on Newfoundland's west coast and that it is virtually absent in the Anticosti area. Recent marking data interpretation confirms this tendency. Biologists estimate that the population's reproductive components may have disappeared. Exchanges between the 3Pn and 3Ps areas seem to have intensified, which justified closing the fishery in Burgeo Bank's offshore area during the winter period.

4.2.3. Resource Status – Industry's Point of View

Even if the Committee has been able to observe that no one disputes the fact that the stock is in poor condition, many fishing industry stakeholders consider the biologists'

vision to be much too pessimistic. They think that, on the contrary, the stock is on the way to recovery. Arguments made in support of this perception are:

- catches by unit of effort (fishery performance) have been particularly high on all of Newfoundland's west coast and have even exceeded historical levels,
- the presence of high cod concentrations along the coast during the entire summer season (associated with very substantial catches in capelin traps),
- phone surveys carried out after the fishing season indicate a progressive improvement of stock status since the end of the 1990s.

Stakeholders also think that the assessment through analytical models underestimate the existing biomass in as much as it largely depends on scientific surveys that are not good at taking into account the coastal part of the distribution where a large part of this biomass is currently concentrated. The validity of the scientific survey is also questioned.

4.2.4. Scientific Uncertainties

Official landing statistics may not be consistent with real samplings. Many factors may have underestimated the catches in the period preceding the 1994 moratorium: high-grading of catches, selective throw-backs, false claims, underreporting, high number of bycatches in shrimp fisheries before the Nordmore separator grate was introduced (30% in number compared with official commercial fishing samplings), which could be translated into high levels of post-selection mortality.

The scientific assessment is still largely dependent on the summer scientific survey. This survey can estimate the biomass present in coastal waters, which can bias calculations. There was a change of research vessel in the early 1990s, which can again bias assessments. The research vessel's catchability issue is regularly raised. A new change of vessel expected in the near future could worsen the situation. However, the increasingly significant burden of sentinel fishing surveys in the assessment process could progressively reduce some of these uncertainties.

Winter migrations of northern Gulf cod in the 3Ps administrative division are always a factor complicating the assessment of both 3Pn4RS and 3Ps stocks. A workshop held in 2000 had concluded that the major part of harvested cod in winter in some 3Ps regions

(notably Burgeo Bank) came in reality from 3Pn4RS. Recent management measures (such as winter closure of fishing in the western part of 3Ps) have reduced the proportion of harvested Gulf cod in the area. Fishing mortality inflicted on stock outside 3Pn is still unknown. The intensity and extension of movements between the two areas should be better understood (current research projects by electronic telemetry).

There is no precise data on the northern Gulf cod population structure. Reproductive concentrations have regularly been observed by biologists offshore the Port au Port Peninsula, but information from fishers indicates that spawning can take place along Newfoundland's west coast. The current spatial distribution is believed to be responsible for reproductive component losses, but it could also be a distribution contraction caused by the low biomass rates observed.

Cod has shown a high mortality rate after age three, from the mid-1980s to the mid-1990s. Factors at issue are believed to be adverse environmental conditions (such as low temperatures and decrease in oxygen concentrations), poor fishing practices and increased predation by seals. However, seal diet analysis shows that they especially consume juveniles. Stomach content study could however underestimate the real consumption since seals also feed on "soft" portions of fish (stomach, liver, etc.), which do not appear in the alimentary bolus.

The natural mortality rate was reduced at a historical level in the analytical models used during the March 2005 assessment. Even if this decrease is supported by different scientific observations, it is unsure whether the rate considered in the assessment is consistent with reality, considering notably predation pressure by seals mentioned by both biologists and fishers.

Capelin is a very important forage species for cod. However, there is no precise data on biology, ecology and stock status in the Gulf of St. Lawrence. There is no indication of the potential impact of the current increase in capelin fishing on the stock itself or dependent stocks, such as cod. As a matter of fact, predator-prey relations as a whole remain misunderstood in the Gulf of St. Lawrence.

5. SITUATION CONCERNING THE *SPECIES AT RISK ACT*

In May 2003, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) revised the situation of Canadian cod populations.

The 4T-4Vn stock (November to April) was grouped, among others, with the 4VsW and 4X stocks in a "Maritimes population," whose status is deemed "of special concern."

The 3Pn4RS stock was grouped with the 3Ps stock in a "Northern Laurentian population." The Committee recommended placing this group on the "endangered" species list given the decrease in abundance, which the COSEWIC assesses at about 80% in the last thirty years. The threats to stock persistence identified are fishing, predation by fish and seals, and natural or fishing-induced environmental changes.

Stock aggregation used by the COSEWIC does not match biological units. The units used for fishery management are probably more relevant to species protection than arbitrary divisions used by the COSEWIC.

Stock definitions currently used for eastern Canadian cod have mainly been established at the end of the 1950s and early 1960s by the International Commission for the Northwest Atlantic Fisheries (ICNAF), predecessor of the Northwest Atlantic Fisheries Organization (NAFO). The ICNAF has taken into account a great number of meristic and morphometric factors, but the results of large-scale tagging campaigns have played a determining role. The COSEWIC had the possibility to use these definitions, to treat all eastern Atlantic coast cod as one population or to create its own arbitrary definitions. It chose the latter.

6. STOCK RECOVERY CONSTRAINTS

6.1. Constraints Related to Biology and Environment

6.1.1. Biological Constraints

Nordic stocks or stocks living in a cold environment are distinctly less productive than other stocks localized in more favorable environments. Cod from least productive stocks grow slowly, are harvested at an older age and become sexually mature at a lesser size

and age while producing fewer eggs. Their energetic condition is poorer and varies more than that of cod from the most productive stocks. Of all North Atlantic cod stocks, southern Gulf cod (except extinct 2GH stock) shows the lowest growth rates.

Environmental conditions progressively deteriorated at the end of the 1980s and have not been favorable to cod during the Northwest Atlantic moratorium. This region's stocks thus became even less productive and less able to resist or recover from disruption, whether natural or human. Total mortality is still very high. Fishing mortality, whatever the source (commercial fishing, "recreational" fishing, post selection mortality, etc.), may be minimal compared with natural mortality, but according to researchers, it nonetheless samples the major part of the "production surplus" necessary for biomass growth. It is clear that stocks are currently less productive than at the end of the 1970s and that they can no longer support comparable samplings.

Recruitment has remained low, in absolute value, for about ten years in the Gulf of St. Lawrence. This observation may be related to many factors:

- the spawning biomass is low, in absolute value, which limits the potential of breeding new individuals,
- the spawning biomass is not made up of enough old individuals, which are recognized as breeding more eggs with a better survival probability.

A document published by the FAO in 2001[2] draws connections between 50- to 70-year cycles of climate indicators and cycles of marine species. Thus, there are periods during which some species are privileged compared with other species. According to these studies, the next period favorable to northern Atlantic cod will come around year 2020. These hypotheses remain highly speculative, but the possibility that cod stock recovery may have to wait for cod conditions to become favorable again must be considered, and this could be long. These preliminary considerations suggest that cod stock recovery is subjected to a great number of factors and that it is impossible to predict with certainty the path these stocks will take over time.

[2] FAO, 2001. Climate change and long-term fluctuations of commercial catches: the possibility of forecasting, by L.B. Klyashtorin. FAO Fisheries Technical Paper No. 410. Rome. 86 pp, which is summarized at http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/y7300e/y7300e07.htm.

6.1.2. Environmental Constraints and Climatic Changes

The natural climatic variation had an impact in the past on the geographical distribution, migration and abundance of North Atlantic fish. The intense cold period that has marked Atlantic waters in the 1990s was undoubtedly a significant factor in the stock collapse: the poor condition of fish and poor survival rate of eggs and larva have very likely worsened the situation of populations subjected to intense exploitation. Logic sets similar responses in the future. It is possible to specify the reactions of some species to particular environmental dynamics despite the fact that North Atlantic dynamics are still unknown. Any consideration of marine ecosystem recovery in the Gulf of St. Lawrence must take into account the effects of the natural climatic variation and possible recent anthropogenic climatic change because they can influence the structure, operation and taxonomic composition of ecosystems, which are at the root of recovery. Despite the fact that it is possible to specify the reactions of certain species (such as capelin) to environmental changes, it is impossible to do so for most species and their interactions, and it is difficult to specify the climatic scenario on which to rely. Generally, recovery plans will not depend much on predictions of the influence of the climatic changes on the ecosystem, but these plans could have to be modified according to the inherent uncertainties of the climate, which is particularly true in this fast-changing era.

6.1.3. 4T4Vn Stock

As previously indicated, southern Gulf cod has experienced a spectacular recovery during the second half of the 1970s. The neighboring 4VsW stock has experienced a very similar evolution during the same period. In both cases, the rapid biomass increase seems to have been caused by the sharp increase of egg and larva survival rates, possibly related to the lack of predation by herring and mackerel, whose stocks had collapsed at the time. Currently, those two species, especially mackerel, are highly plentiful.

Natural mortality is higher than during the 1970s and first half of the 1980s. Reasons for this are not completely understood. Recent ecosystem analyses indicate that seals have replaced cod as the greatest consumer of fish at the top of the food chain. The high predation rate induced especially by grey seal populations, but also harp seal, is said to vary between 19 000 and 39 000 t per year, i.e. many times higher than fishing landings.

6.1.4. 3Pn4RS Stock

The likely loss of reproductive components in the population, due to the geographical distribution contraction observed, can limit stock breeding potential. The total mortality was very high until the 1994 moratorium due to a strong natural mortality and very high harvesting rate. Natural mortality is currently at a level considered "normal." Fishing mortality remained relatively high after the withdrawal of the moratorium and while it seems to have dropped recently, it remains relatively strong in relation to the stock's production capacity.

The mixing issue with 3Ps cod stock, essentially in the Burgoe Bank area but perhaps also farther, and the determination of stock structure for assessment purposes are still special concerns.

6.2. Constraints Related to Human Activity and Control

6.2.1. Harvesting Capacity

It is generally accepted that some fleets, and particularly those directed towards groundfish, are still too large, considering the resources available. Implementing adjustment mechanisms of their global exploitation capacity to ensure sustainable resource levels in the long term is imperative. With time, this flexibility will help to ensure the economic sustainability of fleets.

Today, it is generally recognized that there are simply not enough resources to meet the ever-growing needs in terms of employment, income and resource allocations. Many traditional fleets are simply too large for the resources available.

During the consultations carried out in Quebec by the Committee in June 2005, this harvesting overcapacity was recognized. The stakeholders set out the paradox showing that the capacity (ex. inactive licenses) has increased since the moratorium to the extent that numerous fishers have begun to fish cod to keep "historical shares."

6.2.2. Fishing Effort and Gear

Fishing gear remains an issue. Beyond controversy, the Committee believes that all fishing gear can harm stocks and the environment if used incorrectly or used in the wrong area or at the wrong time.

Some stakeholders question the competitive nature of inshore fishing that fosters a resource war that is not easily controllable. This resource war now constitutes a non-motivating and destabilizing element for users and communities wanting to be involved in the DFO's shared management approach.

6.2.3. Control and Monitoring

The majority of the harvesting industry considers the control of fishing activities to be expensive and little efficient.

6.2.4. Motivation and Adherence to Recovery Measures

The stakeholders interviewed by the Committee all showed definite weariness, if not frustration, regarding the different consultations. They strongly believe that the fishers' advice is not heard and that decisions are more political than rational. For example, a "black box" was implemented, while some associations had rather suggested an electronic logbook, or TACs were determined in 2005, which do not seem to take into account the consensus reached in the TAC establishment strategy, or temporary allocations were granted in other fisheries (shrimp and crab). The rigidity of management principles does not allow the necessary flexibility for fleet survival.

Fishers deal with more and more constraints, particularly the increasing control costs. They do not see where their advantage lies, especially to the extent where there is no guarantee of the survival of their enterprise in the short and medium term.

There is thus a generalized decrease in trust in the decision-making process. Any action towards stock recovery should restore the level of trust and ensure, as far as possible, the stability of fishing enterprises. The first approaches set out by the industry go through a decrease in departmental interventions. The minister should make some decisions

necessary to the success of the cod recovery plan, including regional shares, and decisions concerning TACs, but limit its interventions to these decisions.

6.3. Other Potential Constraints

Fisheries and Oceans Canada, in collaboration with Environment Canada, is currently assessing the factors and consequences associated with the potential registration of cod on the species-at-risk list and the subsequent requirement of the strategy and action plan development for this species' recovery under the *Species at Risk Act*.

The process under the *Species at Risk Act* is likely to spread over a longer period than the work of the Canada-Quebec Working Group regarding the cod recovery plan. However, the Committee's recovery strategy will represent an important contribution to the recovery plans required by the *Species at Risk Act*. That is why cod recovery strategies should (as far as possible) be compatible with the requirements of the Act.

For example, the recently published Eastern Canadian Waters Northern Wolffish and Spotted Wolffish Recovery Plan (2003) consists of an ongoing effort from the team charged with wolffish recovery in order to help the recovery of both endangered species. The plan presents some threats to wolfish recovery such as climatic changes, gas and oil exploration and offshore mining activities, earthquakes, throw-backs, military activities, cables and pipelines, and land-based marine pollution. The impacts of these activities on marine organisms in eastern Canadian waters are unknown.

Here is a summary of other threats to cod recovery (similar to those mentioned in the National Northern Wolffish and Spotted Wolffish Recovery Plan) to make the recovery initiative compatible with the requirements of the *Species at Risk Act*.

6.3.1. Oil and Gas Exploration

The increase in exploration and production of oil resources in eastern Canadian waters increases the risk of oil spills, offshore drilling blowouts, tanker content spills and other potential disasters. These accidents release petrochemicals, dissolved metals (toxic metal ingestion) and other solids in the ecosystem. Exposition to these pollutants and other potential pollutants can also directly cause the death or non-lethal deficiency of some

species, their preys and their ecosystems (such as growth retardation and less disease resistance).

Functional waste causes biological effects on relatively short periods and near the release point. Suffocation of benthic organisms by mud and cuttings deposits spread on a 0.5-km radius around the drilling rig. The use of water-based drilling mud at a reduced toxicity rate reduces the direct mortality rate of organisms, as well as the use of oil for lubrication and spotting fluid at a low toxicity rate. The impact area located around the drilling rig would vary in time, location and quantity released. The impacts would quickly cease once drilling stops. Mud, cuttings and hydrocarbons associated and dispersed are estimated to cause localized and non-lethal effects to some deep-ocean organisms. It is believed that it would be difficult to determine the net result of any impact at the population level because of the great spatial and temporal variability of natural populations and limits of current sampling methods. Any potential effect must be localized.

6.3.2. Seismic Activities

Eastern Canadian waters are subject to intense oil exploration. The oil and gas industry uses seismic research techniques that assess under-ocean geology to identify possible natural gas and oil resources. This implies using compressed air guns, cylinders filled with low-volume compressed air to pressure of about 2 000 psi. The series, which usually includes dozens of similar cylinders, is discharged repeatedly in order to produce pressure pulsation. If the potential to kill or harm many fish at different life stages is possible, the effect best demonstrated is the breakup of schools of fish and dispersal of individuals, which can have negative impacts on migrations and reproductive processes.

Impacts on fish and habitat due to seismic activity and other exploration methods used to search for offshore oil resources must be quantified. The impact these activities have on any of cod's life stages is unknown. There is some scientific uncertainty concerning the potential impacts of seismic activity on marine organisms in general.

This scientific uncertainty must be resolved. To this end, the petroleum and gas industry could be asked to contribute in order to be viewed as a partner in cod stock recovery rather than suspected of being one of its eternal disturbers.

The *Bureau d'audiences publiques sur l'environnement* filed a report in August 2004 addressing the issues linked to seismic surveys in the estuary and the Golf of the St. Lawrence. This document notably reports the lack of knowledge about the effect seismic surveys have on marine organisms.

6.3.3. Dumping at Sea

Effects of sewage sludge, fish waste and dredging on cod unknown, but they are likely to be minimal since most of these effects are localized and the affected area is very confined.

6.3.4. Military Activities

For many years now, military activities have been carried out in eastern Canadian waters. The impacts of these activities and their effects on fish and habitat are not well known.

6.3.5. Cables and Pipelines

The location of structures on or in water bed/column can affect cod habitat, although they take up a limited space and cod has a large geographical distribution.

6.3.6. Land-Based Marine Pollution

Any human activity with the potential of damaging cod habitat, no matter how small, must be identified, cleaned when necessary and preventive measures must be applied. Land-based pollution forms, including surface run-off that can contain a surplus of nutrients, sediments, pathogens, persistent toxins and oil, can cause changes in the ecosystem. The extent of the changes and their form depend on many factors, including the types of dissolved or suspended particles, such as non-biodegradable organic chemical products. These pollutants can have a detrimental effect on the reproductive capacities of cod, its prey and surrounding vegetation. They can also have an impact on their general health.

7. BASIC STOCK RECOVERY CONDITIONS

The discussion presented below does not consider the possibility that the environment's production potential varies in time. It assumes that the environment's reproductive potential is relatively steady and that by taking and applying good management measures, the stock will rebuild.

However, if the possibility of the environment's production capacity varying according to time for a given species is considered, it becomes difficult to set targets since during low production periods, it could be impossible to rebuild biomass to targets that are consistent with average or high production periods. During low productivity periods, exploiting stock to a fishing mortality similar (or not) to those average or higher productivity periods, with much lower harvesting rates, could be considered. The problem is identifying productivity periods, if they exist. It is to be noted that this stock productivity concept was examined in the joint proposal on TAC decision rules and that specific indicators have been identified and suggested.

Intuitively, a stock will be considered as recovered when presenting the characteristics generally encountered in a healthy stock. This mainly means the capacity to reproduce, regenerate and maintain itself while allowing optimum annual harvesting. Numerous elements determine the perception and progression rate towards recovery. A number of basic conditions are located at the heart of any recovery initiative, concurrently with adopting rebuilding targets or objectives. Thus, the basic conditions can be grouped in three major categories:

- abundance conditions,
- stock productivity conditions,
- conditions related to human activity and its control (fishing practices, management).

7.1. Stock Abundance Conditions

7.1.1. Total Biomass and Population Growth

In order for the stock to recover, there must be a production surplus allowing a biomass increase. A fish stock must show an ongoing growth of its total biomass to be considered on the way to recovering. If stock biomass and TACs are low, significant changes in total biomass will need to occur with a strong probability before considering increasing TACs. In order for the rebuilding process to continue, a significant biomass growth rate must be maintained during a certain period. This requires adopting biomass growth rate targets in time, minimal biomass threshold values or a growth percentage before reopening any fishery. There must also be a strong probability of sustained growth.

7.1.2. Spawning Biomass

A stock on the way to recovery, or recovered, must have a sustained reproductive potential. The spawning biomass must reach or exceed a critical size that will allow, with strong probability, the ongoing improvement of the total biomass and spawning biomass.

7.1.3. Recruitment

Annual recruitment determines stock size tendency, growth or decline, in relation to the annual sampling rate. It can be interpreted as stock replacement potential. The right annual recruitment (adding a sufficient number of young individuals and survival until maturity) is a necessary condition to stock recovery. Recruitment depends on the size of the spawning biomass and its reproductive potential, but also on other factors such as egg and larva survival (environmental conditions, food, predation, etc.).

7.2. Conditions Related to Stock Productivity

7.2.1. Reproductive Potential

It is now recognized that alone, the spawning biomass volume is not sufficient to estimate a stock's reproductive potential and thus its recovery potential. Other elements must be taken into account:

- the health of every reproductive component,

- a balanced proportion of the different ages of mature fish.

7.2.2. Geographical Distribution and Breeding Area

It would be preferable not to exploit a population reduced to a very low density on a portion of its historical distribution. Likewise, stocks should not be considered as recovered as long as spawning does not occur in the majority of spawning grounds and for a period near historical values.

7.2.3. Fish Condition and Individual Growth

Both the right individual growth and condition are important for healthy stock building. The body growth rate must be sufficiently high, and losses due to mortality sufficiently low, to foster an observable increase in biomass. Moreover, fish in good condition is likely to produce more eggs and of better quality. A stock made up of fish in good condition will have more chances of recovering. Conversely, fish condition can be a measure of recovery possibilities.

7.2.4. Habitat

While knowing that fish, at the beginning of its existence, is particularly exposed to a loss of habitat, fish of all age groups need quality habitat. Consequently, the integrity of the most essential habitats must be protected for fish of all age groups, especially those in spawning and breeding areas. Habitat must thus be protected, in terms of both quantity and quality. Participation processes must be established in order to agree on the need to protect habitat, taking into account traditional knowledge and scientific data, and efficient processes must be implemented to ensure compliance with habitat protection measures.

For Gulf cod populations, there is no precise data allowing characterizing their crucial habitats. However, it is often recognized that coastal areas, being the most productive, are areas favorable to young individuals. In an ecosystemic perspective, a precautionary approach would require the protection of these areas as a condition to rebuilding populations.

7.3. Conditions Related to Human Activities

7.3.1. Fishing Mortality Control

The sampling rate, of any activity, must be compatible with the resource's renewal rate. As part of the recovery strategy, fishing mortality should also foster a sustained stock growth until target values are reached within a predetermined period.

7.3.2. Minimizing Risk

Since little information is known on preconditions, triggers or mechanisms at the origin of stock recovery, the decision-making process must try to minimize the risk in the development of managerial measures and their implementation in order to maximize recovery chances.

7.3.3. Precautionary Framework and Predetermined Rules

A careful management framework attempting to avoid irreversible damages to fish population or avoid perpetuating low stock levels must be implemented. An agreement on decision and harvesting rules, including the resulting technical measures, must first be reached. This procedure should guarantee an ongoing commitment towards recovery and prevent new annual discussions.

7.3.4. Research and Monitoring

Ongoing research focused on recovery and a monitoring protocol must be implemented in order to extend the knowledge base necessary to the objectives pursued. It is important to define the most appropriate indicators to ensure this follow-up.

7.3.5. Enforcement and Control

All the necessary control and monitoring measures must be implemented to ensure good fishing practices that will prevent the destruction of the resource's recovery capacity.

Management decisions must take into account their potential impacts on the deployment of the fishing effort and the control possibilities.

In this regard, all the stakeholders interviewed by the Committee have said to be worried about the fact that opening fishery for short periods (a few days) result in a

disproportionate "resource war", which is difficult to control, particularly as part of a competitive fishery. This resource war is now a demotivating and destabilizing element for users and communities wanting to be involved in the DFO's shared management approach.

7.3.6. Adjusting Fishing Capacity

The reduction in the fishing capacity, to adjust to the breeding potential of stocks, and the restructuring of the fishing industry have been identified, by the majority of stakeholders, as important elements for the future of the industry. These adjustments appear to be an integral part of the basic conditions to cod stock recovery.

The industry must develop adaptation mechanisms of their global exploitation capacity in order to ensure sustainable resource levels in the long term. In time, this flexibility will help ensure the economic sustainability of fleets.

7.3.7. Restoring Trust

In the shared stewardship philosophy, fishers and organizations representing them should actively participate in the development, implementation and assessment of the stock recovery strategy.

They must participate in the processes of defining the rules of the precautionary approach, including the determination of reference points (limits and targets[3]), definition of policies and assessment of stock situation within the different "areas" specified in the precautionary approach.

Fishers' associations should play a major role in the implementation of a fishery focused on conservation:

- promotion and awareness of their members, notably for responsible fishing,
- development of a responsible fishing code (for example, see Gulf shrimp vessels, group B) in order to include the potential effects of fishery on habitat and other non-targeted species,

[3] Generally, the identification of limit points is considered to be a scientific responsibility and target choices are the shared responsibility of all stakeholders.

- implementation of code compliance measures for fishers,
- increased awareness to conservation by active participation in education and training programs[4].

One of the great roles of fishers' associations is now to develop fishing plans focused on conservation. These plans should include rules governing the use of gear, the protection of the resource and its renewal, the collection of data and reporting systems.

However, in order for this participation to be effective, it is imperative that fishers and their associations trust the process and know where their advantage lies. They must be involved and recognize that their advice is indeed taken into account.

Many conditions are necessary:

- the decisions or advice of various committees must be operational;
- equity must prevail: equity in conservation measures (one sole group or region must not bear the burden of stock recovery) and equity in resource sharing,
- the leadership must ensure some fishing stability so fishers have a minimum guarantee on the sustainability of their activities (knowing there will be little interest in adopting conservation principles if their future is not ensured).

7.4. A Sufficient Level of Knowledge

Some stakeholders interviewed by the Committee have said to be worried about the decreases in research budgets allocated to DFO's biologists as biological and environmental conditions in the Gulf of St. Lawrence are still not well known.

They believe fishers are not scientists and that research must be carried on.

It is important to maintain and reinforce research activities that can address the industry's concerns.

Mechanisms allowing to ensure a more active and concrete participation of the fishing industry must be implemented in the following areas:

[4] NB: The FAO has adopted a code of conduct for responsible fisheries. This code of conduct applies to all stakeholder interested in fishery management, including scientists, managers and NGO, not only fishers.

- knowledge acquisition,
- definition of research priorities.

8. TOWARDS A STOCK RECOVERY STRATEGY

The previous sections have reviewed the issues that cod stocks in the Gulf of St. Lawrence must face. Whatever the practices addressed in the scientific assessment, there is general agreement on the following elements:

- total biomasses and spawning biomasses are among the lowest in history (since the 1950s for southern Gulf stock and 1974 for northern Gulf stock),
- stocks now seem a lot less productive than they were from 1975 to 1985,
- recruitment is average or lower than average,
- limited geographical distribution in the case of 3Pn4RS stock.

It seems logical that the approach towards the recovery of these populations be to adopt measures offering the possibility of increasing stock size, reducing mortality, enhancing reproductive capacity and restoring geographical distribution as far as the current breeding conditions allow it. There are numerous scientific and environmental uncertainties. Serious social and economic issues are also raised since the implementation of limits and targets will have notable effects for the fishing industry. The participation of industry stakeholders in developing and approving appropriate and attainable objectives is of crucial importance for the success of stock recovery processes.

8.1. Indicators

8.1.1. Basic Principles

The situation of a stock and its progress towards recovery are assessed based on indicators, or parameters (spawning biomass (SSB), total biomass, age structure, recruitment, geographical distribution, etc.).

According to a basic principle, indicators should be simple, relevant and reliable. Many indicators should be used, as far as possible, to obtain a general view of the situation. All sources of information, and their reliability, must be taken into account.

The value of each parameter related to a recovery must be considered individually. The target and the desirable period to reach this target will have to be determined.

It is to be noted that to consider the stock as being recovered, a set of indicators chosen in advance will have to reach its own target values.

8.1.2. Choice of Indicators

During the Canada-Quebec Committee's consultations, many representatives interviewed said that a lot of work had been done to define the "decision rules for annual cod TAC establishment." The indicators developed result from a consensus between the different stakeholders (Department and fishers), and there is no reason to look for other indicators at this moment. The Committee thinks that these indicators should be used as a starting point as part of the recovery strategy. Work remains to be accomplished in order to implement a true precautionary approach that meets cod recovery objectives.

8.2. Biological Recovery Objectives

Stock rebuilding objectives consist of rebuilding spawning stock biomass and age structure, restoring stock components and geographical distribution and protecting cod habitats.

The TAC establishment strategies also give indications with regard to objectives.

During the Committee's consultations, stakeholders estimated that it was unrealistic to target high historical values. It seems more reasonable to target intermediate levels (e.g. 50% of historical average catch)

The tables presented in the appendix show a summary of scientific data on stock status and some directions concerning the rebuilding objectives. The long-term objectives must be finalized. This is sensitive work for the industry as it raises the issue of acceptable social and economic objectives as part of a more or less fast recovery strategy ("aggressive").

8.2.1. 4T4Vn Stock (November-April)

Biomass

At the 2002 National Workshop on gadidae reference points, almost all of the methods used for southern Gulf cod had an 80 000-ton reproductive biomass limit reference point.

The TAC establishment strategy suggests that the total biomass be higher than 185 000 t for the stock to be considered healthy.

Geographical Distribution

Southern Gulf cod has changed the extent of its migrations, and is scarcer along Gaspé's coasts during the summer.

One objective would be to restore the geographical distribution to a certain percentage of the historical value (e.g. 80%).

Age Structure

One objective would be to foster the survival of a certain percentage of old individuals in order to give a primary place to those spawners during low stock abundance periods. It is a well-known fact that egg quality and their survival rate significantly increase with the size of fish. Protecting this group of individuals should be the subject of particular focus in the recovery plan.

FRCC's conservation plan for this cod stock suggests that the existence of four (4) age groups of average abundance, or higher, within the population may constitute the objective of reestablishing an appropriate age structure for this stock and would serve as a stock rebuilding indicator. Although southern Gulf cod stock does not currently meet this criterion, it should be noted that the age structure does not show a major imbalance.

8.2.2. 3Pn4RS Stock

Spawning Stock Biomass

DFO biologists identified a short-term objective (85 000 to 110 000 t). During the 2002 Workshop on gadidae reference points, no precise estimate was possible since there is little data on the expected recruitment levels when the SSB is between 100 000 and

200 000 t, notably because the stock has quickly gone through this phase. Thus, it was concluded that as long as the stock is not well engaged in the 100 000 to 200 000-ton

range, it would be difficult to give a more precise estimate of the critical area's frontier biomass.

The average SSB from 1974 to 1985 was about 258 000 t while the current SSB is 38 000 t.

Considering the uncertainties surrounding the 4RS3Pn cod conservation limit, a reasonable SSB short-term objective would be just above 100 000 t.

An intermediate target between the current and historical level suggested for stakeholders echoes the suggested 100 000-t target.

Geographical Distribution

Fishers of 4RS3Pn divisions believe that this stock's geographical distribution has spread in the coastal area, in the last few years, and that the distribution is greater than in the 1980s (for example, fishers report unusual cod concentrations to the south of Anticosti Island). However, recent reports on stock status indicate that cod is increasingly aggregating in the 4R coastal area division and is thus more likely to be harvested by fixed gear.

The objective is thus to restore the entire stock distribution.

Age Structure

One objective would be to foster the survival of a certain percentage of old individuals in order to give a primary place to those spawners during low stock abundance periods. It is a well-known fact that egg quality and their survival rate significantly increase with the size of fish. Protecting this group of individuals should be the subject of particular focus in the recovery plan.

As for the northern Gulf stock, the existence of four (4) average abundance age groups or more in the population could form the objective of restoring an appropriate age structure for this stock and would be used as an indicator of stock rebuilding.

The assessment carried out in 2005 reports a strong abundance of old individuals. However, this encouraging information is tempered by the low recruitment level. This structure may not be maintained in the medium term.

8.3. Social and Economic Objectives

The basic objective is the one given by the Atlantic Canadian Fishery Strategy, i.e. building an economically viable fishery.

There is an agreement to consider that stock wealth is much lower than what it has been in the past. This implies deciding what the fishery will be in the long term. For example, there are two extreme positions:

- maintaining the current fishing capacity, with the pressure that it implies, and accepting slow recovery with low TACs over a long period,
- rebuilding the harvesting industry to adapt it to stock production with the associated social and economic costs,

During the Committee's consultations, stakeholders insisted on the strong dependence of several sectors of Quebec's fishing fleet on cod and groundfish in general. To ensure a minimum of economic activity, they estimated that a fishery should be maintained. They were therefore unanimous in considering a slower recovery, allowing a moderate harvesting rate.

The Department and the industry must build on this slow-progress period in order to resolve the problems than can interfere with the measures taken (such as impacts of fishery in the 3Ps division compared with recovery effort of the 3Pn4RS area).

A long-term objective of about 50 % of the long-term landing history seems an acceptable target for part of Quebec's industry.

9. AN AGENDA FOR ACTION

A cod stock recovery plan must be established as a set of actions that are to be implemented simultaneously. The failure of any of these actions can compromise the entire plan. The chosen action categories must favour, among others, increases in biomass and stock productivity.

It must be emphasized that important actions to increase biomass are already recognized:

- Nordmore separator grate mandatory in shrimp fishery; by significantly limiting bycatches of small fish, this measure fosters recruitment while preventing throw-backs of sub-legal sizes,
- a voluntary reduction in the fishing effort, by reducing the number of nets per fishing license; this measure is likely to limit harvesting volumes and thus slow down fishing mortality,
- a very conservative TAC, which protected a significant portion of the spawning biomass,
- the use of a selective gear in terms of fish size; the gillnet only samples one category of individuals and individuals exceeding the selection size become less and less vulnerable to harvesting; this effect, coupled with the TAC, fosters the retention of a large spawner biomass.

A good majority of the industry agrees with these conservation measures.

In "Groundfish Conservation Framework for Atlantic Canada" (FRCC.97.R.3), the FRCC has already defined a basis for the definition of courses of action.

9.1. Restoring Stock Abundance

To successfully manage a fishery, the key objective is to limit the impact of the fishery on the resource. The direct pressure of fishing on stocks must be controlled in order to adapt the exploitation rate to the natural growth rate of stocks and to its reproductive capability. When choosing target exploitation rates, the uncertainty margin regarding the status of the resource and future trends must be taken into account. Adopting a careful approach to the depleted stocks requires establishing exploitation rates that allow them to recover. For example, it is now recognized that the F0.1 strategy does not guarantee that stocks will be able to maintain themselves and certainly not recover when depleted. The poorer the information base, the greater the uncertainty margin, and an even more careful approach to the establishment of TACs must be adopted.

9.1.1. Total Allowable Catches (TAC)

The TAC must be adjusted according to the biomass and objectives. For two of the cod stocks studied, theoretically, no directed fishery should occur as long as the spawning biomass is considered as being in the critical area.

According to the consultations that were held, the strategy must foresee that TAC-related decision rules be used as a starting point.

9.1.2. Fishing Effort Control

The goal is not only to control "how many" fish are harvested, but also "how" they are harvested.

The basic mechanism is the limitation of the number of gears, their size and their characteristic. Only fishing gear presenting predetermined characteristics, which foster conservation, should be authorized.

In the framework of a cod stock recovery objective, the Committee collected several comments to the effect that mobile gear for groundfish, considered potentially harmful to critical habitats, should, at a minimum, be reserved for areas and period in which their impact will be limited.

Also to be considered are the improvement of dockside monitoring and the broadening of observer programs in fisheries where cod bycatch is an issue and in directed cod fishery when (and where) small-fish harvesting is likely to be high.

The recently implemented measures to control gillnet use (ex: labelling, reduced number of nets) are viewed as a positive factor. These measures must now be maintained and reinforced. Moreover, the number of nets per exits should be maintained at the lowest possible level, in accordance with the viability of the exploitation (limit of bycatches in other fisheries).

It remains obvious that controlling the fishing effort will only be truly efficient when the fishing capacity is appropriate for the resource's potential. The industry will have to carry on its rebuilding measures in order to reduce excess harvesting.

9.1.3. Bycatch Limit in Other Fisheries

Cod bycatches can be high in some fisheries. The use of gillnets in various fisheries can lead to a significant amount of cod catches during certain seasons. Lost gillnets may continue to harvest ("ghost fishing"). To limit these "unaccounted" deaths, many measures will have to be maintained or implemented:

- systematic implementation of "test fisheries" to assess the cod bycatch rate before opening other directed fisheries such as halibut and plaice,
- strict measure enforcement on cod bycatch such as maximum bycatches and closure of directed fisheries when maximums are reached,
- implementation of protocols for protecting juveniles and bycatch limits as a condition allowing to maintain licenses for many fisheries,
- mandatory use of Nordmore grates for any shrimp fishing to reduce or minimize groundfish bycatch,
- use of recognized selectivity mechanisms by fishing vessels using otter trawls when harvesting other fish species,
- implementation of an abandoned gillnet reporting and labeling program.

According to the stakeholders, the mixing issue with the 3Ps area must be resolved.

9.1.4. Protecting Young Fish

Generally, the protection of juveniles is accepted since they represent the biomass of future reproduction. Fishing gear must be designed to avoid catching juveniles as far as possible.

The existing measures to protect young fish in the Integrated Fisheries Management Plan (IFMP), such as minimum mesh size, minimum hook size, minimum fish size and small fish protocols, must continue to be applied. Moreover, the DFO and the industry should periodically review the relevance of minimum limits concerning hooks and mesh size as well as areas where minimum mesh sizes are applied in order to ensure the integrity of restrictions relating to gear with reference to small fish protocol objectives. Where there are high concentrations of juveniles (small fish), solutions such as the increased used of

sea observers should be intensified accordingly. Finally, when juvenile concentrations are known, strict measures such as the closure of areas and closing periods should be considered. When determining and applying closing periods or closure of areas is impossible, the DFO and the industry should consider developing a protocol providing for the closure of defined areas (boxes) in the management area at given periods during which young fish is concentrated. These areas could be reopened after experimental fishery.

9.2. Fostering Stock Productivity

9.2.1. Fostering Reproductive Potential

The reproductive potential is guaranteed, on the one hand, by the existence of a sufficient spawning biomass and, on the other hand, by the diversified age structure. Other factors can stimulate reproduction, such as protecting breeding concentrations in order not to disrupt the spawning process. The basic principle of "letting fish reproduce at least once" remains valid.

According to the majority of stakeholders, the implementation of a conservative TAC remains the most important measure.

The establishment of selective harvesting methods must be reinforced. For fixed gear (gillnets and hooks), a minimum size, to protect the smallest individuals, but also a maximum size must be considered in order to allow large spawners to survive among the population. This maximum size aims at avoiding the exploitation of a cohort during its life and its "pursuit" throughout growth.

Closed areas and periods represent the main fishery management tool used to protect spawning grounds, spawning aggregations and stock sub-elements. Area closure, in some cases, can be applied to any type of gear and fishery while in other cases, it can apply to a type of gear, fishery or fisher (such as non-resident). For example, in the northern Gulf, groundfish fishing is closed in St. George's Bay and Port au Port Bay in the 4R division on a seasonal basis.

Area closure does not constitute, in the majority of cases, a constraining measure of the exploitation rate since it often compensates for an effort increase outside the closed area and outside the closing period. However, it limits the disruption of the spawning process and can avoid the destruction of the most sensitive habitats.

9.2.2. Protecting Genetic Diversity

The genetic diversity of a fish population can be revealed by the existence of different spawner groups or sub-stocks whose behavior is different or which show different biological or physical characteristics. This diversity allows this population to protect themselves from unexpected changes in the environment. In other words, diversity contributes to sustainability. Each spawner component must be preserved in as strict a manner as if it was a distinct stock, and each stock's geographical distribution must be maintained, notably not to overexploit local sub-stocks.

Many measures can reach this objective:

- the implementation of a conservative TAC allowing the biomass to rebuild should help maintain diversity or recolonization of deserted areas,
- effort control on reproductive concentrations,
- seasonal closure of areas, and quotas spread in time and space.

9.2.3. Reducing Seal Populations

It is generally supported by the fishing industry that unless the issue of cod predation by harp seal and grey seal in the Gulf is resolved, and until it is, the chances of success of a cod stock recovery plan, both in the southern and northern parts of the Gulf, are almost nil. Also, the industry is willing to follow a plan regarding cod as long as it relies on an aggressive and parallel plan to reduce cod predation by seals. Moreover, industry representatives agreed that the only way to reach this objective is to reduce the size of the seal population residing in the Gulf of St. Lawrence.

It is often assumed that the reduction in the number of seals will cause a decrease in cod consumption and an increase in cod abundance. This hypothesis seams logical, at least in the short term. A strong decrease in predation by seals for commercial-size cod would

immediately increase the size of the spawning stock. Moreover, a decrease in prerecruit predation could offer an appropriate relief in the short term to allow more recruits to contribute to the spawning stock. However, other results are possible, in particular in the long term. The number of cods consumed by seals, or their weight, depends not only on the abundance of cod and seals, but also on the geographical distribution, cod concentration and availability of other prey for seals. The complexity of the food web and the fact that humans have a rudimentary understanding of its dynamic make it difficult to assess any advantage specific to the decrease in seal abundance that could be beneficial for cod. For example, the decrease in seal herds in the southern part of the Gulf could have a reverse effect to the one expected if it caused an increase in herring and mackerel, which are known predators of larva and juvenile cods.

It is desirable that a more in-depth study be carried out with regard to what effect seal populations, especially the grey seal, have on cod.

Some of the potential measures suggested to reduce the impact of predation on cod include:

- increasing total allowable catches of harp seals above the 350 000 animals maximum per year to reduce the population,
- implementing additional measures to try to keep seals at a distance from areas where cod is grouped,
- Allowing seal hunters to kill all seals near cod concentrations and all seals located in traditional cod concentration areas would be considered “harmful.”

9.2.4. Protecting Prey Populations

Southern Gulf cod has quite a diversified diet and it is impossible to identify a limited number of prey that should be protected in order to foster cod recovery.

In the northern part of the Gulf, members of the industry are convinced that, if seal herd reduction is associated with the success of the cod stock recovery plan, the same applies to the protection of cod prey. Particularly, northern Gulf capelin stocks are considered as the main factor stimulating the rebuilding of cod stocks. Therefore, this cod plan depends on a renewed information policy on capelin stock status in the region, the level of

dependency of cod on capelin during its biological cycle and the conservation of a strong capelin stock in the northern part of the Gulf of St. Lawrence.

Capelin fishing should be limited in the Gulf of St. Lawrence.

9.2.5. Protecting Habitats

The following measures are consistent with the usual measures:

- limiting activities that could jeopardize habitats,
- applying techniques to reduce the negative impact of harvesting on fishing grounds and habitats,
- closing particularly sensitive areas to any potentially harmful activities.

During the consultations, certain representatives indicated that the creation of a protected coastal area must be considered in concrete terms. Activities that are potentially harmful to the environment should be forbidden in an area that is 15 to 20 nautical miles wide. They also stated that hydrocarbon exploration and exploitation activities needs to be severely limited, if not forbidden, at least until stocks are recovered.

9.3. Reducing Fishing Capacity

It remains obvious that controlling the fishing effort can only be truly effective if the fishing capacity is in line with the resource's potential. The industry must pursue its rebuilding actions in order to reduce the fishing overcapacity, while ensuring that the results of this exercise will not lead to a reduction in Quebec's ability to compete in Atlantic fisheries.

A voluntary rationalization program should be introduced on a regional basis and be coupled with fiscal modifications (exemption of capital gain, for example) in order to encourage fishers who want to withdraw. Fishers' associations should be involved in such a program's definition to ensure that it effectively meets the fishing capacity reduction objectives.

In the same vein, it is hoped that the processing industry will adapt its capacity to the resource and harvesting potential.

10. SHARED STEWARDSHIP

10.1. General Approach

Shared stewardship means that fishery participants must be actively involved in the fishery management decision-making process at appropriate levels and ultimately share the responsibility of results.

Fishers, processing firms and other stakeholders have played, during the last ten years, an increasingly important role in the fishery management process. Stakeholders are an integral part of daily fishery management through their participation in the integrated activity and program management plan such as the establishment of annual fishing plans focused on conservation, the sea observer program, the dockside monitoring program and the sentinel fishery program.

Also, under the fiduciary obligations with regard to Aboriginals stemming from various rulings made by the Supreme Court and the Constitution, consultations on the shared management of fisheries management measures must include the concerned Aboriginal communities. These communities will be able to assess if shared management complies with their rights and can decide on their degree of involvement.

The Policy Framework for the Management of Fisheries on Canada's Atlantic Coast recognizes that the move towards shared management will evolve, out of necessity, and that the process will evolve in the long term. Many believe that the participation of stakeholders directly involved in the exploitation of stocks will occur during the current fishery management processes. However, the Department will give operators greater decisional authority in some fields as their capacity to take on additional management responsibilities increases and they show their commitment to sustainability. The adoption of an approach inclusive of the development of policies in which individuals who are not operators would have the possibility of participating in the development of policies dealing with fisheries is also suggested.

A number of "shared stewardship" initiatives were undertaken in the Gulf of St. Lawrence during the last few years. Sentinel fishery programs in the 3Pn4Rs and 4T divisions actively involve fishers and their associations in the scientific process and contribute to a better understanding between the industry and the research community. There are also many "co-management" agreements in shrimp and snow crab fisheries. Snow crab agreements can be found in the St. Lawrence Estuary (area 17), north of Magdalen Islands (area F) and west of Cape Breton (area 19). In any case, these agreements provide for TAC-sharing rules, participation of fishers in the research process (experimental fisheries) and participation of fishers in TAC-related decisions.

As for stocks in the Gulf of St. Lawrence, this shared management could include participation in:

- stock status definition rules,
- TAC establishment rules,
- the establishment, implementation and evaluation of scientific projects focused on groundfish fishing.

Different shared management models are conceivable, such as the coastal fishery councils suggested for western Newfoundland and fishers' cooperative approaches, such as the one developing on the Lower North Shore. These councils would have decisional power on precise operations relating to regional issues such as harvesting, bycatches and enforcement, and would reinforce (and not replace) the DFO's capacity to foster a sustainable fishery.

Apart from formal agreements with the Department of Fisheries and Oceans (such as co-management agreements), shared stewardship also involves some form of industry self-regulation such as:

- voluntary restraint of fishing effort,
- self-control over quality and quantity of catches,
- *Etc.*

During the Committee's consultations, one stakeholder suggested that fishers could be more involved in the control and monitoring of activities, which would increase efficiency and reduce costs.

There will have to be a short-term assessment of ways fishers, processors and other stakeholders concerned will play their shared management role during the current fishery management process. Similarly, the industry and the other stakeholders concerned will have to be consulted on the advantages and potential obstacles related to the (long-term) enforcement of a shared management model, such as coastal fishery councils.

10.2. Fostering Shared Management

A series of actions should be undertaken to foster the participation of the industry and the success of a shared management approach:

- pursuing the implementation of regional shares within competitive fisheries for all species of groundfish. This would allow the "appropriation of the resource" and promote regional conservation initiatives,
- ensuring some stability to fishing enterprises. The temporary allocation systems should be revised to this effect. Considering the low groundfish TACs, we should focus on more multi-species fisheries than we currently do. More flexible management methods (e.g. allowing mobile gear quotas fishing by fixed gear) would also fulfill this end,
- in collaboration with fishers' associations, implementing a license buy-back system allowing fishers to retire "with decency and dignity".

In compliance with the Policy Framework for the Management of Fisheries on Canada's Atlantic Coast, we need to ensure that stakeholders have the technical, human and financial ability to be actively involved in a shared stewardship approach.

11. SCIENTIFIC RESEARCH

Scientific knowledge is needed to understand population development. It should help grasp changes and guide management decision-making.

The stakeholders interviewed by the Committee have insisted on the need for biologists dedicated to fisheries.

Research should thus be granted guaranteed financing.

The work in progress should be continued, insisting on the following elements:

- population structure and mixing of stocks,
- reproductive potential of cod,
- predator-prey relationships and definition of indicators,
- better knowledge of the biophysical environment and relationship between this environment and cod stocks,
- definition of crucial habitats,
- definition of protected areas and determining their effect on cod populations.

The relationship between the DFO and the different stakeholders must be strengthened and links of trust must be forged (or restored). To do so, management and Science must implement a communication strategy to explain and enhance understanding of the measures taken. This strategy would address the transparency purposes required from the general public. To this effect, scientists must proceed with the popularization approach of their work and results.

12. CONCLUSION

In the framework of a recovery strategy, stakeholders consider the following elements to be crucial:

- the implementation of a voluntary rationalization program, defined on a regional basis and coupled with appropriate fiscal measures,
- the introduction of regional groundfish shares.

A cod stock recovery plan must be developed as a set of measures that must be implemented simultaneously. The failure of one of these measures may jeopardize the overall plan.

One category of measures aims at promoting biomass growth and stock productivity. The tools at our disposal remain the "traditional" management tools:

- production control: TAC, quotas and allocations per fishing enterprise,
- control over means of production: licenses, permits and fishing effort (vessels and gear),
- associated technical measures: selectivity, area closure and seasons.

It would be wise to consider additional tools, such as the implementation of a "protected coastal area" to protect these productive areas from harmful activities.

Still, the resource and ecosystem cannot be managed. What is managed is a human economic activity. Participation in and compliance with the recovery plan by stakeholders are prerequisite conditions to the success of the plan. This means restoring trust:

- between the Department and the industry,
- between stakeholders (fishing industry, provinces, etc.).

It is also necessary that stakeholders, especially fishers, find their interest in conservation measures and judge for themselves the progress accomplished.

To this effect, pursuing the implementation of regional groundfish shares is a step in this direction. They should allow the "appropriation" of the resource and promote decentralized and participatory management methods.

However, management and conservation principles must be harmonized between the different "regions" (this notion still needs to be defined) in order to ensure a minimum of consistency in measures and avoid that a group, or many, bear the conservation burden alone. An umbrella committee should be responsible for tracking action plans and will be responsible for the results. During the Committee's consultations, several shareholders suggested that the Gulf Groundfish Advisory Committee could play this role.

On a regional level, different stakeholders can work at defining and tracking the action plans:

- fishers, through their associations, to head captain;
- communities and other regional authorities, whose role is not to be neglected, for example, in habitat protection. In this regard, the initiatives undertaken as part of Aboriginal fisheries could serve as a starting model,
- groups or associations interested in the marine industry, such as ZIP committees. Some of these groups have already been involved in fisheries as intermediaries in conflict resolution, for example.

The Department of Fisheries and Oceans will also have to keep its place within the process notably by implementing management methods that facilitate these new approaches, providing the knowledge necessary and acting as "ultimate adjudicator" in the interest of all Canadians.

For its part, the Government of Quebec ensures that existing and future policies issued by the federal government respect skill sharing, are adapted to Quebec's particularities and ensure equal sharing of the resource between the provinces.

The Government of Quebec also ensures that its own fishing industry support policies and programs are part of the context dictated by the state of the resource during its recovery.

Moreover, from Quebec's point of view, its intervention model and institutions must be taken into consideration by the federal government in the framework of its own policies and must be defended by the latter in international forums as during position-taking in the context of international business negotiations.

APPENDICES

STOCK CHARACTERISTIC SYNTHESIS – 4T4Vn

Criteria	Indicator	Maximum since 1971	Average 1971-1985	Current value	Comments	Global measure
Abundance	Total biomass (tons)	473 622 (1986)	248 546	96 458	Biomass values stem from analytical models (SPA) and are still controversial. According to these models, no significant biomass changes were made in the last four years. Biologists report a SSB value of about 80 000 t as conservation limit value. The TAC establishment strategy provides a critical value between 70 000 t and 90 000 t.	-
	Spawning biomass (SSB) (tons)	353 845 (1986)	173 986	66 387 (2004)		-
	Recruitment (1 000 individuals aged 3)	322 350 (1983)	137 214	64 620 (2004)	The recruitment level remains very low. The 2001 and, particularly, 2002 classes are more significant than the previous ones.	-
Stock productivity	Weight at age 6 (kg) Commercial fishing	1.79 (1977)	1.36	0.93 (2004)	The condition of fish remains lower than for the historical period. It is considered average.	+/-
	Length at age 6 (cm)	59.2 (1978)	53.17	46.6		+/-
	% maturity at age 5				No information.	?
	Age structure of population (% aged 10-15)	5.72 (2002)	1.10	3.53	This high value is a positive sign. However, this percentage is biased by the low abundance of young individuals. The age structure remains unbalanced. The accumulation of old individuals is stimulated by low exploitation rates.	+/-
	Breeding period and site					?
	Geographical distribution				Scientific surveys indicate that cod can especially be found in the eastern part of the Gulf. It is little prevalent in Chaleur Bay and the Gaspé Peninsula.	+/-
	Predators/prey				Predation by seals remains very high.	?

	Critical habitats				Shediac Valley is known to be an area of abundant juvenile cods.	**?**
Fishery/ Management	Landings (tons)	69 317 (1972)	53 703	2 281 (2004)	Catches have been largely limited by TAC since 1999.	
	Exploitation rate (aged 7+)	53 (1992)	34.77	4 (2004)	Fishing mortality was very high before the 1993 moratorium and higher than the usual target value (18%). It has remained below 10% since 1998.	**+**
	Catch per unit effort				Standardized rates and sentinel fisheries have indicated no tendency towards an increase since 1999. The fishers surveyed by telephone indicate that catches have improved.	**+/-**
	Management concerns				The low TAC and short fishing season make management mechanisms complex and little efficient. The use of mobile gear is still controversial.	**-**

STOCK CHARACTERISTIC SYNTHESIS – 3Pn4RS

Criteria	Indicator	Maximum since 1974	Average 1974-1985	Current value	Comments	Global measure
Abundance	Total biomass (tons)	602 643 (1983)	467 787	54 434 (2005)	Biomass values stem from analytical models (SPA) and are still controversial.	**-**
	Spawning biomass (SSB) (tons)	378 045 (1983)	257 869	38 501 (2005)	According to these models, no significant biomass changes were made since 1997. Biologists report a SSB value between 85 000 t and 110 000 t as conservation limit value. The FRCC reported a short-term target value of 90 000 t (aged 5+). The spawning biomass should be higher than 200 000 t in order to significantly increase the likelihood of good recruitment.	**-**
	Recruitment (1 000 individuals aged 3)	206 003 (1980)	116 647	9 595 (2004)	The recruitment level remains very low. There has not been any strong age group since 1993.	**-**

Stock productivity	Weight at age 6 (kg) Commercial fishing	1.75 (1999)	1.44	1.62 (2004)	Values indicate that fish is currently in good condition.	+
	Length at age 6 (cm)	56.85 (1976)	53.97	55.56 (2004)		+
	% maturity at age 5	91 (1998)	49	40 (2004)	The maturity gap with younger individuals in the 1990s is interpreted as a stress index. Recent data indicates a return to historical values.	+
	Age structure of population (% aged 10-13)	6 (2004)	1.5	6	This high value is a positive sign. However, this percentage is biased by the low abundance of young individuals. The age structure remains unbalanced.	+/-
	Breeding period and site				Concentrations are known off St. George's Bay (4R). Cod seems to reproduce along Newfoundland's west coast over a longer period than before.	?
	Geographical distribution				Currently, fish is essentially concentrated in the 4R area. Winter migration towards the 3Ps area has apparently increased in the last decade. The migratory pattern has changed during the 1990s (migrate sooner and farther). Spawning components may have disappeared. *The stock will not be considered entirely recovered as long as cod is not sufficiently present to the northwest of Anticosti Island.*	-
	Predators/prey				Predation by seals remains very high. The effect of capelin fishing is subject to questioning.	?
	Critical habitats				No information.	?
Fishery/ Management	Landings (tons)	106 080 (1983)	86 412	3 112	Catches have been largely limited by TACs since 1997.	
	Exploitation rate (aged 7 to 10)	54 (1992)	34	9	Fishing mortality was very high before the 1994 moratorium and higher than the usual target value (18%). It got close again to the target value beginning in 1997 (around 20% between 1997 and 2002).	+
	Catch per unit effort				Harvesting rates of sentinel fisheries with fixed gear (gillnets and longline) have multiplied by more than two since 1995. The geographical distribution of catches has also improved.	+

	Management concerns				The use of gillnets remains controversial.	**?**

CANADA/QUEBEC
COD STOCK RECOVERY COMMITTEE
Stocks 4T4Vn and 3Pn4RS

SUMMARY OF RECOMMENDATIONS

1 –Considerations

The cod stock recovery strategy involves an integrated approach in which the concerned stakeholders take part in the different steps of the strategy and the decision-making process.

The strategy should be seen as a set of simultaneously implemented actions. The failure of any of these actions may compromise the entire plan.

The recovery strategy should be part of the Precautionary Approach principles.

The criteria defined for the TAC determination rules are a starting point in this process. Moreover, considering the uncertainties, no precise target was proposed. However, historical levels do not seem very realistic. Intermediary levels can be considered.

The measures to adopt should aim to:

- - increase stock size,
- - reduce mortality,
- - increase reproductive capacity,
- - restore geographic distribution.
- Increasing scientific knowledge is an important foundation for stock recovery.

2 – Toward an Action Plan

The action plan is based on a series of broad objectives.

2.1 – Rebuild Stock Abundance

- Define TACs that favour a continuous increase in the biomasses.
- Control the fishing effort to maintain it a level that is compatible with stock productivity. It is important to ensure that the harvesting capacity is in line with the resource's potential.

Moreover, only gear with the pre-established features that favour conservation should be authorized.

- Limit bycatches in other fisheries (test fisheries, bycatch limits and closure of directed fishing when limits are reached, protocols to protect juveniles and bycatch limits, use of recognized selectivity mechanisms, program to label gillnets).
- Protect young fish (gear selectivity, heightened monitoring of the concentrations, area closures).

2.2 – Favour Stock Productivity

- Favour the reproductive potential (gear selectivity, closure of spawning grounds – including Saint-George's Bay/Port-au-Port Bay in division 4R).
- Protect genetic diversity (seasonal/geographic TAC, area closures).
- Restore geographic distribution (with a possible target: 80% of the historical distribution).
- Reduce seal populations (increased TAC, measures to keep seals away from cod concentrations).
- Adopt a cautious approach when developing capelin fishing in the northern Gulf.

2.3. – Protect Habitats

- Limit activities that could compromise habitat quality.
- Apply techniques to reduce the negative impact harvesting has on fishing areas and habitats.
- Close especially sensitive areas to all potentially harmful activities.
- Limit, if not forbid, hydrocarbon prospecting and exploitation activities, at least until the stocks recover.
- Foresee the creation of a 10 to 15 mile "protected coastal area", closed to all potentially harmful activities.

2.4 – Reduce Harvesting Capacity

- Continue with the industry's downsizing.
- Create a volunteer capacity reduction plan associated with fiscal adaptations.

3 - Shared Management

3.1 – General Approach

- Heightened stakeholder participation in the decision-making process:
    - In the stock status definition rules,

- In the TAC determination rules,
- In the elaboration, implementation and evaluation of scientific projects that focus on groundfish fishing.

- Develop new shared stewardship formulas. For example:

  - Coastal fishery committees,
  - Industry self-regulating and self-controlling mechanisms.

- The following stakeholders can take part in shared management:

  - Fishers through their association, to head captain,
  - Communities and other regional bodies.

3.2 – Favour Shared Stewardship

The Committee firmly believes that in order for a recovery strategy to succeed, fishers must be part of the process. Here are several important points:

- Restore trust between the stakeholders and the DFO,
- Provide fishing businesses with a certain stability,
- Adopt an efficient voluntary program to reduce harvesting capacity,
- Introduce regional shares permitting stabilized access, decentralized management, adhesion to conservation and increased accountability,
- Give more local responsibility,
- More flexibility in the management system,
- Ensure that the stakeholders have the technical, human and financial ability to be actively involved in a shared stewardship approach,
- Implement a voluntary fleet downsizing program.

4 – Increase Scientific Knowledge

- We need biologists who are devoted to fisheries. DFO's research capacity needs to be improved.
- Stakeholders need to be more involved in the scientific process.
- Research should receive guaranteed funding.
- Work in progress should be continued.
- Important issues need to be addressed, with adequate funding
  - Population structure and stock mixing,
  - Cod's reproductive potential,
  - Predator-prey relationships and definition of indicators,

- Better knowledge of the biophysical environment and the relationship between this environment and cod stocks,
- Definition of crucial habitats,
- Definition of protected areas and determination of their effect on cod populations.

- The transfer of scientific information to a greater public needs improvement.