Canada

Government of Newfoundland and Labrador

A Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador

Canada-Newfoundland and Labrador
Action Team for Cod Recovery
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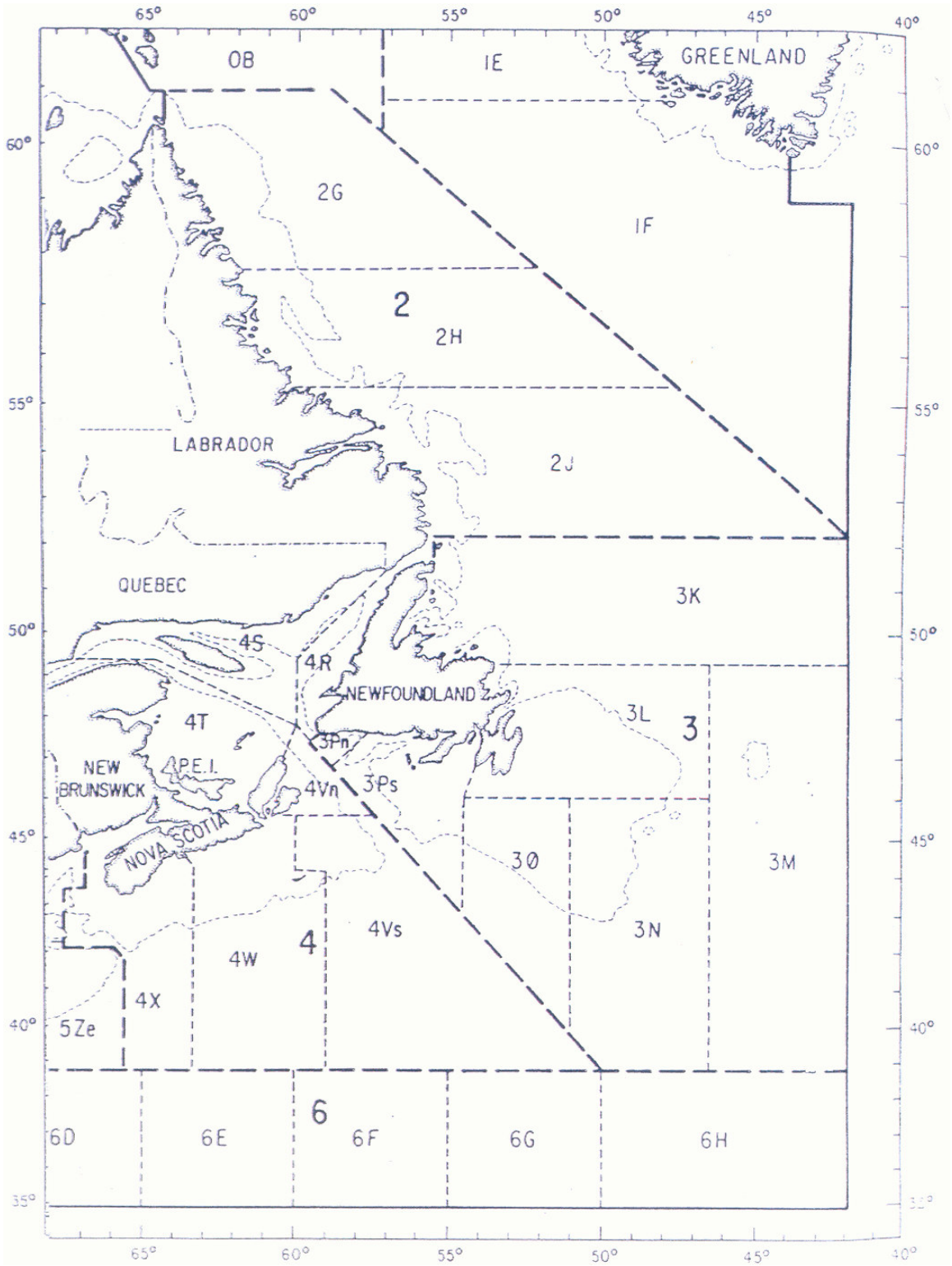
Boundaries of the NAFO Convention Area



1. Introduction

1.1 Perspective

The four cod stocks adjacent to Newfoundland and Labrador have been critically important to the economy, history and culture of the province. During the 1980s, the northern Labrador (2GH), southern Labrador - east Newfoundland (2J3KL), southern Newfoundland (3Ps) and northern Gulf (4RS3Pn) cod stocks provided in excess of 300,000t of fish per year to the province's fishing industry. In so doing, they provided a livelihood for thousands of industry workers, as well as an economic base for hundreds of communities and businesses in Newfoundland and Labrador.

Most cod stocks in the Newfoundland and Labrador Region declined dramatically during the 1960s and 1970s as a result of overfishing by distant-water fleets from Europe. Declaration of the Canadian 200 nautical mile Exclusive Fishery Zone in 1977 resulted in the recovery of some stocks during the 1980s. The intent was to fish these stocks conservatively so as to promote stock growth, but it is clear that fishing mortality was higher than intended during this period.

Extended cold periods from the mid-1980s to the mid-1990s, and especially the severe conditions of the early 1990s, contributed to slower individual growth, lower recruitment, poorer body condition, higher mortality and altered distribution patterns in cod stocks throughout the Newfoundland and Labrador area. In addition, capelin, the major prey for cod off eastern Newfoundland, experienced many changes that clearly were not caused by fishing. High fishing mortality, unfavourable environmental conditions and an increase in predation subsequently resulted in a second collapse that has been, for many stocks, more severe and persistent than the first.

In the early 1990s, almost all cod fisheries in Newfoundland and Labrador were placed under moratoria due to severe resource declines. At the onset of the moratoria, there were high expectations that these stocks would recover quickly. By 1997, only the 3Ps cod stock had recovered to a level which could support a small commercial fishery. The growth in this stock was not matched by a comparable increase in any of the region's other stocks. A partial recovery of the 4RS3Pn and 2J3KL stocks resulted in the re-opening of limited commercial/index fisheries in these areas in 1997 and 1998.

The fishery in northern Labrador (2GH) was not officially closed to direct commercial fishing until 1996. But landings from the area declined to less than 1,000t during the latter half of the 1980s and no commercial catches were taken from this area after 1991.

Commercial and index fisheries continued on the 3Ps, 2J3KL, and the 4RS3Pn cod stocks throughout the 1998 to 2002 period. The quota in 3Ps stood at 15,000t in 2002, but the quotas for 4RS3Pn and 2J3KL cod were only 7,000t and 5,600t, respectively.

In 2003, the northern cod and northern Gulf cod fisheries were once again placed under moratoria. Scientific assessments indicated that these stocks were at historically low levels and showed no signs of imminent recovery. The fishery in Divisions 4RS3Pn re-opened with a small quota of 3,500t in 2004. The TAC in this area was increased to 5,000t in 2005, but the 2J3KL cod fishery remains closed.

1.2 Bilateral Cod Recovery Action Teams

The Government of Canada and the Government of Newfoundland and Labrador formed the Canada-Newfoundland and Labrador (NL) Action Team for Cod Recovery in August 2003. This Action Team was mandated to develop a stock recovery and long-term management strategy for the four major cod stocks adjacent to the province of Newfoundland and Labrador. The Action Team was a joint initiative between Fisheries and Oceans Canada (DFO) and the Newfoundland and Labrador Department of Fisheries and Aquaculture (DFA), as well as the chair in Fisheries Conservation at Memorial University of Newfoundland and Labrador.

The Canada-NL Action Team for Cod Recovery represents one of three federal-provincial Action Teams which were established to develop cod recovery strategies for cod stocks in Atlantic Canada and Quebec. A Canada-Quebec Action Team was formed in September 2003 and a Canada-Maritimes Action Team was created in October 2003. These Action Teams have similar mandates to that of the Canada-NL Action Team and were formed to ensure that an integrated approach for cod stock recovery was developed for stocks that span provincial boundaries.

1.3 Mandate

The Canada-NL Action Team for Cod Recovery is mandated to prepare a strategy that will contribute to the rebuilding and management of the 2GH, 2J3KL, 3Ps and 4RS3Pn cod stocks. The Action Team's mandate does not include the internationally managed southern Grand Banks cod stock in Division 3NO.

The Action Team's Terms of Reference (Annex 1) further stipulates that in developing a recovery strategy, the Team will work to:

- build an understanding on the current status of cod stocks adjacent to Newfoundland and Labrador;

- increase cooperation between the two levels of government, the fishing industry, Aboriginal organizations, communities, universities, environmental groups and other appropriate individuals in the identification and implementation of conservation management measures to rebuild these stocks; and

- identify and evaluate current science priorities and information with respect to the management of these stocks.

The Canada-NL Action Team is not mandated to provide recommendations to the Minister of Fisheries and Oceans on cod stock management or annual Total Allowable Catch (TAC) levels. Likewise, the Action Team is not mandated to address access or historical share issues within the Atlantic fishery or to undertake new scientific research. However, the cod recovery strategy will be used to guide the future management of these stocks.

In establishing the above mandate, it is recognized that the complexity and interaction of biological and environmental factors involved makes the conditions for the recovery of these stocks (and the timeframe over which such recovery might occur) impossible to predict. In light of this, the Action Team's efforts are intended to enhance the prospects for the recovery of these stocks over the long-term.

1.4 Consultation Process

In recognition of the need for a more collaborative approach on this issue, the Action Team initiated a broadly-based consultation process as part of the cod recovery initiative. In January 2004, the Action Team established an External Advisory Committee (EAC) consisting of sixteen (16) representatives of the fishing industry, the community, Aboriginal interests, Memorial University of Newfoundland and Labrador and other appropriate groups. This Committee provided advice and guidance to the Team and acted as a "sounding board" in the identification and implementation of stock recovery measures.

In February 2005, the Action Team also initiated a public consultation process to promote discussion and solicit a broader range of input on key cod recovery issues. These issues are summarized in the Action Team's consultation paper – *Towards a Cod Recovery Strategy – Some Essential Factors and Considerations.*

The first phase of the Action Team's consultation process consisted of a two-day workshop which was held in February 2005. This Workshop included approximately 100 participants from government, industry, Aboriginal groups, development associations, academia, and the Canada-Quebec and Canada-Maritimes Action Teams on Cod Recovery. A summary of the discussion and views received during this Workshop is available in the *Workshop on Cod Recovery - Summary Report.*

During the second phase of the consultation process, the Action Team conducted a series of "town hall" meetings. Meetings were held in: Grand Falls-Windsor, Bonavista, Marystown, Clarenville, St. John's, Goose Bay, L'Anse au Clair and Port-aux-Basques in March 2005.

1.5 Report Structure

This report represents the Action Team's Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador. The report consists of seven chapters and is organized as follows:

- Chapter two provides information and context on the ongoing activities regarding the *Species at Risk Act* which (although separate from the Action Team's mandate) may have implications for the cod recovery strategy.

- Chapter three provides an historical overview and a synopsis on the current status of the 2GH, 2J3KL, 4RS3Pn and 3Ps cod stocks and chapter four provides a general overview on potential factors which are believed to have impeded cod stock recovery to date.

- Chapter five outlines the goals and objectives for the Action Team's Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador.

- Chapter six details the Strategy itself and the recommended action plans which are intended to contribute to the recovery of these stocks over the longer-term. A summary of the strategy is provided in chapter seven.

2. Species At Risk Act

2.1 Overview

The *Species at Risk Act* (SARA) was proclaimed in 2003, but did not fully come into force until June 2004. The main objectives of the SARA legislation are to prevent wildlife species from becoming extinct, to provide for recovery of species which are at risk as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened. The Minister of the Environment and the Minister of Fisheries and Oceans are responsible for the administration of SARA.

2.2 COSEWIC - Species Assessment

In January 2004, the Minister of the Environment was presented with assessments on 115 species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) - of which 91 species (including four Atlantic cod populations) were assessed as being at risk.

The COSEWIC cod population assessments were not based on the management units normally applied to cod in Newfoundland and Labrador waters. Instead, the northern Labrador (2GH), southern Labrador - east Newfoundland (2J3KL) and southern Grand Bank (3NO) cod stocks were grouped into a "Newfoundland and Labrador" population and the northern Gulf (4RS3Pn) and southern Newfoundland (3Ps) cod stocks were grouped into a "Laurentian North" population.

COSEWIC recommended that the Newfoundland and Labrador population be designated as endangered and the Laurentian North population be designated as threatened. If these populations are added to the List of Wildlife Species At Risk (Schedule 1 of SARA), recovery strategies and action plans must be prepared. Recovery strategies must be completed within one year if a population is listed as endangered and two years if a population is listed as threatened.

In the event that a species/population is listed under SARA, the Minister of Fisheries and Oceans may issue a permit to allow for incidental harm in the period prior to the development of a recovery strategy. In October 2004, Allowable Harm Assessments were conducted by DFO for the Newfoundland and Labrador and Laurentian North cod populations. These scientific evaluations were carried out to identify potential sources of harm and to determine the level of incidental harm, if any, that would not jeopardize the survival or recovery of cod in both populations. It was concluded that, continuance of 2004 fishing practices in 2J3KL and 4RS3Pn would not jeopardize survival or recovery over the one-to-two year permitting period should the populations be listed. In the case of 2GH cod, it was concluded that there is insufficient information to know what level of human-induced mortality would jeopardize the stock; however, there is no evidence that current practices have caused any recent decline in the stock. The Allowable Harm Assessment for Laurentian North Cod also determined that the 3Ps cod stock is considered to be recovered, and should be managed under conventional fisheries management practices.

2.3 Listing Process

In April 2004, the Minister of the Environment announced that the COSEWIC assessments for the 12 aquatic species designated as being at risk (including the Newfoundland and Labrador and Laurentian North cod populations) would go through an extended consultation period before being transmitted to the Governor in Council (GIC). Listing of these species could have significant and widespread impacts on the activities of aboriginal peoples, commercial and recreational fishers, farmers and Canadians at large. Given this, stakeholders need to be clearly advised of the potential impacts of listing and provided with an opportunity to advise government of their opinions - including ways to protect the species and help them recover. Consultations with affected parties are particularly important for species whose listing could have significant social and economic impacts.

Consultations on the Atlantic cod populations were conducted by Fisheries and Oceans Canada in the fall of 2004. These consultations allowed those who could be affected by a potential listing to convey their concerns and to provide information on how they may be impacted. In September 2005, DFO also held targeted consultations with industry stakeholders and the provincial Department of Fisheries and Aquaculture to assist in the determination of the social and economic impact of cod being listed under SARA. Social, economic and biological concerns will now be considered in the Minister of Fisheries and Oceans' recommendation to the federal Environment Minister, who in turn will make a final recommendation to the GIC on listing these populations under SARA. The Government of Canada's listing recommendation will then be published in Canada Gazette for a specified period of time to allow for further public input. It is anticipated that a final decision on listing Atlantic cod (and several other aquatic species) under SARA will likely not be made until the winter/spring of 2006.

2.4 Implications

The Canada-NL cod recovery initiative is not directly linked to the ongoing listing process being conducted on Atlantic cod. However, in developing the recovery strategy, the Action Team was mandated to consider the endangered/threatened species designations for Atlantic cod by COSEWIC and any requirements of SARA, if these stocks are listed.

It is anticipated that the Canada-NL Action Team's recovery strategy will inform the on-going deliberations by the Minister of Fisheries and Oceans with regards to the designation of Atlantic cod under SARA. If these populations are added to the List of Wildlife Species at Risk, the Action Team's recovery strategy would provide the basis for the subsequent development of recovery strategies and action plans within the required one or two-year time periods. In the event these populations are not listed, the strategy will be used to guide the recovery and management of these stocks. Both levels of government remain committed to and recognize the importance of the long-term recovery of cod stocks adjacent to the province of Newfoundland and Labrador, irrespective of any decisions which are taken with regards to the listing of Atlantic cod under SARA.

3. Status of Cod Stocks

3.1 Overview

This chapter provides a brief historical overview of each of these cod stocks as well as information on the current status and outlook for the stock in question. This information was derived from the 2005 DFO Science Advisory Reports and represents a highly summarized version of the most recent scientific information available on these stocks.

Industry views on the biological status of certain cod stocks are not consistent with the DFO Science Advisory Reports. Consultations by the Action Team have confirmed that the disconnect between government and industry is most pronounced in the case of the northern Gulf cod stock and, to a lesser extent, the inshore component of the southern Labrador - east Newfoundland cod stock. Given this, the chapter also attempts to capture key industry views on stock status and highlight where those views differ from the DFO Science Advisory Reports.

The chapter concludes with a summary and a commentary of the Action Team's views on this issue.

3.2 Northern Labrador Cod - 2GH

- **Historical Overview**

The cod of northern Labrador were at one time considered as part of the Labrador - east Newfoundland (2GHJ3KL) stock complex. They have been considered separately for management purposes since the early 1970s - in part because the impact of fisheries in the 1960s was more severe in this area than in the south.

Annual landings from this stock were relatively low (under 5,000t) prior to the mid-1960s, but increased dramatically to the 60-90,000t range over the 1965-1969 period due to a pulse of fishing effort by distant-water fleets. Landings declined to less than 5,000t in most years during the 1970s and early 1980s and to less than 1,000t during the latter half of the 1980s. No commercial catches were taken from this area after 1991.

The quota in the 2GH area was set at 20,000t in 1974 and remained at this level until 1993 when it was reduced to 1,000t. The reduction in landings throughout the 1980s was due to the low availability of fish and not quota restrictions. This stock was officially closed to directed commercial fishing in 1996.

- **Current Status**

Little is known about the historical or recent trends in the biomass of this stock and, in fact, it is not clear that the stock is a discrete unit. Most of the fish caught in this area may have come from the most northern portion of the 2J3KL cod stock. There have been no attempts

since the early 1970s to use landings data to estimate the biomass of fish in the area. Likewise, research surveys are not very informative because coverage has been infrequent and generally not at the appropriate season and depth. No significant catches were obtained during research surveys in this area over the 1996 to 2001 period.

- **Outlook**

The biomass of this stock is not known, but is thought to be extremely low. In the absence of information specific to the stock, it is suspected that the circumstances are similar to those in the northern, offshore portion of 2J3KL. Because the cod off Labrador and eastern Newfoundland declined from north to south, it is speculated that any rebuilding will occur from south to north. That is, recovery of cod in the inshore and offshore areas of 2GH should not be expected until recovery is well under way in the northern parts of the 2J3KL stock.

3.3 Southern Labrador-East Newfoundland Cod - 2J3KL

- **Historical Overview**

Landings from this stock increased throughout the 18th and 19th centuries to about 300,000t during the early decades of the 20th century. As distant-water vessels began fishing this stock in the 1950s, total landings rose to a peak of 810,000t in 1968. Thereafter, landings plummeted to 140,000t by 1978. After extension of jurisdiction in 1977, catches rose to around 240,000t during the early 1980s. The stock declined later in that decade and, in July 1992, a moratorium was declared on directed fishing.

In 1998, a small fishery (with a TAC of 4,000t) was reopened for inshore vessels. The TAC was increased to 9,000t in 1999 but lowered to 5,600t by 2001-2002. Initially, good catch rates were experienced in many areas, but in succeeding years, these catches (and good catch rates) became increasingly concentrated in only a few areas. In the spring of 2003, this stock was again closed to both directed commercial and recreational fishing. This closure remains in effect.

- **Current Status**

The total biomass of this stock stood at approximately three million tonnes in the early 1960s, but declined to 500,000t by the late 1970s. The biomass subsequently increased to about one million tonnes by the mid-1980s, but collapsed during the late 1980s and early 1990s. The total spawning stock biomass (SSB) declined from approximately 1.5 million tonnes in 1962 to only 125,000t by 1977. The SSB was about 400,000-500,000t during most of the 1980s, but declined rapidly after 1988.

This stock is comprised of both offshore and inshore populations. The spawning stock in offshore areas declined to a very low level by the mid-1990s. For the past decade, it has been at about 1-2% of the level during the 1980s.

The various inshore populations (or aggregations) appear to have been more productive than offshore populations since the early 1990s. It was these inshore populations that were exploited by the small directed fishery during 1998-2002. Localised inshore aggregations now occur mainly from southern Bonavista Bay to western Trinity Bay, but also as far north as White Bay and as far south as St. Mary's Bay. The largest and densest of these aggregations occurs in Smith Sound (Trinity Bay) during winter.

A sequential population analysis (SPA) for the central portion of the inshore area (southern 3K and northern 3L) indicates that the SSB increased during the moratorium to a peak in 1998. The SSB declined during the period of the re-opened inshore fishery (1998-2002), but has increased again since the closure in 2003. Nevertheless, the level in 2005 remains well below the peak in 1998. The SPA estimate of the SSB in the central portion of the inshore at the beginning of 2005 is just 13,000t. Other information indicates that the SSB might be higher, but less than 20,000t.

- **Outlook**

The overall biomass of this cod stock is considered extremely low. The biomass continued to decline after imposition of the moratorium in 1992, and has not improved to any noticeable degree since the low point in the mid-1990s. Offshore populations, which historically comprised most of the stock, are characterized by small, young fish that are broadly distributed at very low density. These populations are not increasing because of very low recruitment and high mortality. Inshore populations, which historically were small compared with the offshore, migrating populations, have been more successful since the early 1990s. They have a relatively good size and age structure, form dense aggregations at times, can be seen in shallow water, and can yield high catch rates in some areas. Nevertheless, the inshore biomass is very small compared to historical levels of the stock as a whole.

3.4 Southern Newfoundland Cod - 3Ps

- **Historical Overview**

Landings from this stock were in excess of 50,000t up to the early 1970s - with substantial catches by non-Canadian fleets. After extension of jurisdiction in 1977, landings declined to around 30,000t until the mid-1980s. French fishing effort on this stock increased in the mid-1980s and total landings peaked at 59,000t in 1987. Landings then declined steadily to 36,000t by 1992. A moratorium was imposed on this stock in August 1993.

In 1997, the fishery was reopened with a quota of 10,000t. The quota increased to 20,000t in 1998 and to 30,000t in 1999. Thereafter, the quota was reduced to 20,000t in 2000 (when a new April 1 to March 31 management year was introduced) and 15,000t in 2001. The TAC for this stock has remained at the 15,000t level since the 2001 management year.

- **Current Status**

Recent assessments on this stock have considered several model formulations, of which two have been reported. The results from the various formulations are characterized by similar trends in biomass, recruitment and exploitation, but different absolute estimates of stock size. The numbers presented below come from one specific model formulation.

The total and spawning stock biomasses of this stock declined from the late 1950s to the extension of jurisdiction. The total biomass then increased from about 120,000t in 1977 to 250,000t in 1985. It declined to about 70,000t by 1993-94, but then increased to about 140,000t by 1998-1999. In the past few years there has been a decline to just above 100,000t.

The SSB rose from less than 40,000t in 1977, peaked at almost 120,000t by 1985, and it then declined to about 40,000t in the early 1990s. It subsequently rebounded to just over 110,000t by 1998-1999, but has since declined to about 80,000t. Cod in 3Ps have been maturing at a younger age since the early 1990s, and in 2002-2004 the SSB comprised an unusually high percentage of smaller/younger individuals as the relatively strong 1997 and 1998 year-classes matured. There was concern that this implied a lowered reproductive potential, because younger spawners are less effective at producing eggs.

The 3Ps stock has produced mostly weak year-classes for the past 15 years. However, spawner potential (when measured by SSB of cod of ages 7 and older) has been relatively high since about 1996. The reason for the decrease in reproductive success is unknown.

Landings from the commercial fishery over the 1997 to 2000 period halted the rapid growth seen during the moratorium. Production was sustained in recent years by the relatively strong 1997 and 1998 year-classes, but is now declining. Recruitment has been poor since 1998, and the stock is expected to continue to decline unless strong year-classes are produced soon (or catches are considerably reduced). The age structure of this stock has improved, but it is not quite as extended as it was historically.

- **Outlook**

Since the 1990s, conditions have been much more positive for the 3Ps cod stock than for the other three cod stocks adjacent to Newfoundland and Labrador. Despite this, the stock is now smaller than it was at the time the fishery re-opened in 1997. Natural mortality does not seem to be unusually high but fishing mortality remains high in some areas, especially Placentia Bay. The growth of individual fish has been relatively good recently, but average recruitment remains well below the levels experienced in the 1970s and 1980s. The age structure of the stock is still somewhat contracted. Since 1997, the fishery supported by this stock has been at about 50 percent of the long-term average. Current catch levels are unlikely to be sustainable in the long-term unless recruitment improves.

3.5 Northern Gulf Cod - 4RS3Pn

- **Historical Overview**

Landings from this stock averaged approximately 82,000t over the 1964 to 1985 period and peaked at more than 100,000t in 1983. Thereafter, landings declined rapidly up to 1993. A moratorium was imposed on this stock in 1994 and remained in place until 1996.

In 1997, a small fishery (with a modest TAC of 6,000t) was opened for inshore vessels using fixed gears. The TAC was reduced to 3,000t in 1998, but increased to 7,500t in 1999. The quota was reduced slightly to 7,000t in 2000 and remained at this level up to 2003 when a second moratorium was imposed. The fishery reopened in 2004 with a small quota of 3,500t. The TAC was increased to 5,000t in 2005.

Harvesting activity has changed significantly in this stock area since the first moratorium was imposed in 1994. Prior to this, mobile gear fleets conducted winter fisheries and were responsible for more than 60% of total landings. Since 1997, the fishery has been prosecuted exclusively with fixed gear (gillnets, longlines and hand lines). Fishing occurs primarily in the summer and fall with monthly allocations distributing catches along the coast.

- **Current Status**

The average total biomass for this stock was in the order of 467,000t during the 1974 to 1985 period. The biomass increased from about 300,000t in 1974 and peaked at about 603,000t in 1983. Thereafter, it steadily declined to only 26,000t by the time the moratorium was imposed in 1994. The biomass improved over the 1995 to 2005 period, and averaged about 50,000t during this time. The total biomass was estimated at approximately 54,000t in 2005.

The average SSB for this stock was approximately 250,000t during the 1974 to 1985 period. The SSB peaked at 378,000t in 1983 and then steadily declined to only 9,000t by 1994. The SSB improved over the 1995 to 2005 period and averaged approximately 38,000t during this time. The SSB stood at approximately 39,000t at the beginning of 2005.

- **Outlook**

The status of this stock has improved since the first moratorium was imposed in 1994. However, stock abundance, recruitment levels and the SSB continue to be well below the levels experienced during the 1974 to 1985 period. Fishing mortality is believed to have been high at the 7,000t to 7,500t TAC levels in place over the 1999 to 2002 period. Cod in this stock experienced an elevated natural mortality rate from the mid-1980s to the late 1990s, but this has returned to normal levels since the early 2000s. Condition and growth

have improved in recent years, and are currently at a level not observed since the early 1980s.

3.6 Industry Views

Industry views on the status of the northern Labrador, the offshore component of the southern Labrador - east Newfoundland and the southern Newfoundland cod stocks appear to be generally consistent with the DFO Science Advisory Reports. However, such is not the case with the northern Gulf or the inshore component of the 2J3KL cod stocks.

- **Northern Gulf Cod – 4RS3Pn**

Harvesters in 4RS3Pn strongly hold the view that this stock is in significantly better shape than indicated by the scientific assessments. Harvesters believe that the assessment results are much too pessimistic. Industry arguments which have been put forth in support of the view that this stock is on the way to recovery include:

- catch rates in the commercial fishery have been particularly high along the southwest and west coast of Newfoundland in recent years and have often exceeded historical levels;

- catch rates in sentinel fisheries have been high and high by-catch rates have been experienced in other fisheries over a large portion of the 4RS3Pn area in recent years;

- industry telephone surveys of fixed gear licence holders indicate a progressive improvement in stock status since the end of the 1990s;

- high concentrations of cod have been observed during the whole summer along coastal areas in Division 4R and Subdivision 3Pn;

- fish condition and growth have improved in recent years and is currently at a level not observed since the early 1980s; and

- natural mortality rates have returned to normal levels in recent years.

Fish harvesters have also expressed strong reservations with the analytical approaches currently used in the assessment of this stock. They believe that this stock has experienced improved recruitment in recent years which is not reflected in the scientific assessments. They further believe that the analytical models underestimate the existing biomass because they are largely dependent on scientific surveys which do not fully account for the distribution of fish in coastal areas - where a large part of the biomass is currently concentrated. They also question the validity of the scientific surveys in terms of timing, consistency, location, etc.

- **Southern Labrador - East Newfoundland Cod – 2J3KL (Inshore Component)**

Most industry stakeholders in 2J3KL believe that the inshore component of the southern Labrador – east Newfoundland cod stock is in better shape than indicated by the scientific assessments. Industry arguments which have been put forward in support of this view include:

- the significant and growing aggregations of cod in the Bonavista Bay and Trinity Bay areas;

- an improvement in recruitment in almost all inshore areas in recent years;

- an apparent improvement in the distribution of cod over a wider and wider inshore area of Division 3K and 3L;

- an improvement in sentinel fishery catch rates in many areas; and

- the high by-catches of cod being experienced in certain other fisheries and areas.

3.7 Summary

Input received from industry stakeholders (via the Workshop on Cod Recovery, the community consultation process and the External Advisory Committee) confirms that industry views on the status of the 2GH, the offshore component of the 2J3KL and the 3Ps cod stocks are generally consistent with the DFO Science Advisory Reports. There also appears to be general support for the continuation of a cautious management approach in 3Ps and the continuation of a moratorium on directed fishing in 2GH and in offshore areas of 2J3KL.

Industry views on the biological status of the 4RS3Pn and the inshore component of the 2J3KL cod stocks differ from the DFO Science Advisory Reports. In each of these areas, industry stakeholders believe that the stock is in better shape than indicated by the scientific assessment results. Industry arguments in support of this view focus in large part on stock abundance indicators such as improving catch rates in commercial and/or sentinel fisheries, significant and growing aggregations of cod in inshore areas and high by-catch levels in other directed fisheries. However, biological factors such as declines in natural mortality levels and improvements in fish condition and size in 4RS3Pn or improved recruitment in inshore areas of 2J3KL are also cited as further evidence in support of the view that these stocks or stock sub-components are recovering.

Many of the improvements in the abundance indicators and biological factors cited by industry on the status of the 4RS3Pn cod stock and inshore component of the 2J3KL cod stock are reported in the DFO Science Advisory Reports for these stocks. It is also important to note that industry stakeholders do not dispute that the 4RS3Pn and 2J3KL cod stocks are well below their historical levels. Stakeholders recognize that these stocks cannot, at present, support large scale directed fisheries.

The differing perceptions between many industry stakeholders and the DFO Science Advisory Reports on the status of the 4RS3Pn cod stock and the inshore component of the 2J3KL cod stock essentially revolve around the precise size of the current biomass and SSB in these areas. Based largely on day-to-day observation, fish harvesters, processors and fishing communities believe that the biomass and SSB for the 4RS3Pn stock and the inshore component of the 2J3KL cod stock are currently higher than the levels determined via the scientific assessment process. As a result, many industry stakeholders feel that these stocks can support a higher TAC level (in the case of 4RS3Pn) or a re-opening of a small scale directed inshore fishery (in the case of 2J3KL). This has also resulted in extensive demands for the resumption of a recreational fishery in these areas.

The Canada-NL Action Team for Cod Recovery is not mandated to provide recommendations on annual TAC levels or the re-opening of directed fisheries for stocks currently under moratoria. However, the Action Team is mandated to attempt to build an understanding on the current status of the stocks. The Action Team further recognizes that the success of the cod recovery strategy will be increased through consensus building, collaboration and shared stewardship. In light of this, the growing disconnect between industry and government on the status of the 4RS3Pn cod stock and the inshore component of the 2J3KL cod stock needs to be addressed in the short-term in the interest of moving forward with stock recovery and sustainability over the longer-term. The development of a collaborative strategy with regards to the management of short-term fishing mortality levels in each of these areas represents a significant challenge to cod recovery.

4. Potential Factors Affecting Rebuilding

4.1 Overview

The current status of Atlantic cod stocks cannot be traced to a single factor but is instead likely related to a combination of inter-related factors, including recruitment, fishing mortality, natural mortality and general fish condition. Other factors such as seismic activities, climate change, ocean dumping, etc. may also be having an impact on cod stock recovery, but the direction and degree of this impact is largely unknown. Historically, these cod stocks have exhibited lower productivity than cod further south or in the eastern Atlantic Ocean because they live in colder environments. In addition, the ocean climate became even harsher and was unusually cold during at least the first half of the 1990s. This "cold" regime was particularly unfavourable to stock productivity and therefore to recovery.

4.2 Reproductive Capability

Studies of the reproductive potential of cod stocks have shown that first time spawners are less successful than repeat spawners, small spawners have shorter durations of spawning and fish in poor energetic condition have lower fecundity. All of these factors imply that larger, older spawners in good condition contribute more per kilogram to the reproductive potential of a stock.

When these cod stocks collapsed in the early 1990s, they had very few fish overall, few older fish and a high proportion of first time spawning fish. There is little information on spawners (or the SSB) in the northern Labrador cod stock, but it is believed that their numbers are exceedingly low. For the other three stocks, the lack of older spawners and the poor energetic condition of fish contributed to a reduction in the reproductive capability of these stocks beyond that brought about by the reduction in the SSB alone.

Reproductive information on these stocks shows that:

- inshore recruitment in 2J3KL improved in the late 1990s, but recruitment in the offshore has remained very low since the early 1990s;

- there has been a persistent long-term decline in the strength of year classes produced in 3Ps since the mid-1970s, with only the 1997 and 1998 year-classes being relatively strong in recent years; and

- there have been no significant signs that recruitment to the 4RS3Pn stock has improved over the last twelve years.

For the southern Labrador - east Newfoundland and northern Gulf stocks, where the distribution of spawning components has been examined, a severe reduction in the size of some spawning components and/or a reduced area of spawning are also believed to be

contributing to poor recruitment levels. In addition, contracted age structure remains a problem, especially in offshore 2J3KL.

4.3 Fishing Mortality

A lack of fish caused a cessation of directed fishing on the northern Labrador cod stock long before the fishery was formally closed in 1996. There was no reopening of this stock during the late 1990s, so directed fishing was not a factor in the lack of recovery.

In contrast, when fisheries were reopened on the other three stocks, the level of catches met or exceeded surplus production (in large part due to the low productivity of these stocks), thereby contributing to the cessation of stock rebuilding and even a partial reversal of increases that had occurred during the moratoria years.

While the exact level of discarding, misreporting, poaching and unreported catches is unknown, many feel this represents another significant source of mortality that could be contributing to the lack of recovery in these stocks.

4.4 Natural Mortality

There is no information on the rate of mortality sustained by 2GH cod. However, there is evidence that mortality from sources other than fishing has been high for the southern Labrador - east Newfoundland stock and, until recently, the northern Gulf stock. Total mortality is especially high on juvenile fish in offshore areas of 2J3KL, where few fish survive beyond age five.

Although the causes of the elevated mortality levels on the 2J3KL cod stock and, until recently, the 4RS3Pn cod stock are not fully known, it has been concluded that:

- the energetic condition of cod following spawning was particularly low in the early 1990s for some cod stocks, and may have been low enough to result in mortality; and

- the mortality implied by estimates of cod consumed or otherwise killed by seals is such that it could be contributing to the lack of recovery in all areas - with the possible exception of 3Ps.

Natural mortality levels have returned to more normal levels in recent years for the 4RS3Pn cod stock due mainly to improved environmental conditions which have resulted in renewed growth and a significant improvement in fish condition. The estimates of seal consumption, which have remained constant over this period, remain significant for this stock.

The consumption of cod by seals in Subdivision 3Ps has not been estimated. However, harp and hooded seals migrate through this area seasonally. There are some harbour seal

colonies in 3Ps, but populations are small. There are no breeding colonies of grey seals in this area, but they are known to feed in this area during non-breeding periods.

The contribution of other sources of mortality such as disease, starvation and other predators, to total mortality is unknown. Until the relative contribution of the various sources of mortality is known, the impact of seal predation on these stocks cannot be determined.

4.5 Fish Condition and Growth

The overall influence of fish condition on stock status is difficult to assess. The condition of individual fish is probably indicative of the physiological strength of individuals in the population, which may in turn affect mortality rates or be important to reproductive capacity. Studies on the 4RS3Pn cod stock, for example, indicate that the fecundity of females in poor condition was 2.5 to 7 times lower than females in good condition.

The harsh environment in the 1990s is believed to have affected survival and fish growth. When the moratoria were applied, most of the fish in these stocks were small for their age and many were in poor condition, having little energy reserves to survive over the winter months or critical stages of their life cycle. The energetic condition of cod following spawning was particularly low in the early 1990s and may have resulted in increased mortality levels in some of these stocks.

Studies on the condition and growth of fish in these stocks show that:

- some studies have indicated that 2J3KL cod may not be faring well in certain seasons and areas due to the low availability of capelin and that there may not be sufficient capelin to support a recovery in this stock - especially in the offshore and the north; but other studies and observations do not suggest any concerns at present with growth or condition of 2J3KL cod;

- the growth and condition of fish in the 3Ps stock is good, but the weight at age for older fish is still smaller than in the 1970s; and

- the condition level of 4RS3Pn cod decreased at the end of the 1980s and into the early 1990s, but has improved in recent years and is currently at a level not observed since the early 1980s.

4.6 Other Factors

In developing a recovery strategy for the 2GH, 2J3KL, 3Ps and 4RS3Pn cod stocks, the Canada-NL Action Team for Cod Recovery is mandated to consider the endangered/ threatened species recommendations for Atlantic cod by COSEWIC and any requirements of SARA if these stocks are listed. The identification of all factors affecting rebuilding (or threats to the survival) of a species represents a key element of species recovery strategies under SARA. A summary of other potential threats to cod

recovery which may have an impact on the rebuilding of these cod stocks is provided below.

- **Seismic Activities**

Eastern Canadian waters are a region of increased exploration for petroleum related resources. To identify potential oil and gas reserves, the offshore oil and gas industry uses seismic exploration techniques to evaluate the geology which underlies the sea. This involves the use of a seismic vessel towing one or two arrays of "airguns" – cylinders that repetitively discharge compressed air at a pressure of about 2,000 psi. Each array typically contains some tens of such cylinders, which are "tuned" to release a single pulse of sound energy through the water column. The seismic vessel also tows long streamers containing hundreds of sensitive receivers called "hydrophones" which record the sound waves that are reflected back from the various rock layers beneath the ocean floor.

- **Climate Change**

Natural climate variation has impacted the distribution, migration and abundance of north Atlantic fishes in the past, and logic dictates similar responses in future. The responses of some species to specific environmental dynamics can be specified, although those dynamics are still uncertain in the North Atlantic. Any consideration of rebuilding of Newfoundland and Labrador marine ecosystems must take account of the effects of natural climatic variation and also the recent anthropogenically enhanced climate change as they may influence ecosystem structure, functioning and species composition. Although the reactions of some species (e.g. capelin) to environmental change can be specified, this cannot be adequately done for most species and their environment. Overall, rebuilding plans will likely not depend greatly on any predictions of climate change influences on the ecosystem, but plans should always be tempered by the inherent uncertainties of climate. This is especially true in this era of rapid change.

- **Oil and Gas Exploration/Production**

Increased exploration and production of petroleum resources in eastern Canadian waters increases the possibility of oil spills, although major spills such as offshore oil well blowouts have been extremely rare worldwide. Such accidents release petroleum into the ecosystem. Permitted discharges resulting from drilling and production operations can also expose organisms to trace amounts of petroleum, metals and other substances that could lead to direct mortality or sub-lethal impairments to particular species, their prey or their ecosystem. However, Newfoundland and Labrador monitoring programs and international experience have indicated that such effects are limited to the immediate vicinity of larger installations (e.g. production platforms).

- **Ocean Dumping**

The effects on cod from sewage sludge, fish waste and dredging are unknown, but are likely minimal since most of these effects are localized and the area impacted would be very confined.

- **Cables and Pipelines**

The placement of physical structures on the bottom substrate or in the water column could affect cod habitat although in a spatially limited manner given the widespread distribution of cod.

- **Marine and Land-Based Pollution**

Land-based forms of pollution including runoff, which may have excess nutrients, sediments, pathogens, persistent toxins and oil may result in changes to the ecosystem. The magnitude of change and its form depends on many factors including, the types of dissolved or suspended particles, such as non-biodegradable organic chemicals. These pollutants may adversely affect the reproductive capabilities of cod, their prey and surrounding vegetation as well as interfere with their general health.

4.7 Summary

The current status of cod stocks adjacent to Newfoundland and Labrador cannot be traced to a single factor but is instead likely related to a combination of inter-related factors, including reproductive capacity, condition, growth and natural mortality throughout the life history and fishing mortality. The significance of each of these factors varies across stocks and over time. Other factors such as climate change, seismic activities, oil and gas exploration, etc. may also have an impact on cod recovery, but the direction and degree of this impact is largely unknown.

The status of the 3Ps cod stock has been much better than that of the other three cod stocks since the mid-1990s. The decline in this stock in the 1980s was not as severe as the other cod stocks and stock productivity was relatively good following the imposition of the moratorium in 1993. In addition, the growth and condition of individual fish is good and natural mortality shows no signs of being unusually high. Nevertheless, recruitment remains well below historical levels and the age structure of the stock is still contracted. Due care and attention to stock conservation is still required in this area, but the potential threats to recovery are considered to be lower for this stock than they are for the 2GH, 2J3KL and 4RS3Pn cod stocks.

The status of the 4RS3Pn cod stock has improved in recent years, condition and growth have improved and natural mortality has returned to more normal levels. However, stock abundance, recruitment and the SSB continue to be well below historical levels.

In the case of the 2J3KL cod stock, the overall biomass is extremely low. Offshore populations are not increasing and are experiencing very low recruitment and high mortality levels. Some inshore populations appear to have been more productive since the early 1990s and have relatively good size and age structure, but the inshore biomass is very small compared to the historical levels for this stock as a whole.

Little is known about the historical or recent trends in the biomass of the 2GH cod stock. A directed fishery was not reopened on this stock in the late 1990s, so fishing mortality is not contributing to a lack of recovery. However, it is suspected that recovery in this area is impeded by severe levels of the problems plaguing the 2J3KL cod stock and in particular the offshore component of this stock.

Most of these cod stocks suffered from reduced recruitment and increased total mortality over of the last two decades. Fishing mortality levels have been drastically reduced since the early 1990s and natural mortality levels appear to have returned to more normal levels in certain stocks. However, none of these stocks are as productive as they were in the 1970s or 1980s and significant recovery will not occur unless recruitment increases, thereby generating substantial and sustained growth over the long-term. Given this, conservation considerations must continue to prevail and fishing mortality must continue to be managed in a cautious manner.

5. Goals and Objectives

5.1 Primary Objective

The primary objective of the Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador is to promote the conservation of the northern Labrador, southern Labrador - east Newfoundland, southern Newfoundland and northern Gulf cod stocks in order to:

- prevent further declines in the biological status of these stocks; and

- contribute to the recovery and sustainable management of the stocks over the long-term.

5.2 Policy Context

The cod recovery strategy has been developed within the context of the *Policy Framework for the Management of Fisheries on Canada's Atlantic Coast*. The framework provides a clear policy direction for the management of all Atlantic fisheries and is based on the four interrelated objectives of:

- Conservation and Sustainable Use;
- Self-reliance;
- Shared Stewardship; and
- Stable and Transparent Access and Allocation Approach.

The Policy Framework's conservation and shared stewardship management objectives are particularly relevant to the Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador.

Conservation and sustainable use of the resource represents the most important objective for fisheries management. Conservation of the marine resources and habitat, and the rebuilding of resources (and the restoration of habitat) where necessary, remain the highest priority for the management of all fisheries. Within the limits of available knowledge, all fishing activities will be conducted in a manner that leads to sustainable resource use.

The shared stewardship management objective recognizes that industry participants and other interested stakeholders must become more involved in fisheries management policy development and decision-making processes. It also recognizes that achievement of the conservation objective requires that governments, resource users and others with an interest in the fisheries share responsibility for the implementation of fisheries management decisions and for their outcomes. Enabling resource users and others to play a greater role in decision making, and thus to take a greater responsibility for

resource management decisions and outcomes will further a conservation ethic and enable stakeholders to take greater control of their economic and social well-being.

5.3 Biological Considerations

Ideally, a rebuilt cod stock should have most, or all, of the biological characteristics normally found in healthy or sustainable fish populations. These would include such features as the ability for the stock to reproduce and sustain itself while maintaining some degree of maximum or optimal annual yield. These features might be envisaged as those capabilities the stock would have if it were in long-term equilibrium and being fished consistently at a chosen reference level.

Most cod stocks adjacent to Newfoundland and Labrador are currently unable to reproduce and sustain themselves while maintaining some maximum or optimal annual level of landings. Therefore, where necessary, conservation requirements must continue to prevail and management decisions should be guided by the following biological considerations:

- the avoidance of serious harm to the reproductive potential of the stock such as that arising from a continuously low or unproductive SSB;

- the requirement for a sustained rate of growth in the total biomass of the stock over an extended period of time;

- an improvement in recruitment from the current low levels being experienced in most of these stocks;

- the distribution or repopulation of the stock over its traditional grounds; and

- the health of individuals in the population as measured in terms of fish condition and growth.

5.4 Targets and Timeframes

Recovery targets and timeframes will have the greatest impact on primary industry participants since they affect the long-term viability and sustainability of their businesses and ultimately the future of their communities. It was for this reason that the Action Team, as part of the Workshop on Cod Recovery and the community consultation process, solicited input from industry stakeholders on these issues. It was felt that the participation of stakeholders in the determination of the most appropriate and acceptable targets was of paramount importance to the success of the recovery process.

The views of most industry stakeholders on this issue are as follows:

- the historical high levels for stock parameters such as total biomass, SSB, annual recruitment, etc. do not represent realistic rebuilding targets for these stocks under

current circumstances - historical highs should, at best, be used as reference points for what might be possible over the longer term;

- more modest recovery targets should be adopted for a range of parameters such as abundance, stock distribution and age structure - with "stock growth" as the primary objective; and

- the recovery strategy should attempt to achieve an improvement or modest level of growth in these targets over a short-term rebuilding time frame (i.e. 5-10 years).

Stakeholder views on specific recovery targets are in part fuelled by concerns over the socio-economic consequences such an approach would have on fish harvesters, processors and fishing communities. Industry participants fear that long-term and unrealistically high targets imply that fisheries might never resume. Recovery strategies must address the question "recovery for whom" and must consider the people who depend on the fish.

In recent years, concern over the potential socio-economic consequences associated with long-term stock recovery targets has resulted in considerable tension between DFO and commercial/recreational fish harvesters. Industry demands for increased fishing opportunities with respect to the 4RS3Pn and 2J3KL cod stocks are based in part on the belief that these stocks are in better shape than indicated by the Science Advisory Reports and can therefore support higher fishing mortality levels in the short-term. However, demands for a re-opening of directed fisheries on the inshore component of the 2J3KL cod stock and an increase in the TAC in 4RS3Pn also provide evidence of a willingness on the part of many commercial and recreational fishers to assume greater risks to stock rebuilding in the short-term in the interests of achieving a better balance between short-term socio-economic considerations and a faster long-term recovery.

The preference for a more practical short-term approach is also rooted in a concern that a rigorous, quantitative approach implies a degree of scientific knowledge, precision and certainty which does not exist. There is a general view that not enough is known about the actual level of the various stock parameters at any given time to properly select realistic quantitative rebuilding targets.

Specific targets for stock parameters such as the total biomass, the SSB, recruitment, growth and condition have not been incorporated into the Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador. Nor does the strategy include timeframes over which some form of recovery might hope to be achieved.

The strategic approach outlined in chapter six is intended to contribute to an improvement or modest growth in various stock parameters such as the SSB, total biomass, abundance, and distribution over both the short-term and the long-term.

6. Management Strategies

6.1 Approach

Any strategy to rebuild the 2GH, 2J3KL, 3Ps and 4RS3Pn cod stocks requires a long-term commitment by government, industry and other stakeholders to initiating and maintaining a number of management strategies or approaches. These strategies are intended to further mitigate the impact of human activities on the resource and to thereby contribute to stock recovery. Such an approach also requires a more collaborative and inclusive fisheries management framework. Not only is a cooperative approach required between both levels of government, but a "shared stewardship" approach between governments, industry, fishing communities and other interested stakeholders is essential.

The Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador consists of eight interrelated management elements which can be broadly categorized under the following themes:

- Modifying the Management Framework
- Management of Fishing Mortality
- Foreign Fishery
- Improving Recruitment
- Predator Species
- Prey Species
- Seismic Activities
- Enhancing Scientific Knowledge

An overview of each of these management elements and a summary of key considerations examined by the Action Team in the development of the recommended approaches is provided in the following sections.

6.2 Modifying the Management Framework

6.2.1. Overview

The management framework for cod and other groundfish stocks has undergone considerable change since the early 1990s. Groundfish stocks are now managed in accordance with an Integrated Fisheries Management Plan (IFMP) process. The IFMP process includes elements such as long-term objectives for the fishery, management objectives for conservation and sustainability and evaluation criteria for management measures and enforcement programs.

Stakeholders now play an integral part in the day-to-day management of fisheries through such activities as the development of annual Conservation Harvesting Plans (CHPs), the at-sea observer program, the dockside monitoring program, the sentinel fisheries program and the Regional Assessment Process (RAP) of Science.

Despite the evolution in the management framework, stakeholders continue to feel isolated from the decision-making process. The process also continues to be largely devoted to annual debates over the management of what are essentially non-recovered cod stocks. These debates focus on short-term issues related to stock status, TAC levels and why directed fisheries should be re-opened rather than on more long-term cod recovery considerations.

Further change to the fisheries management framework represents an essential element of the recovery strategy for these stocks. Areas where further progress is required include:

- the development of a risk management framework which incorporates precautionary decision-making;

- the development of a more inclusive shared stewardship approach;

- the development of a TAC decision rules process for directed fisheries; and

- the implementation of an assessment process whereby the risks associated with the re-opening of small-scale fisheries on stocks currently under moratoria can be evaluated.

The focus must shift toward long-term rebuilding rather than annual debates on stock status and TAC levels.

6.2.2 Risk Management Framework

6.2.2.1 Background

The Precautionary Approach (PA) framework is a risk management approach for use when there is an absence of full scientific certainty regarding a fish stock; a potential risk of serious or irreversible harm to the stock; and a need to make management decisions regarding a stock. The proposed Canadian PA framework is based on the following principles:

- the application of the precautionary approach is a legitimate and distinctive decision-making framework;

- sound scientific information forms the basis for applying this approach;

- mechanisms for re-evaluation and transparency must exist;

- a high degree of transparency, clear accountability and meaningful public involvement are prerequisites for the application of the framework; and

- decisions must be guided by society's chosen level of risk.

Several measures consistent with the PA are already being used in the management of cod stocks in Newfoundland and Labrador. For example, dockside and observer monitoring programs have been introduced or enhanced to ensure that removals are well documented and do not exceed harvesting limits. Sentinel surveys and joint government-industry surveys are being conducted to enhance research and reduce uncertainties in the determination of stock status. Risk analyses have been introduced to provide managers with information on the risks of stock declines associated with potential management options. Finally, a number of management measures such as closed areas and protocols to protect juvenile fish, and to reduce by-catch have been introduced to complement quota controls and monitoring.

Fisheries and Oceans Canada is proposing that a three-zone management model, based on the biological status of the stock, be developed for the application of the PA in Canadian fisheries. Under this model, fish stocks would be defined on the basis of "healthy", "cautious" and "critical" states or zones. Conceptually, these three zones represent areas where biological/ecosystemic and socio-economic considerations change in relative priority. When a stock is in the healthy zone, there can be more emphasis on socio-economic considerations. In the critical zone, conservation considerations must prevail. In the cautious zone, a balance needs to be developed.

6.2.2.2 Recommended Approach

1. **It is recommended that government, in conjunction with industry, further develop a risk management approach for the management of cod stocks in Newfoundland and Labrador.**

Specific elements of the PA which require further development include:

- the determination of reference points for various biological indicators/productivity factors that could be used to define the boundaries between the critical/cautious and cautious/healthy zones; and

- the development of associated decision rules and management actions which could be taken as the status of a given stock changes.

Conservation limit reference points represent thresholds which indicate when a stock is considered to have impaired productivity and is thus in a situation in which serious harm has occurred. These points are generally expressed in terms of biological indicators such as SSB, mortality rates and abundance; or productivity characteristics such as recruitment, growth rates, condition index and geographic range of distribution. If a stock is approaching or below the limit reference points, increasingly restrictive resource use strategies such as moratoria or limited fisheries are required.

Decision rules function as guidelines or triggers so that management actions become more precautionary if resource status warrants. Ideally these rules should be pre-determined so

that management actions are agreed to in advance of a stock reaching a certain critical threshold. In the absence of pre-determined targets, precautionary responses should be predicated on a risk aversion strategy when limits are approached.

During the 2002 Workshop on Reference Points for Gadoids, preliminary work was conducted on a limit reference point for the SSB for the 2J3KL and 4RS3Pn cod stocks. More recently, as part of the 2004 scientific assessment of the southern Newfoundland cod stock, work was conducted on various SSB limit reference points for the 3Ps cod stock. However, no work has been conducted to date in this area for the 2GH cod stock and very little work has been conducted with regards to development of precautionary decision rules for any of these stocks.

In the case of the 4RS3Pn cod stock, the 2002 Workshop determined that it was not possible to give a precise estimate of the SSB limit reference point because there is very little data on the desirable levels of recruitment when the SSB is between 100,000t and 200,000t. This stock passed rapidly through this phase and it was concluded that until the stock is well into the 100,000 to 200,000t range, it will be difficult to give a more precise estimate of the SSB limit reference point for the critical zone. In light of this uncertainty, it was determined that a reasonable short-term limit for the SSB would likely be between 85,000t and 110,000t for this stock.

In the case of the 2J3KL cod stock, a SSB limit reference point has not been identified. But, the 2002 Workshop determined that the limit would be higher than 300,000t for the stock as a whole. Although the biomass of the 2J3KL cod stock is unknown, it is clearly far below any limit reference point and it is clear that the productivity of the stock is seriously impaired.

In the case of the 3Ps cod stock, various candidate reference points were reviewed during the 2004 assessment. The lowest spawner biomass from which a secure recovery has occurred was recommended as being suitable for this stock because the stock has undergone two recovery cycles since 1977. This limit reference point was defined as the SSB in 1994 (i.e. 40,000t and 12,000t for the two SPA formulations reported in the 2005 assessment). The current SSB is 2.1 times larger and 4.0 times larger than the recovery limit reference point under the two respective SPA formulations.

6.2.3 Shared Stewardship

6.2.3.1 Background

Shared stewardship, as envisaged under the Policy Framework for the Management of Fisheries on Canada's Atlantic Coast, essentially means that participants in the fishery will over time become more effectively involved in the direct management of fisheries. Fish harvesters and other industry stakeholders will contribute their specialized knowledge and experience, will effectively participate in the decision-making process at appropriate levels and will ultimately share in the responsibility and accountability for management decisions and outcomes.

Experience with the management of Atlantic fisheries over the last decade, suggests that movement towards shared stewardship will be gradual. Participation by stakeholders most directly involved in the exploitation of specific stocks will continue to take place through current fisheries management processes. Over the long-term, as resource users increase their ability to assume additional management responsibilities and demonstrate their commitment to sustainability, Fisheries and Oceans Canada would delegate authority in specific decision-making areas to industry.

The development of a more inclusive shared stewardship management model represents a significant challenge for fisheries management in general and cod recovery in particular. Such an approach requires a shared vision, a commitment to conservation and sustainability and a transparent and innovative management framework. Furthermore, the roles, responsibilities and accountabilities of the various stakeholders need to be clearly defined. Where appropriate, the range of stakeholders also needs to be expanded beyond enterprise owners to include crewmembers, processors, recreational fishers, fishing communities, aboriginal groups, non-government organizations and academic institutions.

Shared stewardship is a concept which will be developed within the context of overall reform to fisheries management in general. Despite the fairly deep-seated sense of frustration with the current management process, it will also likely be gradual and long-term in nature. Nonetheless, within the context of cod recovery, all opportunities for additional shared stewardship opportunities should be pursued.

6.2.3.2 Recommended Approach

2. It is recommended that government, in conjunction with industry, identify and pursue additional shared stewardship opportunities for the management of cod stocks.

The Action Team's Workshop on Cod Recovery clearly demonstrated a strong desire on the part of fish harvesters and other stakeholders for the implementation of additional shared stewardship opportunities. Fish harvesters maintain that they continue to feel excluded from the management process, are consulted but do not share in the final decision-making, and are not informed of decisions on a timely basis. There is also a strong view that the greatest influence in fisheries management decision-making continues to rest with those who are most distant and disconnected from the actual fishing activity. They are of the view that such an approach alienates harvesters and communities and is counter-productive to stock rebuilding.

The recent progress which has been achieved in the development of TAC decision rules for the northern Gulf cod stock provides an opportunity for industry stakeholders to become more effectively engaged in the management of this stock. Other approaches which should be pursued include:

- examine ways by which fish harvesters, processors and other affected stakeholders can become more effectively involved in the current scientific assessment and fisheries management processes; and

- consult with industry and other interested stakeholders on the potential benefits and impediments associated with the development of shared stewardship and shared decision-making management models for these stocks over the longer-term.

6.2.4 TAC Decision Rules

6.2.4.1 Background

When limited directed fisheries were re-opened on the northern and southern Gulf cod stocks in 2004, resource users were invited to work with DFO to develop rules-based procedures or decision rules by which cod TACs would be set in future years. This approach is an early application of the concept of shared stewardship and involves participatory decision-making with industry and an attendant acceptance of accountability by both parties for the outcome of those decisions.

Considerable progress was achieved on the development of TAC decision rules in the northern Gulf area in 2004/2005. A DFO/Industry Working Group worked collaboratively on a strategy that would test the state of the 4RS3Pn stock by adjusting the TAC in response to changes in stock condition as monitored by a suite of abundance indicators and stock productivity factors. The abundance indicators include the SSB, sentinel catch rate data, research vessel survey data, commercial fishery catch rate information, fisher telephone survey questionnaires and so forth.

In May 2005, the Minister of Fisheries and Oceans announced that the TAC for the northern Gulf cod stock would be increased from 3,500t to 5,000t in 2005. At that time, the Minister noted that the TAC decision rules were influential in making his decision. However, these rules need further refining and need to be consistent with the long-term rebuilding strategies for these stocks.

6.2.4.2 Recommended Approach

3. It is recommended that the TAC decision rules process be adopted for all cod stocks in the Newfoundland and Labrador Region.

The TAC decision rules approach in 4RS3Pn provides an opportunity to promote further shared stewardship and to allow resource users to become more effectively involved in the management of the fishery. This approach requires further development in terms of industry responsibilities and accountabilities. However, consideration should be given to developing a similar type of process for all other cod stocks in Newfoundland and Labrador.

The TAC decision rules process is also consistent with the type of management approaches which have been recommended by the Fisheries Resource Conservation Council (FRCC)

for the 4RS3Pn and 3Ps cod stocks. In 2004, the FRCC noted that a conservation management rule driven by a suite of abundance indicators would eventually guide decision-making in an appropriate direction for the 4RS3Pn stock. Similarly, the draft Fisheries Resource Conservation Plan (FRCP) which was developed by the FRCC for the 3Ps stock noted that proposed changes to the TAC should result primarily from growth in the SSB, but should be tempered by changes in other key indices such as age structure, geographical distribution and condition.

In the view of the Action Team, it is particularly important that some form of TAC decision rules process be developed on a priority basis for the southern Newfoundland cod stock. Such an approach would entail the development of appropriate criteria, indices and rules, which could be used to determine future TAC levels.

The 3Ps cod stock is currently in better shape than other cod stocks in Newfoundland and Labrador. The TAC has been stable at 15,000t since the 2001 management year and the SSB is above the recovery limit reference point which was recently developed for this stock. Numerous conservation measures consistent with the precautionary approach have also been implemented in recent years in an attempt to ensure that this stock is managed on a sustainable basis over the long-term.

The current SSB of 3Ps cod can be characterized as being "healthy". Nevertheless, recruitment has been poor since 1999 and current catch levels may not be sustainable unless productivity improves. Likewise, although the age structure of this stock has improved in recent years, it is not as extended as it was historically. These factors point to the need for the continuation of a cautious management approach for this stock.

The development of a TAC decision rules approach would be considerably more complicated in the case of the 2GH and 2J3KL cod stocks. Furthermore, given the current status of these stocks and the fact that they are closed to directed fishing, this type of approach does not represent an immediate priority. Nonetheless, the TAC decision rules approach should also be pursued for these stocks as they recover over the longer-term.

6.2.5 Risk Assessment Process

6.2.5.1 Background

A more important priority for the 2GH and 2J3KL cod stocks is the development and implementation of a formal assessment process by which government and industry can review the scientific, management and public policy issues and considerations associated with the re-opening of directed fisheries on stocks currently under moratoria. Such a process would also evaluate the various risks to recovery associated with the re-opening of small-scale index type fisheries on these stocks. This is an immediate and particularly important stock recovery issue for the inshore component of the 2J3KL cod stock.

The overall biomass of the southern Labrador - east Newfoundland cod stock is considered to be extremely low and has not recovered to any noticeable degree since the low point in

the mid-1990s. This stock is also far below any conservation reference point. Furthermore, the offshore populations, which historically comprised most of this stock, are characterized by small young fish that are broadly distributed at very low density. The offshore component is not increasing due to very poor recruitment and high mortality.

The inshore populations of 2J3KL cod, which were historically small compared to the offshore component, appear to have been more productive than the offshore populations since the early 1990s. They have relatively good size and age structure, form dense aggregations at times, can be seen in shallow water and can yield high catch rates in some areas. Nevertheless, the most recent scientific assessment for this stock concluded that the SSB in the central portion of the inshore (southern 3K and northern 3L) at the beginning of 2005 was only 13,000t. The inshore northern area (2J and 3K) appears to have very low densities of cod and the inshore southern area (southern 3L) is primarily dependent on seasonal migrations of fish from Subdivision 3Ps.

Industry views on the status of the offshore component of the 2J3KL cod stock appear to be generally consistent with the DFO Science Advisory Reports and there appears to be support for the continuation of a moratorium in this area. However, such is not the case with the inshore component of this stock.

Many fish harvesters believe that the inshore component of the southern Labrador - east Newfoundland cod stock is in better shape than indicated by the scientific assessments and that this component can support a small-scale fishery. Industry and community views on the status of the inshore component are influenced by the significant aggregations of cod in areas such as Bonavista and Trinity Bays and by other factors such as improving sentinel fishery catch rates in many areas. Many fish harvesters in the 2J3KL area believe that a small directed fishery is necessary in order to provide additional scientific information which can be used to measure progress against stock recovery targets. They also believe that such a fishery can be consistent with stock recovery and that there is much to be gained from having “fishermen on the water”. Recreational fishers in this area hold similar views.

The demand for the re-opening of a small-scale directed fishery and the resumption of a recreational fishery in 2J3KL represents a priority management issue which must be addressed in the short-term in the interests of moving forward with stock recovery and sustainability over the longer-term. This issue also represents a major impediment to the development of a more collaborative shared stewardship approach for this stock. The continuation of a moratorium on the inshore component of this stock is, in fact, often cited as further evidence that industry stakeholders continue to be excluded from the fisheries management process and are being consulted, but do not share in the final decision-making.

The development of an evaluation process to examine the risks associated with the re-opening of a directed fishery would not be applicable to the 2GH cod stock at this time. However, this type of approach should also be pursued for this stock as it recovers over the longer-term.

The biomass of the northern Labrador cod stock is believed to be extremely low and the prospects for recovery over the short-term are not promising. In the absence of information specific to this stock, it is suspected that the circumstances are similar to those in the northern offshore portion of 2J3KL. It is further speculated that the recovery of cod in the inshore and offshore areas of 2GH is not likely to occur until recovery is well under way in the northern parts of the 2J3KL stock. This conclusion appears to be generally supported by industry stakeholders.

6.2.5.2 Recommended Approach

4. **It is recommended that the moratorium which has been in place on the 2GH cod stock since 1996 be maintained.**

5. **It is recommended that the moratorium which has been in place on the offshore component of the 2J3KL cod stock since 1992 be maintained.**

6. **It is recommended that the moratorium which has been in place on the inshore component of the 2J3KL cod stock since 2003 be continued subject to:**

    - **the development of a formal process by which government and industry can evaluate the issues, considerations and risks associated with the re-opening of a small-scale fishery on this stock; and**

    - **this process being developed and implemented on a priority basis.**

In determining if a small scale fishery can or should occur on the inshore component of the 2J3KL cod stock, several key scientific issues will have to be further evaluated including the potential impact such a fishery might have on the recovery of the offshore component and the impact such a fishery could have on the growth, distribution and sustainability of the inshore component.

There is a strong possibility that cod currently in offshore 2J3KL undergo spring/summer feeding migrations to the inshore. At current offshore population levels, any offshore fish exploited in an inshore fishery may further impede recovery in the offshore. Furthermore, many of the fish historically caught in the inshore were immature, so inshore removals may capture some offshore fish before they have a chance to spawn.

The potential for cod currently in the inshore to repopulate the offshore of 2J3KL also remains uncertain. Genetic studies using microsatellites have demonstrated a population substructure between most inshore and offshore areas. It has been suggested that the presence of this substructure indicates that inshore-spawning cod have existed for a considerable time, have distinct inshore migration and behavioral patterns and are not likely to change these patterns and move into the offshore area. Nevertheless, it is known that fish can expand their ranges, especially when their density is high. Allowing the inshore biomass to grow may increase the likelihood that some inshore-spawning cod

will move to the offshore, start spawning there and thereby contribute to offshore recovery.

The risk of an inshore fishery affecting rebuilding of the offshore component of 2J3KL is currently the subject of much debate. Many fish harvesters believe that such a fishery will have little impact on the offshore component of this stock. Other harvesters have concerns that any inshore harvest will have a negative impact on the offshore component. However, an inshore fishery will have an impact on the rate of growth and perhaps the geographic distribution of the inshore component. A fishery in the southern portion of 2J3KL (southern 3L) may also have an impact on the adjacent cod stock in 3Ps. The trade-offs and associated risks that a small scale fishery will have on the recovery, growth and sustainability of the inshore component of 2J3KL cod stock require further consideration and evaluation.

Several fisheries management issues also require further evaluation prior to deciding whether to re-open an index fishery on the inshore component of the 2J3KL cod stock. The more important of these include whether such a fishery would be re-opened over the entire geographic area or managed on a smaller sub-component basis, if the fishery should include both commercial and recreational participants, what by-catch levels may be allowable in fisheries directed at other species and how all sources of fishing mortality can be effectively monitored and controlled.

6.3. Management of Fishing Mortality

6.3.1 Overview

Government and industry have implemented a myriad of conservation measures over the last decade in an attempt to promote cod stock recovery. The more significant of these pertain to the management of fishing mortality via moratoria and the reopening of directed fisheries on a limited basis. However, moratoria and small-scale directed fisheries represent only part of the suite of management measures which have been implemented in an attempt to effectively manage fishing mortality on these stocks.

When directed fisheries were closed, additional management measures such as Conservation Harvesting Plans (CHPs), limited entry licences, seasonal limits and complex by-catch protocols were established in other directed fisheries. When they were re-opened, further restrictions and management measures including the geographic restriction of fishers within a given stock area were instituted.

Likewise, the subsequent decline in some of these stocks resulted in conservation measures aimed primarily at “by-catch management”, which now represents the overriding consideration in the management of all groundfish fisheries in the Newfoundland and Labrador Region. In the case of the directed fishery in subdivision 3Ps, conservation measures now focus on accurate monitoring of landings, protection of small fish and spawning activity, control of by-catch in other fisheries and the mitigation of impacts on the adjacent northern Gulf cod stock.

Several changes in fishing gear and harvesting practices have also been introduced to better manage the by-catch of cod and the catch of juvenile cod. These changes include:

- the introduction of small fish protocols and by-catch limits as a condition of licence in many fisheries;

- the mandatory use of Nordmore grates in all shrimp fisheries;

- the voluntary use of rigid grates by vessels directing for flounder with otter trawls;

- an increase in the mesh size (from 140 mm to 155 mm) of otter trawls in directed cod fisheries;

- a reduction in the use of capelin traps with permission for mid-shore capelin fishers to use tuck seines;

- the implementation of mandatory tagging and reporting program for lost gillnets; and

- an increase in the mesh size (from 130 mm diamond to 155 mm square) of Danish seines.

Cod-related enforcement efforts by DFO now include both directed and preventive enforcement. The former concentrates on the enforcement of conservation measures which prohibit directed fisheries on moratoria stocks, measures to minimize cod by-catch in other directed groundfish fisheries and monitoring measures to ensure the accurate reporting and recording of cod catches. Preventive enforcement measures include promotion of awareness and compliance, interactions with dockside monitoring companies, and publication of results of prosecutions for associated violations of cod conservation measures.

6.3.2 Industry Views

Industry stakeholders are not convinced that an expansion of current management measures to control fishing mortality is necessary. Many of these measures are quite stringent and costly - especially when quotas are low. Stakeholders also feel that there is a need to review the effectiveness of existing measures, some of which have been in place since the early 1990s and may require updating to reflect current conditions.

Some benefit might be gained from additional gear selectivity capabilities, especially in the area of fish size. However, the objectives that should apply to the most desired or optimal catch in terms of age, size, and retained species need to be clearly identified. Gear technology can then be developed or modified to best achieve these objectives. The impact of various fishing gears on habitat also needs to be addressed.

Industry is also of the view that harvesters and communities need to become more effectively engaged in the development and implementation of conservation measures. Education must be carried out and stewardship needs to be developed. Management measures must "find their way onto the water".

6.3.3 Considerations

- **By-catch**

By-catch management now represents the overriding consideration in the management of all groundfish fisheries in the Newfoundland and Labrador Region. This is likely to continue and to become an even more prominent issue as these stocks recover over the longer term.

The by-catch of cod continues to remain high in some directed fisheries and with some gear types. By-catch remains an issue in inshore gillnet fisheries for lumpfish and blackback flounder off eastern Newfoundland. The American plaice fishery in 4R has also been closed on several occasions when cod by-catch was above acceptable levels. The by-catch of juvenile cod in capelin traps also represents a potential concern. Improved markets for capelin in Japan and an increase in the abundance of capelin nearshore has resulted in a renewed interest in this fishery in recent years. Many capelin harvesters are now using purse seines or tuck seines, but capelin traps are still being used in some areas.

Over the long-term, an examination of the trade-offs between the socio-economic impact of cod by-catch limitations on other fisheries versus the biological requirements of a particular cod stock may be required. Likewise, consideration of the impact that recovering cod stocks may have on the abundance of other species such as shrimp and crab may be required.

- **Discarding/Small Fish**

The discarding of undersized or poor quality fish in directed cod fisheries also represents a potential concern. The use of gillnets in directed cod fisheries often results in discarding of poor quality cod and sometimes in lost nets which continue to "ghost" fish for many years. Gillnets represent one of the most effective ways to harvest cod, but winds are often too high after September for inshore enterprise owners to regularly tend their nets. There has been an increased occurrence of discarding of undersized fish in the 3Ps cod fishery in recent years. Directed longline fisheries for cod often result in the catch of a relatively high proportion of juvenile fish.

- **Monitoring/Compliance**

There are gaps in the coverage of the Dockside Monitoring Program (DMP) and shortages of at-sea observers (and related funding) for coverage in some areas and fleets. The DMP is not mandatory in the lumpfish fishery, for example, where cod by-catches can be high at certain times. The IQ management regime for the 3Ps cod fishery also results in an overly long fishing season which presents monitoring and enforcement problems.

Efforts at building voluntary compliance have proven difficult. In addition, there are difficulties in meeting the high public expectations to respond to all incidents of illegal fishing activities. The exact level of discarding, misreporting, poaching and unreported catches is unknown. However, many feel that this represents an important source of mortality that could be contributing to the slow recovery in these stocks.

6.3.4 Recommended Approach

7. It is recommended that the current multi-faceted approach to the management of by-catch, discarding of small fish, etc. be continued and that additional measures be implemented, when necessary, to effectively manage fishing mortality issues related to cod stocks.

Experience since the early 1990s has shown that severe controls on fishing mortality in the form of moratoria, by-catch limits, small fish protocols, changes in fishing gear and so forth have not resulted in a significant rebuilding of these stocks - with the notable exception of the southern Newfoundland stock. Currently, the northern Labrador stock lacks aggregations of cod and the control of fishing mortality is not an issue. However, this is not the case in the other three stock areas. These stocks are nowhere near as productive as they were in the 1970s and 1980s. Therefore, the extent to which fishing mortality in the form of by-catch, discarding of small fish, unreported catch, etc. can be more effectively managed, monitored and enforced, needs to be further pursued.

Specific management actions could include:

- Adopt more stringent requirements, where necessary, for the management, control and monitoring of by-catch in other directed fisheries by:

    - implementing restrictive openings for other directed fisheries to avoid areas and times of excessive cod by-catch;

    - increasing observer coverage in fisheries where cod by-catch is problematic in order to implement timely closures; and

    - developing, in consultation with industry, additional options, such as gear modifications, to reduce cod by-catch levels.

- Increase the level of observer coverage in directed cod fisheries when (and where) the catch of small fish is likely to be high and conduct a review, in conjunction with industry, of additional measures such as seasonal closures or gear restrictions to address the discarding of juvenile fish.

- Continue efforts to improve the Dockside Monitoring Program (DMP) through initiatives such as the Fish Landing Station Protocol (FLSP). Also, continue the current initiative to redesign the Observer Program and consider, in conjunction with industry, management measures that will alleviate on-going monitoring and enforcement issues.

- Develop and implement an effective public relations and awareness campaign on the importance of cod conservation.

6.4 Foreign Fishery

6.4.1 Overview

Fishing intensity by non-Canadian fleets on the southern Labrador - East Newfoundland cod stock increased greatly in the 1960s as offshore freezer trawlers from West Germany, Spain, Portugal and France exploited the dense offshore over-wintering aggregations. Landings of 2J3KL cod by foreign fleets peaked in 1968 with a reported catch of approximately 687,000t. Annual landings of 2GH cod also increased dramatically (to the 60,000 to 90,000t range) over the 1965 to 1969 period due to a pulse of fishing effort by distant-water fleets.

Foreign catches of 2J3KL cod exceeded 150,000t on an annual basis up to 1977 when Canada unilaterally declared a 200-mile Exclusive Fishery Zone. After extended jurisdiction, Canada signed bilateral agreements with several countries which allowed foreign fleets to harvest fish surplus to Canadian requirements inside the zone. These agreements were a transitional measure as Canada developed the capacity to fish offshore. Foreign allocations of 2J3KL cod were terminated in 1986 after the expiration of the Long Term Agreement (LTA).

During the late 1980s, foreign fleets caught significant quantities of 2J3KL cod in the NAFO Regulatory Area (NRA). A proposal to close the 3L cod fishery was adopted at the 1991 annual NAFO meeting and a moratorium was implemented in the NRA in January 1992. Reported catches of 2J3KL cod by foreign vessels averaged less than 25 tonnes per year in the NRA over the 1993 to 2002 period. However, there is a certain amount of uncertainty associated with the foreign catches of cod (and other NRA stocks) during this time because the reported catches of some fleets were not considered to be reliable.

The moratorium which was implemented on 2J3KL cod by NAFO in 1992 has remained in place since that time. In addition, a 5% cod by-catch limit has been implemented in

other directed groundfish fisheries and a 2.5% cod by-catch limit is in place for shrimp fisheries. At present, the modest levels of 3L cod by-catch occur in the Greenland halibut and shrimp fisheries. The American plaice, witch flounder and redfish fisheries are also under moratoria and fisheries such as yellowtail, skate and hake occur mainly in Division 3NO. The overall estimate of annual by-catches of 2J3KL cod in the NRA is relatively low at less than 100t.

6.4.2 Compliance

The decline of cod and flounder stocks in the NRA during the late 1980s and early 1990s coincided with an apparent migration of Greenland halibut (turbot) from the Canadian zone into this area. As a result, the EU fleet began heavily directing for this species during the early-to-mid 1990s.

As a result of the Canada-EU Agreement, which was signed in May 1995 to resolve the Canada-EU dispute ("Turbot War") and later adopted by NAFO, a more effective enforcement regime was implemented in the NRA which continued for several years after 1995.

Compliance by foreign fleets improved following the adoption of the enhanced NAFO enforcement regime, but once again declined over the 2000 to 2003 period with vessels conducting directed fisheries for moratoria species, including 3NO cod, in shallow water on the Tail of the Grand Banks. However, significant improvements have been observed since the implementation of the Canadian NAFO Strategy in 2004. This strategy involves a significant investment by Canada for continued aerial surveillance, additional fishery officers and patrol vessels, data analysis and port inspections, additional scientific research, and enhanced diplomatic initiatives on a number of fronts. Canada's comprehensive strategy to combat foreign over-fishing will entail the expenditure of in excess of $115 million over the 2004 to 2009 period.

6.4.3 Considerations

Generally speaking, foreign fisheries do not represent a significant factor in the recovery of the 2GH, 2J3KL, 3Ps or 4RS3Pn cod stocks. However, this is not widely accepted by the general public in Newfoundland and Labrador, particularly as it relates to foreign fishing on the Grand Banks.

It is believed that the continuing low level of foreign catch on the Nose of the Grand Bank in Division 3L is due, in large part, to the absence of commercial quantities of cod in this area. The biomass of cod found during offshore surveys in Division 3L has remained low since the early-to-mid 1990s. The proportion of cod in the 3L portion of the NRA averaged only about 3% of the total 2J3KL survey biomass over the 1995 to 2002 period. In addition, much of the foreign fishing activity in Division 3L is directed at Greenland halibut which usually occurs in water deeper (>1,000m) than where cod are normally found.

In Subdivision 3Ps, the cod fishery is jointly managed by Canada and France in accordance with the 1972 treaty agreement and the 1994 Procès-Verbal. The 3Ps cod TAC is shared (on 84.4/15.6 percent basis) by Canada and France. The French fishery is conducted by an inshore fleet of fixed and mobile gear vessels from St. Pierre et Miquelon (SPM). In addition, 70% of the French quota is fished by a Canadian offshore trawler and landed in SPM. French authorities provide regular reports on the fishery to Canadian officials and foreign activity is not considered an issue with this stock.

Foreign fishing activity is not a factor in either the northern Gulf cod stock or the northern Labrador cod stock.

6.4.4 Recommended Approach

8. It is recommended that Canada pursue a comprehensive strategy to combat foreign over-fishing in the NAFO Regulatory Area.

The Canadian strategy to combat foreign over-fishing has resulted in increased dedicated enforcement activities and diplomatic interventions related to non-compliance. Work has also commenced to modernize international fisheries governance in organizations such as NAFO.

If larger quantities of 2J3KL cod become available in the NRA, there is a risk that fishing mortality from foreign fisheries could increase. This could have a significant impact on cod recovery. Ensuring that the impact of the foreign fishery on a rebuilding 2J3KL cod stock is minimized will require the continuation of the enhanced enforcement program implemented in 2004. New management measures (area and seasonal) could also be considered under the strategy if cod returns to this area and if such measures are supported by the Scientific Council of NAFO.

6.5. Improving Recruitment

6.5.1 Overview

The 2GH, 2J3KL, 3Ps and 4RS3Pn cod stocks are currently all experiencing low recruitment. With the exception of the 3Ps cod stock, this is in large part due to the reduced size of the SSB. However, other factors such as a high portion of first time spawning fish, a reduction in the size of some spawning components and/or a reduced area of spawning are also believed to be contributing to low recruitment.

The low SSB levels and reduced overall reproductive potential imply that there is little likelihood of achieving strong year classes during the early stages of recovery for most of these stocks. However, conservation measures, which could contribute to an increase in the number of fish reaching spawning age, an improvement in the age distribution of spawners and an improvement in the range over which spawning occurs should be considered. Management measures to mitigate the impact of human activities on cod habitat should also be considered.

Closed areas represent the primary fisheries management tool used to protect habitat, spawning grounds, spawning aggregations or stock sub-components. The Large Ocean Management Area (LOMA) concept may also represent a model by which cod habitat may be protected. Cod stock enhancement measures such as the release of hatchery-reared juvenile cod or the catch, grow-out and release of wild cod have also been proposed as a potential method which might contribute to improved recruitment.

6.5.2 Closed Areas

6.5.2.1 Background

Directed fishing was routinely carried out on spawning concentrations of cod prior to the introduction of the moratoria of the early 1990s. When these fisheries were re-opened in the mid-to-late 1990s, various closed areas and times were instituted to protect spawning aggregations or a particular stock sub-component. Specific area closures which have been implemented (or proposed) to assist cod recovery are as follows:

- **Hawke Channel**

This area was initially closed to otter trawls and gillnets in September 2002 - as a measure to conserve the declining snow crab resource in Division 2J. The existing closed area of the Hawke Channel was expanded (to a 50 by 50 nautical mile zone) in 2003 as a conservation measure to protect spawning and juvenile concentrations of cod.

- **Bonavista Corridor**

In 2003, the Minister of Fisheries and Oceans accepted the recommendation of the FRCC pertaining to the closure of Tobin's Point area in the offshore area of Division 3L. This recommendation has not yet been implemented. Industry is generally supportive of the area closure, but further discussions are required to define the location, timing and duration of the closure.

- **Inner Placentia Bay**

The inner portion of Placentia Bay in the Sound Island, Woody Island and Bar Haven Island area is closed to all groundfish fishing activity on a seasonal basis - from January 1 to May 2. This conservation measure is intended to protect over-wintering and spawning aggregations of migratory cod and the over-exploitation of the Placentia Bay sub-component of the southern Newfoundland stock.

- **St. Pierre Bank**

The St. Pierre Bank/Halibut Channel area of Subdivision 3Ps is closed to directed fishing for cod on a seasonal basis - from March 1 to June 30. The coastal area (3Ps - a,b,c) is

also closed to directed cod fishing on a seasonal basis - March 1 to May 31. These measures are intended to protect cod during spawning periods.

- **Burgeo Bank**

The Burgeo Bank area of Subdivision 3Ps is closed to directed cod fishing on a seasonal basis - November 15 to April 15. The coastal zone portion of this area is also closed to directed cod fishing by non-resident fishers during this seasonal period. These closures are intended to protect 4RS3Pn cod from directed fishing during the time when fish from this stock are believed to migrate into this area.

- **Bay St. George**

The Bay St. George/Port au Port area of Division 4R is closed to all groundfish fishing activity on a seasonal basis - May 15 to June 23, 2004 and April 1 to May 14, 2005. This closure is intended to protect cod during spawning periods.

6.5.2.2 Considerations

There is general support within industry that if there is to be a fishery on "stocks in trouble" then spawning aggregations should be protected and a recognition that it is better to harvest fish that have already contributed to the stock. However, area closures can be problematic in terms of the identification of spawning areas and times, the displacement of harvesting effort and so forth. In the case of 3Ps, the harvest of post-spawning fish has also resulted in fish which are of poor quality and texture. For these reasons, closed areas need to be closely monitored to determine if the initial objectives for such closures are being realized.

There is a great deal of scientific uncertainty regarding where and when cod spawning actually occurs or where it occurred historically. Identification of a relatively small closed area to protect spawning activity is therefore difficult to accomplish. Improvements in recruitment or stock status resulting from the implementation of closed areas are also difficult to quantify.

Implementation of closed areas will generally result in a displacement of fishing effort to alternate fishing grounds. Fishing effort can also become concentrated into progressively smaller geographic areas (and for shorter periods of time) when multiple area closures begin to converge - as is the case in Subdivision 3Ps. The displacement or concentration of fishing effort in alternate areas may be equally detrimental to the stock - given the uncertainties surrounding the location of spawning or juvenile cod concentrations.

6.5.2.3 Recommended Approach

9. It is recommended that the existing closed areas management approach be continued to protect spawning aggregations, critical habitat, or specific sub-components of cod stocks.

Specific management measures which would be continued (or could be adopted) under this approach include:

- Continue the current suite of closed areas and conduct an analysis on the potential effectiveness of these areas in an attempt to determine if the initial objectives for these closures are being realized.

- Determine, in conjunction with industry, if there are other spawning aggregations or critical habitat that should be protected through the implementation of additional closed areas.

- Consider, where necessary, additional measures to reduce the level of exploitation on specific sub-components of these stocks.

- In areas where the closure applies to directed cod fishing only - consider expanding the application to all fisheries if cod by-catch levels are problematic.

- In areas where the closure applies only to certain gear types - consider expanding the application to all gear types if they are destructive to cod habitat or are generating excessive by-catch.

6.5.3 Critical Habitat

6.5.3.1 Background

Cod mature, feed and spawn in various habitats throughout their life cycle - from a vast area of the continental shelf, throughout the water column and in a range of bottom depths. These habitats are critical to the survival of the species and can be vulnerable to natural or human-induced changes in the ocean ecosystem.

Although natural change to fish habitat is impossible to prevent, it is possible to control the use of the ocean by humans. The sources of human-induced change to the marine environment include activities such as fishing, aggregate mining, exploration and production of hydrocarbons, marine tourism, pollution, marine transportation and aquaculture. The effect of these activities on the marine environment may include pollution (chemical, solid waste, noise), or the physical disruption, alteration and/or destruction of habitat.

6.5.3.2 Considerations

Mitigating the potential damage or destruction to critical fish habitat requires, not only knowledge of the location of such sensitive areas, but also an understanding of the consequences of preventing human activity from damaging habitat. It may not be practical or acceptable to consider protecting all critical habitat in relation to cod. Before any action can be taken to mitigate potential damage or destruction of habitat it must first

be determined if alterations to the habitat in question are acceptable, and if so, to what degree.

Under SARA, the critical habitat of a species must be identified (to the extent possible) in the Recovery Strategy and where this is not possible, it should be identified in the Action Plan. If insufficient information exists to identify critical habitat, a schedule of studies required to identify it must be included in the Recovery Strategy and/or Action Plan.

Large Ocean Management Areas (LOMA) represent a new approach to managing the marine ecosystem to protect the oceans and the resources they contain. LOMAs may contain smaller Marine Protected Areas (MPA) or other conservation techniques (i.e. *Fisheries Act* closures) where concerns unique to that particular area can be managed.

A significant number of sensitive areas have already been closed to protect spawning aggregations and/or exploitation levels on particular stock sub-components. These closures may also be functioning to protect critical cod habitat areas in waters adjacent to Newfoundland and Labrador.

6.5.3.3 Recommended Approach

10. It is recommended the ecosystem approach concept be examined as a potential approach to assist cod recovery and protect critical cod habitat - e.g. Large Oceans Management Areas (LOMAs), Marine Protected Areas (MPAs) or further area/time closures.

6.5.4 Enhancement

6.5.4.1 Background

Atlantic cod have been a primary target for marine stock enhancement since the 1880s. During the early part of this period, hatched larvae where released in several countries including Norway, the United States, Canada and Newfoundland. More recently, two basic approaches have been proposed to enhance the reproductive potential of cod stocks adjacent to Newfoundland and Labrador. These approaches include cod catch, grow-out and release projects and the release of hatchery-reared juvenile cod.

6.5.4.2 Considerations

A key unknown with regards to cod enhancement is the survival rate of the eggs and offspring produced by the fish released under a grow-out and release approach or the hatchery-reared juveniles approach. To have an impact on cod recovery, the scale of the enhancement program would need to be enormous. Roughly 99.9% of cod mortality occurs within the first four months following spawning.

The scale of any proposed cod enhancement initiative would be extremely small relative to the size of the existing small spawning stock populations. Additional recruitment due

to enhancement would only be a fraction of what is produced by the existing population. As well, the availability and cost of feed could represent a key logistical and economic issue for any large scale grow-out and release projects.

Local capacity to produce large numbers of juvenile cod for use in enhancement programs may increase substantially in the near future. However, production of juvenile cod is expensive. Based on current technology, costs are estimated at about $2 per fish. Scaling enhancement to provide a reasonable number of fish to evaluate the feasibility of any inshore cod enhancement project would require a significant public investment.

Other factors currently impeding recovery, particularly factors associated with the high level of natural mortality in the southern Labrador - east Newfoundland stock will likely affect the feasibility of enhancement projects. Fishing mortalities, by way of directed fisheries or by-catch in other fisheries, also represent impediments to the success of cod stock enhancement.

6.5.4.3 Recommended Approach

Industry stakeholders and the Action Team are of the view that cod enhancement should not be pursued at this time due to costs, scale and the uncertain outcomes.

6.6. Predator Species

6.6.1 Overview

Mortality from sources other than fishing is very high for the southern Labrador-east Newfoundland cod stock. Total mortality is especially high on juvenile cod in the offshore areas of 2J3KL where few fish survive beyond age five. Until recently, natural mortality was also high for the northern Gulf cod stock. However, mortality from sources other than fishing has shown no signs of being unusually high for the southern Newfoundland stock in 3Ps and there is no information available on natural mortality levels for the 2GH cod stock.

The causes of elevated mortality levels on the 2J3KL cod stock and, until recently, the 4RS3Pn cod stock are not fully known. However, many believe that predators are the single most important cause of this increased natural mortality.

The predators of cod tend to change as they grow. Very small cod are eaten by squid, various groundfish (such as sculpins) and some seabirds. Larger juveniles are eaten by various groundfish (most notably Greenland halibut and cod), harp and hooded seals, certain marine mammals (e.g. harbour porpoise, pilot whales) and likely minke whales. Large cod probably have few natural predators, but seals can prey upon them by belly-feeding. In the Gulf of St. Lawrence, an increasing abundance of mackerel and herring has been postulated to result in high predation on cod eggs and larvae.

6.6.2 Seals

The predator that has received the most attention in terms of cod recovery is the harp seal. It has been estimated that harp seals consumed about three million tonnes of prey (all species) in 2J3KL and 3Ps in 2000. This represents about 40% of the annual consumption of prey by the harp seal population. Approximately one-half of the annual consumption by harp seals is taken in the Arctic and approximately 10% is taken in the Gulf of St. Lawrence.

Cod is a minor prey for harp seals. The harp seal diet (as reconstructed from the hard parts of prey found in their stomachs) is mainly comprised of plankton-feeding pelagic fish. The dominant prey species for harp seals in the 2J3KL area are capelin, Arctic cod, sand lance and herring.

Although cod constitutes a minor prey for harp seals, studies indicate that seals can consume significant quantities of cod. For example, the quantity of 2J3KL cod consumed by harp seals in 2000 (based on samples collected up to 1998) was estimated at 37,000t based on average diet data and other factors such as the number of harp seals, the energy requirements of individual seals, the average duration of seal occurrence within the 2J3KL area and the relative distribution of seals between the inshore and offshore areas. Similarly, a more recent study on the consumption of Atlantic cod by harp seals in the northern Gulf of St. Lawrence estimated that harp seals consumed in the order of 28,000t of 4RS cod in 2003. It should be noted, however, that these consumption estimates are highly imprecise due to geographic, seasonal and annual variations in the diet.

There is insufficient evidence to determine if the high mortality levels being experienced in the offshore area of 2J3KL since the mid 1990s are associated with fishing, poor condition, predation or other factors. Recorded by-catches of cod by domestic and foreign fisheries in this area have been small. Likewise, most information on body size shows that the fish have not been in unusually poor condition in recent years.

Although the diet data from offshore areas do not include cod, it has been concluded based on seal feeding behavior in inshore areas and trends in the abundance of both seals and cod, that predation by seals is a factor contributing to high total mortality of cod in the offshore area of 2J3KL. The contribution of other predators to total mortality is unknown.

Adult cod in the inshore areas of Divisions 3KL have also been experiencing high mortality over and above that due to fishing. The continuing presence of cod in the stomach contents of harp seals sampled inshore combined with observations of belly-feeding on adult cod indicate that predation by harp seals is a contributor to the high natural mortality of 2J3KL cod in the inshore.

The mortality rate for cod in 4RS3Pn has also been high until recently. In 1986, it was decided to increase the natural mortality level from 0.2 to 0.4 for this (and other) cod stocks for stock assessment purposes. This increase was intended to reflect a deterioration of environmental conditions, an escalation in wasteful fishing practices and an increase in predation by seals. Environmental conditions and fishing practices have improved in recent years and as a result natural mortality is believed to have returned to more normal levels. Nonetheless, seal predation remains significant in this area.

Predation on cod by hooded seals is less well known. The size of the hooded seal population is not currently known because (prior to the recently completed survey in February 2005), a survey had not been conducted since 1990. In addition, there is no data available since the early 1990s to assess the diet of hooded seals. Analysis of a limited number of stomach samples collected in the late 1980s and early 1990s shows that hooded seals could be important predators on the southern Labrador - east Newfoundland cod stock.

It has also been suggested that seals might have a detrimental affect on cod by competing with them for prey species such as capelin. However, there are numerous other capelin predators including squid, other groundfish, baleen whales and birds. Furthermore, cod, harp seals, and numerous other predators share other forage fish such as herring, Arctic cod and sand lance.

6.6.3 Atlantic Seal Hunt Management Plan

Fisheries and Oceans Canada adopted an Objective Based Fisheries Management (OBFM) approach for harp seals in 2003. This approach uses reference points and control rules to establish a clearer basis for managing the harp seal hunt. The reference points were set based on the maximum observed size of the herd (up to that time) of 5.5 million seals. Under the OBFM approach, the Department of Fisheries and Oceans is committed to maintaining the harp seal population at a level above the 70% reference point - which is about 3.99 million animals.

The Canadian harp seal management plan which was introduced in 2003 allowed for a total Canadian harvest of 975,000 seals over the three-year period 2003 to 2005. At this TAC level, the population was projected to decline from an estimated 5.5 million animals to about 4.7 million animals by 2006.

A new aerial survey was conducted on the harp seal population in 2004 under the Atlantic Seal Research Program. This survey was designed to estimate pup production and derive a population estimate for the herd. The aerial survey indicated that the estimated number of harp seal pups born in 2004 was very similar to the number estimated to have been born in 1999.

The National Marine Mammal Peer Review Committee conducted a scientific peer-review of the 2004 pup production and population estimate for the harp seal herd in May 2005. When using the 2004 pup estimate in a mathematical model, the total population

size of the herd was estimated at 5.7 million animals in 2004. The population has been stable since the mid 1990s and this higher estimate is due to the way in which the model fits to the data collected since 2000 (often referred to as re-tuning the model).

The recent scientific information on the Northwest Atlantic harp seal population will serve to provide scientific advice to Fisheries and Oceans Canada in the preparation of a new Atlantic Seal Hunt management plan. A Seal Forum was also held in November 2005 where DFO, sealers, industry stakeholders, non-government organizations and other interested groups discussed plans and options for the next multi-year management plan.

6.6.4 Industry Views

Industry stakeholders strongly believe that cod stocks will not recover given the increasing level of consumption by harp seals. The size of the harp seal population or the number of seals which should remain in the system represents a key cod recovery issue in their view. Stakeholders recognize that it is difficult to get good seal diet data particularly during active feeding and foraging periods; and that modeling seal consumption is very complex. They further acknowledge that the removal of substantial numbers of harp seals would have a positive effect on recovery in the short-term, but that the long-term benefits are less certain.

Industry also has concerns with what they view is an increasing number of hooded seals and question why this species is not managed in a manner similar to harp seals. The impact of hooded seals on cod needs to be further examined particularly since hooded seals are known to hunt mainly offshore and to feed on larger fish.

The growth of large colonies of grey seals in the Belle Isle area of 4R and 2J3K is also viewed as a problem which is being overlooked. The establishment of Seal Exclusion Zones, with allowable kill provisions, would limit the growth of such colonies in what is regarded as a prime habitat area for grey seals.

6.6.5 Considerations

The $6 million Atlantic Seal Research Program (ASRP), which was implemented in 2003, is intended to provide information on the extent of seal predation on cod and scientific advice on management measures that could reduce current and future predation levels. The ASRP consists of several key initiatives including harp and hooded seal surveys, movement and migration research, seal consumption/diet data analyses, and research into the effectiveness and feasibility of management measures such as Seal Exclusion Zones. A two-year pilot Seal Exclusion Zone project was established in Smith Sound, Trinity Bay, during the winters of 2003/04 and 2004/05. However, preliminary results indicate that a Seal Exclusion Zone is not practical in this area and may be unrealistic in larger areas.

The complexities of the food web, and man's rudimentary understanding of its dynamics, make it very difficult to assess the potential benefit that might accrue to cod from specific

reductions in the abundance of harp seals. It is often assumed that a reduction in the number of seals will result in a decrease in the consumption of cod and as a result the abundance of cod will increase. This assumption seems logical, at least in the short term. That is, a sharp (i.e. significant) reduction in seal predation on cod of commercial size would immediately increase their availability to the fishery (or increase the size of the spawning stock).

Similarly, a reduction in seal predation on pre-recruit fish might give enough short-term relief to permit substantially more recruits to contribute to the spawning stock. However, other outcomes are possible, especially in the longer term. It must be recognized that the number or weight of cod consumed by seals may depend not only on seal abundance and cod abundance, but also on the distribution and degree of aggregation of the cod and the availability of alternate prey for the seals. There is also the possibility that cod saved from predation by seals may die from some other cause before they can contribute to a fishery or to the production of more cod.

The 2001 *Report of the Eminent Panel on Seal Management* concluded that an increase in the harvest of harp seals would result in a reduction in the annual consumption of Atlantic cod and, by extension, an increase in the amount of commercially exploitable fish. However, the Panel's analysis indicated that this reduction would be modest. An increase in the harvest of harp seals in the order of 375,000 adult females or 750,000 pups over a five-year period would result in the consumption of Atlantic cod being reduced by 3,100 to 3,900t per year, of which 1,500 to 1,900t would be commercially exploitable fish.

The high mortality experienced by 2J3KL cod and, until recently, 4RS3Pn cod has been a major impediment to recovery. However, even if survival can be substantially improved, these stocks will take a long time to reach their previous historical biomass levels. Each of these stocks is starting from a very low level and given the small spawner stock biomass levels and reduced overall reproductive potential there is little likelihood of strong year-classes during the early stages of recovery. Furthermore, each of these stocks has an inherently low population growth rate due to the slow individual growth of the fish and the relatively late age at maturity.

6.6.6 Recommended Approach

11. It is recommended that DFO consider the impact that seals, in particular the Northwest Atlantic harp seal population, may be having on cod recovery in the development of the multi-year management plan for seals.

The Canada-NL Action Team for Cod Recovery is of the view that seals and, in particular, harp seals are contributing to the lack of recovery in the southern Labrador - east Newfoundland and northern Gulf cod stocks.

Recent scientific information indicates that the Northwest Atlantic harp seal population remains stable and healthy at approximately 5.7 million animals. This is well above the

70% reference point of approximately 3.99 million animals as specified under the OBFM approach for this population.

The harp seal hunt must continue to be managed in a way that ensures conservation of the herd as well as the sustainability and economic viability of the seal hunt. However, given the size of the current harp seal population, there is a need to examine further measures to control the population.

6.7. Prey Species

6.7.1 Overview

The influence of forage species on cod recovery is difficult to assess. However, concerns exist that inadequate supplies of certain prey species may be hindering the recovery of some of these stocks. These concerns are related to the importance of prey to fish condition and growth and the resulting influence that this may have on productivity; and perhaps the ability of fish to survive harsh environmental conditions.

Cod feed on a wide variety of prey. The major prey for small cod are planktonic crustaceans, notably hyperiid amphipods in the north and euphausiids on the Grand Bank. For medium-size cod the major prey are schooling planktivorous fish. The most important of which is capelin, but Arctic cod are eaten in the north, herring are consumed in inshore waters, and sand lance are important on the Grand Bank. Large cod tend to feed on medium-sized fish and crabs, especially toad crabs and small snow crabs. Shrimp are consumed by a broad size range of cod. Cod also feed on smaller cod, but cannibalism is not an important aspect of the cod's diet.

6.7.2 Capelin Stocks

Capelin is the prey species that has received the most attention in terms of cod recovery, particularly with regard to the 2J3KL cod stock. Most commercial catches of this species are taken in the 2J3KL area and there is some concern that there may not be sufficient capelin available to support a recovery of this stock to its former biomass level - especially in the offshore and in the north.

Capelin is a small pelagic fish member of the *Osmeridae* family with an arctic circumpolar distribution. In the northwest Atlantic, capelin can be found along the coasts of Newfoundland and Labrador, on the Grand Banks as well as in the Estuary and the Gulf of St. Lawrence. Scientific assessments for this species are conducted based on the capelin populations in SA2 + Divisions 3KL and Divisions 4RST.

The status of the capelin stock in SA2 + Divisions 3KL has been highly uncertain since the early 1990s. A spring offshore hydroacoustic survey in 1990 produced a population estimate of approximately 6.9 million tonnes, whereas the estimate the following spring stood at only 100,000t. Hydroacoustic surveys have failed to find much capelin in the offshore since that time. In contrast, capelin indices from the inshore areas (such as

commercial catch rates and school areas derived from aerial surveys) do not suggest such a precipitous decline.

Recent scientific assessments of the capelin population in Division 4RST have indicated that the stock is relatively healthy and that the commercial fishery does not appear to have an impact on capelin abundance. However, science have advised that any increase in the TAC for this population should be progressive due to capelin's prominent role in the marine ecosystem, the lack of knowledge regarding its biology and the absence of an abundance survey targeting specifically this species.

Capelin stocks undergo substantial changes in biomass over time. These changes appear to be related primarily to changes in recruitment, which are in turn influenced by wind patterns acting on spawning beaches and possibly temperature and other factors. The biomass is also dependent on the individual size of fish in the population. For example, it has been estimated that even if the number of capelin in the SA2 + Division 3KL stock had not changed between the 1980s and 1990s, the total biomass would have declined by close to 30% due to a decline in the weight of individual fish over these two periods. It is likely that the number and kind of predators also affects the survival rate of capelin.

Many inshore fish harvesters believe that the capelin stock in SA2 + 3KL has been well below its historical abundance since the early 1990s. This perception may be influenced, in part, by the many apparent changes in capelin biology that occurred during the 1990s - including a reduction in average size, the late arrival in coastal waters and increased spawning in deeper waters. These (and other) changes were initially believed to be due to below normal sea temperatures. However, the biological characteristics did not revert to their former status during the latter half of the 1990s and early 2000s despite a warming in water temperatures. Water temperatures may not have been the sole reason for the apparent changes in capelin biology.

6.7.3 Capelin Fishery

Canada has never had a reduction fishery for capelin and as a consequence, the Canadian fishery has been small relative to those in waters around Iceland and in the Barents Sea. In the late 1970s, scientists advised that the TAC for capelin should be set at a conservative exploitation rate of 10 % due to poor recruitment. The rationale for maintaining this approach was expanded in 1982 when concern was expressed over the effect that the capelin fishery might have on cod and other predators. There has been no scientific evaluation of the capelin stock in SA2 + Division 3KL since 2000, and hence it is not possible to determine the current exploitation rate or to assess the extent to which exploitation has affected stock status in more recent years.

Foreign catches of capelin increased substantially in the early 1970s and peaked at about 250,000t in 1976 when foreign fleets began fishing this species in the offshore area of 2J3KL. The foreign fishery for capelin was closed in Division 3L in 1979, but continued at a relatively low level in Divisions 2J3K up to 1991. The foreign fishery in offshore 2J3K was closed in 1991.

Canadian fish harvesters started to fish for mature capelin inshore, near the spawning beaches in the late 1970s. The inshore coastal fishery expanded rapidly during the 1980s and catches peaked at the 90,000t level in the late 1980s. However, the domestic capelin fishery declined rapidly after 1990. Annual catches varied considerably throughout the 1990s, but the average catch amounted to only 20,000t during the 1994 to 2003 period. Weak markets were a factor in this decline.

In April 2003, the TAC for capelin in the Gulf of St. Lawrence and in waters to the northeast of Newfoundland and Labrador was reduced by 40%, from 49,000t to 29,000t, for the three-year period 2003 to 2005. This reduction was implemented as a precautionary approach, given the uncertainty around the status of capelin and in recognition of the importance of capelin as a food source for cod. The TAC for capelin in 4RST was subsequently reinstated to its former level of 13,000t in 2005 based on the health and abundance of capelin in this area.

The inshore coastal fishery landed 35,430t of capelin valued at $9.6 million in 2004 and 33,520t valued at $9.5 million in 2005. The 2004/2005 fisheries represented the first substantial capelin fisheries for some years.

6.7.4 Considerations

Capelin were historically the main food of the southern Labrador - east Newfoundland cod stock. Growth and condition of fish in this stock likely depend on having an abundance of capelin on which to feed. Studies from 1994-2004 have indicated that offshore cod off southern Labrador and north of the Funk Island Bank (2J and northern 3K) lacked capelin in their diet and had reduced liver and reproductive condition, as compared to the 1980s in the same area and to cod in more southern areas in the 1990s. The normal seasonal decline in body condition after spawning may also have been more severe in the northern areas. In contrast, cod in the inshore area appear to be faring well in all seasons, and their diet has been relatively rich in capelin.

Concerns regarding the inability of a cod stock to recover without a high availability of capelin are based on the assumption that there is no species (or group of species) that can replace capelin in the diet of cod. In the 2J3KL cod stock area, there has been a substantial increase in the abundance of snow crab and northern shrimp since the mid-1990s. Both of these species were moderately important prey for northern cod prior to the 1990s. But, these species may be less valuable than capelin as prey because they are digested much more slowly and have a lower fat content.

The diet composition and intensity of feeding of southern Labrador - eastern Newfoundland cod has been less well studied in recent years. Observations of diet have been made since the late 1990s (during studies conducted by scientists at Memorial University of Newfoundland and Labrador), but the collection of cod stomachs during annual DFO bottom-trawl surveys was discontinued during the latter half of the 1990s.

The inshore fishery catches a small amount of capelin (approximately 34,000t in 2005) relative to the total biomass and only for a short period of time prior to spawning. Given this, the immediate benefit to cod if these capelin were not caught is difficult to assess. Some of the capelin that is spared from the fishery would be eaten by other predators such as whales and birds. Likewise, a high proportion of capelin that survive the nearshore predator gauntlet die during or shortly after spawning.

Many industry stakeholders believe that ecosystem conditions for prey species appear to have improved in recent years and that this could have a positive impact on cod recovery. The general view of participants at the Workshop on Cod Recovery was that SA2 + Division 3KL capelin stock has not improved significantly. However, the abundance of sand lance, billfish and snail fish appears to be increasing. An increase in herring, capelin and squid has also been observed on the south coast of Labrador in recent years and the abundance of capelin in Division 4R appears to have improved. More recent observations in 2005 also support the view that the abundance of capelin is increasing in Division 3KL.

6.7.5 Recommended Approach

12. It is recommended that the current approach for the management of the capelin fishery be continued. That is, no capelin fishery in the offshore area of Division 2J3KL and a conservative capelin fishery in coastal areas.

During the Action Team's public consultation process, a small number of stakeholders recommended that a moratorium be placed on the capelin fishery in order to assist cod recovery. The dominant view, however, was that the current (and historical) TAC for this species is insignificant relative to the estimated total capelin biomass.

6.8 Seismic Activities

6.8.1 Background

There have been several studies which indicate that seismic testing may have limited impact on marine life. The DFO Habitat Status Report "*The Review of Scientific Information on Impacts of Seismic Sound on Fish, Invertebrates, Marine Turtles and Marine Mammals"* (published in September 2004) contained an evaluation of scientific literature for various experimental and field studies on the impact of seismic sound on marine organisms. The report concluded that, "from available evidence, seismic sounds in the marine environment are neither completely without consequences nor are they certain to result in serious and irreversible harm to the environment." The report further noted that the history of seismic surveys globally in marine environments shows no documented fish or invertebrate kills; and that seismic surveys with fairly routine mitigation measures in place are unlikely to pose a high risk of mortality to marine organisms. Another DFO Habitat Status Report "*The Potential Impacts of Seismic Energy On Snow Crab"* (published in October 2004) indicated that a seismic program did not cause any acute or mid-term mortality to the crab.

6.8.2 Considerations

The potential for impacts of seismic exploration on fish, fish behaviour and catchability of commercial species has been an issue of concern to fishers and environmentalists. Limited experimental evidence has demonstrated that juveniles and eggs of fish may suffer immediate mortality within a few meters of seismic guns; however it is likely there is no mortality at greater distances. In addition, physiological and anatomical damage may be occurring in adult animals at unknown depths from seismic sources which may lead to effects such as delayed mortality, greater susceptibility to predation, lower resistance to disease or impaired egg quality.

A recent pilot study on snow crab demonstrated delayed egg-development in eggs that had been exposed at close range (2 meters) 3 months previously (Christian et al. 2003). Anatomical damage to the ears of caged fish exposed at close range has also been found (McCauley et al. 2003) further illustrating the need to explore the physiological and pathological effects of different sound energies on selected species at different stages of development. Given this, it follows that the size of the injury zones for eggs and larvae of fish and shellfish (and other planktonic organisms) stemming from seismic activities will have to be considered before questions of potential impacts on populations can be addressed. However, it is important to point out that the primary concern would be in relation to the potential for impacts at the stock or sub-stock level such as in a confined bay or similar type of risk zone.

Mitigation measures to lessen the impacts on marine life are required with any seismic testing. There are a variety of means to mitigate the impact of seismic exploration, such as a gradual increase ("ramping up") in intensity of air gun discharges to allow fish, marine mammals and sea turtles time to move to avoid the source of the sound; a halt ("shut-down") to all acoustic activity when qualified observers sight select marine mammals or sea turtles within a predetermined safety radius of the energy source; public notices of the intended activity to alert fishers, as commercial fisheries will be occurring during the noted time frame; and avoiding seismic activities during known sensitive areas or timeframes for marine life (i.e. migration routes, spawning areas, moulting or breeding times, etc.).

In February 2005, the Government of Canada and the provinces of Newfoundland and Labrador, Nova Scotia and British Columbia proposed a *Statement of Canadian Practice* for the mitigation of seismic noise in the marine environment. The Statement aims to create consistent and clear academic/industrial seismic applications and when finalized will establish the environmental protection rules that must be followed when conducting seismic work in Canada's marine environment. The document incorporates many of the mitigation measures currently being employed in Newfoundland and Labrador waters.

The *Statement of Canadian Practice* notes that seismic testing conducted utilizing the mitigation measures identified is not expected to cause any significant adverse environmental effects. However, seismic sounds in the marine environment are not

completely without consequence. The Statement notes that the extent of scientific understanding of the potential effects of seismic varies depending on the issue and supports the ongoing acquisition of additional scientific knowledge.

The federal government and provinces are also developing a Memorandum of Understanding (MOU)to formalize their partnership and the process that will be followed to complete, implement and make future amendments to the *Statement of Canadian Practice*. The statement, when finalized will be given effect by regulations under Canada's *Oceans Act*, the *Canada Oil and Gas Operations Act*, the federal and provincial versions of the Nova Scotia and Newfoundland and Labrador Accord Acts, as well as other provincial statutes.

6.8.3 Review Process

The licensing for seismic testing in Newfoundland and Labrador offshore areas is under the authority of the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). The Board consults with various stakeholders during the application and licensing processes to ensure all stakeholders with interest in the ecosystems that may be affected (i.e. federal and provincial government departments, One Ocean) have a role in the process. Permit applications for seismic testing are referred to DFO by the Board for evaluation, comments and recommendations for actions.

When DFO is conducting evaluations of requests for permits for seismic testing, the application of risk management depends on both the severity of the impacts of concern and their likelihood of occurrence. In the event of situations of high scientific uncertainty and potential risk of serious or irreversible harm, the Precautionary Approach suggests decision making and other actions that are more conservative than normal. If the circumstances of a particular seismic program indicate high potential risk after DFO assessment, then more intensive or comprehensive monitoring and provision of extra mitigation measures will be requested.

DFO Science has not made recommendations to date, which would unduly restrict seismic activities, but cautions about important knowledge gaps surrounding some issues. Such caution has also been highlighted in the recent Habitat Status Report *"A Framework to Assist DFO Consideration of Requests for Review of Seismic Testing Proposals*".

6.8.4 Recommended Approach

13. It is recommended that DFO, through its ongoing engagement with industry, the CNLOPB and the science community, continue to develop the collective scientific knowledge of the potential effects of seismic activities on fish stocks - including undertaking further scientific research, where necessary, on the potential effects of seismic activities on finfish.

14. It is recommended that DFO, in conjunction with the CNLOPB, continue to evaluate industry seismic proposals and ensure that appropriate risk mitigation measures are undertaken by industry in carrying out seismic programs - with particular emphasis on ensuring that the potential risks to cod stock rebuilding are minimized. In evaluating seismic proposals and through its recommendations to the CNLOPB, DFO should further ensure that all seismic operations avoid known cod spawning aggregations.

6.9. Enhancing Scientific Knowledge

6.9.1 General Research Activities

As part of its core mandate, DFO Science in Newfoundland and Labrador conducts extensive research on many groundfish species including cod. Multi-species ecosystem surveys are the cornerstone of this research and are conducted using two offshore research trawlers for approximately 200 sea days per year. As well as collecting data for cod, these surveys are used to monitor a wide range of demersal fish, crustaceans and basic environmental parameters.

The Fisheries Conservation Chair at Memorial University of Newfoundland and Labrador conducts fisheries research which complements government programs and provides an integrative focus for fisheries research at Memorial. In addition to providing a wide range of opportunities and training for students at the graduate and post-doctoral level in fisheries science, the Chair focuses on several aspects of fisheries science and management including: the collapse and rebuilding of groundfish stocks; surveys and stock assessment using conventional and acoustic technologies; working with the fishing industry; and an ecosystem-based approach to management and conservation.

The offshore groundfish industry, through the Groundfish Enterprise Allocation Council (GEAC), with support from DFO Science, also conducts an annual stratified survey in the southern Newfoundland cod stock area. This survey, which was initiated in 1997, uses an unlined commercial trawl and the results are included as part of the Regional Advisory Process (RAP) for this stock.

Fisheries and Oceans Canada conducts a range of additional research and monitoring on these stocks. These activities vary from area to area, but include scientific sampling of commercial catches, specialized sampling in support of scientific research, sampling to investigate reported phenomena, and contact with the fishing industry and general public.

More collaborative approaches between industry and government on research and monitoring issues have also been developed for most of these stocks over the last decade. Foremost among these is the Groundfish Sentinel Program (GSP) where experienced commercial fishers are engaged to fish in a structured manner to monitor changes in abundance over time. The GSP also provides an opportunity to collect additional biological information about target resources and a vehicle for other research activities.

The Fisheries Science Collaborative Program (FSCP) is a relatively new initiative between DFO and the Atlantic fishing industry and is intended to undertake jointly funded activities to address priority research issues. The FSCP applies to all species, but in the current year (2004/05) several cod-related research projects are being undertaken including Reproductive Capacity, Condition and Tagging. Participation in this program requires the industry party to provide at least 20% of the resources to complete the necessary work. Local Area Working Groups have been formed between industry and DFO Science to review and agree on the priority research issues and the allocation of available funding. An Atlantic-wide industry/government Management Board oversees the operation of the program.

DFO is also conducting research in a number of new areas related to 2J3KL cod including cod tagging and tracking. In April 2005, $11 million in new program funding was announced that will focus on gaining a better understanding of sensitive marine areas and sensitive aquatic species associated with the Grand Banks. This program will include research on straddling and highly migratory fish stocks, and on sustainable fisheries practices and harvesting strategies that use a precautionary approach.

6.9.2 Other Research Activities

Other research activities currently being conducted in support of cod recovery include:

1. Mixing and Migration

Stock mixing and migration between the northern Gulf and southern Newfoundland cod stocks is a long-standing issue. Earlier research based on tagging and morphometrics provided some insights into this matter. But, a more robust program is currently underway to employ ultrasonic tags and receivers to monitor the movement of fish between these stocks. This research, which began in the summer of 2004, will be conducted over a 15-month period and the results should be available by March 2006. This is a collaborative research project conducted under the FSCP.

2. Quantifying Harm

Targeted research on the inshore migration patterns of 2J3KL cod, through the combining of tagging and telemetry methods, is being conducted as part of this project. Assessments of the efficiency of closed areas for reducing by-catch mortality of 2J3KL cod are also being conducted.

3. Reproductive Potential

The reproductive potential of cod stocks is usually described in terms of spawning stock biomass. However, direct evaluation of egg production is considered a better approach. Recent advances in automated measurement of cod fecundity make this a realistic approach for use in the Canadian fishery.

A research project on the northern Gulf cod stock is currently underway to develop a rapid and automated method of estimating cod fecundity. This research will determine the reproductive characteristics of this stock and develop relationships between the size, condition and fecundity of cod in this area. This information will supplement the data currently used for estimating the changes in egg production that have occurred in 4RS3Pn cod since 1984. The research is intended to evaluate changes in the reproductive potential of northern Gulf cod and the impact of these changes on the potential rate of growth. Results should be available by March 2006.

A second research program, funded in part by the FSCP, will examine fecundity and reproductive potential in northern cod (2J3KL), southern Grand Banks cod (3NO) and southern Newfoundland cod (3Ps).

4. Seal Population Updates

Surveys on the populations of harp seal and grey seal were conducted in February and March 2004 and a hooded seal population survey was completed in February 2005. These surveys will provide new estimates of the population of harp, grey and hooded seals. These research projects are being conducted under the ASRP.

5. Seal Diet

Several studies are underway to enhance knowledge on the diet of different seal species. This research will focus on places and times where diet data have been poor or missing. Targeted gaps include the diet of harp and hooded seals in the offshore areas of 2J3KL. These research projects are being conducted under the ASRP and FSCP.

6. Seal Exclusion Zones

A two-year pilot Seal Exclusion Zone (SEZ) was established in Smith Sound, Newfoundland during the winters of 2003/04 and 2004/05. This pilot project was intended to investigate the effectiveness and feasibility of using exclusion zones to protect cod from seal predation. The objective of the study was to determine if the number of seals in the area could be reduced significantly and maintained at the reduced level after the pilot project ended.

Preliminary results from this study indicate that the number of seals in the Smith Sound Area were generally low, but could vary greatly from day to day. Only 85 animals were shot in over 44 days of hunting in 2003/04 and 52 seals were taken in 33 days in 2004/05. Seals appeared to transit through the area, remaining in the Sound for only short periods at a time. Given this pattern of behavoiur, hunting would not significantly influence the likelihood of seals returning to the area and as a result, the efficacy of hunting to reduce the number of seals is questionable.

7. Seal Exclusion Zone Workshop

A workshop to conduct a scientific evaluation of the efficacy of Seal Exclusion Zones (SEZ) was held in May 2004 and included scientists from Canada, USA and Norway. Workshop participants concluded that:

- the feasibility of SEZs being effective decreased when moving from small, geographically well defined areas to more open offshore areas;

- non-lethal methods (e.g. barriers, acoustics, etc.) can work, but are generally expensive, limited in geographic scale and are usually temporary in nature;

- lethal methods can also be effective, but are dependent upon the skill level of the hunters and can pose safety concerns in some areas; and

- the effectiveness of SEZs may be linked to the biology of the animals inhabiting the areas - removals may be more effective against populations resident to an area rather than transients.

Workshop participants recommended that work in the form of "scenario modeling" be conducted on SEZs to examine issues such as costs, expected effort required, expected benefits, and whether benefits can be quantified before proceeding with any further experiments.

6.9.3 Industry Views

The role of science in cod recovery and management was an issue which was consistently raised throughout the Action Team's consultation process. Generally speaking, most of this input focused on the view that funding levels should be increased significantly.

Specific areas where stakeholders felt that additional research was necessary included:

- additional research surveys should be conducted during spawning seasons in order to give a better picture of abundance;

- potential changes in cod migration patterns require further study;

- research should be initiated in an attempt to determine why cod over age 5 are disappearing from the offshore area of 2J3KL;

- the role and importance of capelin in relation to cod recovery should be further studied;

- the importance and effect of changes in critical habitat on cod recovery needs to be examined;

- more innovative stock assessment approaches and methods such as DNA analysis, remote sensing, and hydro-acoustics need to be adopted; and

- industry needs to play a larger role in scientific research through the development of additional collaborative science projects and activities.

6.9.4 Science Priorities

The current focus of DFO's Science Program is on adjustment and re-alignment of the program to better address new and changing demands for science information. While individual species remain important, DFO is striving to develop a more holistic understanding of ecosystems, which would focus on the interaction between species and with their environment. However, conservation and recovery of depleted stocks remains an essential objective and priority of the program.

The Canada-NL Action Team is mandated to identify and evaluate current science priorities and information with respect to the management of cod stocks. This section provides commentary on potential cod research priorities which in the opinion of the Team provide the strongest linkage to the various recovery strategies that have been identified.

Within this context, a requirement for additional scientific research on the formerly dominant shelf stock components of the 2J3KL cod stock from the Hamilton Bank to the Grand Banks has been identified as a key research priority. In this regard a number of potential projects have been identified and include:

- **Research on the interactions between cod, capelin and seals in the offshore area of Divisions 2J3KL.**

  Further study is required in order to better understand the interactions among cod, capelin and seals and other components of the ecosystem and in particular the role of prey and predators in the recovery of northern cod. A comprehensive study approach would incorporate spatial modeling techniques and require additional data collection including capelin population information and cod stomach examination and analysis. Of particular importance is the ability to include seasonal changes in distribution of all major species.

- **Further work to determine Precautionary Reference Points for cod stocks in Newfoundland and Labrador**

  Conservation limit reference points represent thresholds which can be used to delineate three general stock status zones (critical, cautious and healthy) and indicate when a stock is considered to have impaired productivity and where serious harm may have occurred. Further work is required to refine Limit Reference Points for the

various biological indicators that could be used in establishing a PA framework for cod stocks in Newfoundland and Labrador.

- **Additional research to determine the timing and location of spawning. Such studies would aid in identifying critical habitat in support of closed area management.**

  Dedicated hydro-acoustic/bottom trawling studies would be conducted from February to June to determine the distribution of cod in spawning condition and the relationship between spawning areas and nursery areas. This would include a winter survey (February-March) near the shelf break and to depths of at least 500m from northern Hamilton Bank (2J) to the Nose of the Grand Bank (3L).

- **Additional research to study the impact of seal predation on cod populations.**

  Intensify the collection of harp seal and hooded seal stomachs from offshore waters, ensuring that the sampling is representative of seal distribution in space and time.

- **Additional research to study the migration patterns of cod within the inshore and between the inshore and offshore. A better understanding of cod distribution, behaviour and population dynamics is vital to determining the impact of an inshore fishery on the recovery of cod in the offshore.**

  Extension of current studies that employ acoustic tags and recorders to monitor movements of cod along the coast of eastern Newfoundland, especially in the area from Smith Sound to Bonavista Bay. Dedicated surveys during spring, summer, and autumn to look at the distribution of cod in the deep nearshore waters from Trinity Bay to Notre Dame Bay. These surveys would employ hydroacoustics supported by trawling and deep-water gillnetting. A conventional tagging program should be part of any directed inshore fishery for cod. This will provide additional information on fish movements and important information on exploitation rates.

The research priorities outlined above will be very costly and will require significant resources in terms of personnel, operating and capital costs. Cod research priorities must also consider research requirements to support the management of other commercial species; as well as the move to the broader ecosystem approach to resource management. The Action Team also recognizes that cod recovery requires a collaborative approach. This approach may require new and innovative funding strategies including new federal/provincial partnerships, and productive and strong collaborations with academia, industry and communities.

7. Sumary

Table 1 provides a summary of the objectives, recommendations and action plan for the Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador.

TABLE 1
Elements of a Strategy for the Recovery and Management of Cod Stocks in Newfoundland and Labrador

Element	Objective	Recommendation	Action
Management Framework	• Modify Fisheries Management Framework	1. Further develop a risk management approach for the management of cod stocks. 2. Identify and pursue additional shared stewardship opportunities for the management of cod stocks. 3. Adopt TAC decision rules process for the management of cod stocks. 4. Continue moratorium on 2GH cod stock. 5. Continue moratorium on offshore component of the 2J3KL cod stock. 6. Continue moratorium on the inshore component of the 2J3KL cod stock subject to the development (on a priority basis) of a formal process to evaluate the risks associated with the re-opening of small-scale fishery.	• Determine the PA reference points for various biological indicators/productivity factors that could be used to define the boundaries between the critical/cautious and cautious/healthy zones for each of these stocks. • Develop associated decision rules and management actions which could be taken as stock status changes. • Examine ways by which stakeholders can become more effectively involved in scientific assessment and fisheries management processes. • Consult on potential benefits and impediments related to the development of shared stewardship and shared decision-making management models for these stocks over the longer-term. • Continue development of TAC decision rules process for 4RS3Pn cod stock. • Adopt TAC decision rules process on priority basis for 3Ps cod stock. Implement similar process over long-term as 2GH and 2J3KL cod stocks recover. • Conduct, in conjunction with industry, assessment of the scientific, management and public policy issues and risks associated with the re-opening of a small-scale, index type fishery on the inshore component of the 2J3KL cod stock.
Fishing Mortality	• More Effective Management of Fishing Mortality	7. Continue current multi-faceted approach for the management of by-catch, discarding, etc. and implement additional measures when necessary to more effectively manage fishing mortality issues.	• Adopt more stringent requirements, where necessary, for the management, control and monitoring of by-catch in other directed fisheries. • Increase observer coverage in directed cod fisheries when (and where) the catch and discarding of small fish is likely to be high. • Conduct a review, in conjunction with industry, of additional measures such as seasonal closures or gear restrictions to address the discarding of fish. • Continue efforts to improve the Dockside Monitoring Program (DMP) through initiatives such as the Fish Landing Station Protocol (FLSP). • Continue current initiative to redesign the Observer Program and consider, in conjunction with industry, management measures that will alleviate on-going monitoring and enforcement issues. • Develop and implement an effective public relations and awareness campaign on the importance of cod conservation.
Foreign Fishery	• Minimize catch of 3L cod in NAFO Regulatory Area	8. Pursue a comprehensive strategy to combat foreign over-fishing in the NRA.	• Continue enhanced enforcement program which was implemented in 2004. • Consider new management measures (areas and seasonal) if cod returns to 3L portion of NRA.
Recruitment	• Contribute to Improved Recruitment	9. Continue current closed area management approach to protect spawning aggregations, critical habitat or specific sub-components of cod stocks.	• Maintain the current suite of closed areas, and conduct an analysis of the potential effectiveness of these areas. • Determine if there are other spawning aggregations or critical habitat areas that should be protected through the implementation of additional closed areas.

Element	Objective	Recommendation	Action
		10. Examine ecosystem approach concept as potential approach to assist cod recovery and protect critical habitat – LOMAs, MPAs or further area/time closures.	• Implement, where necessary, additional measures to reduce the level of exploitation on specific sub-components of these stocks. • In areas where the closure applies to directed cod fishing only – consider expanding the application to all fisheries if cod by-catch levels are problematic. • In areas where the closure applies only to certain gear types – consider expanding the application to all gear types if they are destructive to cod habitat or are generating excessive by-catch.
Predators	• Control Impact of Predator Species - i.e. Seals	11. Consider impact that seals, in particular the Northwest Atlantic harp seal population, may be having on cod recovery in the development of new multi-year seal management plan.	• Impact that seals may be having on cod recovery to be considered in development of new multi-year Seal Management Plan. • Seal management measures – including future TAC levels - to be considered within context of OBFM approach.
Prey	• Conservation of Prey Species - i.e Capelin	12. Maintain current approach for management of capelin fishery.	• Continue moratorium on capelin fishery in the offshore area of Division2J3KL. • Continue coastal fishery subject to conservative exploitation rate.
Seismic Activities	• Enhance Knowledge/Risk Mitigation	13. Continue to develop the collective scientific knowledge of potential effects of seismic activities on fish stocks. 14. Continue to evaluate industry seismic proposals and ensure that appropriate risk mitigation activities are undertaken by industry.	• Undertake further scientific research, were necessary, on potential effects of seismic activities on finfish. • Ensure that potential risks of seismic activities on cod stock rebuilding are minimized and ensure that all seismic activities avoid known cod spawning aggregations.

Annex 1

Terms of Reference

Canada/Newfoundland & Labrador Action Team for Cod Recovery
Terms of Reference

Introduction and Rationale

On April 24, 2003, the Minister of Fisheries and Oceans announced the indefinite closure of the Northern cod (2J3KL) and Northern Gulf cod (3Pn4RS) fisheries. These fisheries have been critically important to the economy, history and culture of the Province of Newfoundland and Labrador.

Historically, these two stocks provided approximately 320,000 tonnes of fish annually to the province's fishing industry. In doing so, they provided a livelihood for thousands of industry workers, as well as an economic base for hundreds of communities and businesses. In response to drastic resource declines, a moratorium was imposed on the Northern cod fishery in 1992 and the Northern Gulf cod fishery was closed in 1994.

The 3Pn 4RS cod fishery was re-opened in 1997 based on a Total Allowable Catch (TAC) of 6,000 tonnes. Likewise, the 2J3KL cod fishery was re-opened in 1998 with a TAC of 4,000 tonnes. Total annual landings from each of these two stocks averaged about 9,500 tonnes over the 1998 to 2002 period. The recent closure of these cod fisheries was devastating news for the province, particularly in rural areas where fish harvesters have limited access to alternate fishing opportunities in the region's shellfish fisheries.

Given the historical importance of the cod fisheries to the province and the magnitude of the impacts associated with their closure, the federal and provincial governments announced the creation of a federal-provincial Action Team for Cod Recovery on August 18, 2003. The creation of some form of cooperative bi-lateral approach on this issue was also supported by recommendations from the All-Party Committee on Cod Fisheries, and the Royal Commission on Renewing and Strengthening Our Place in Canada.

The Action team was mandated to prepare and implement a Cod Recovery Strategy aimed at assisting in the recovery and sustainable management of these valuable fish resources. In establishing this mandate, it is recognized that these stocks are characterized by a high level of scientific and environmental uncertainty. Given this, it is also recognized that the success of the Action Teams efforts will be long-term in nature and will "at best" contribute to the recovery of these stocks.

These terms of reference outline the objectives, organization, scope, and methodology for the preparation of the Cod Recovery Strategy. It also includes the anticipated budget and schedule for the work.

Organization, Roles and Responsibilities

The Action Team will be a joint initiative between the federal Department of Fisheries and Oceans, and the Newfoundland and Labrador Department of Fisheries and Aquaculture. The team will also include representation from Memorial University in the field of fisheries science and management.

The Action Team will work under the overall direction of a Deputy Minister' Steering Committee, comprised of Larry Murray and Mike Samson. The Team will be co-chaired by: Wayne Follett, Director General, DFO and Mike Samson, Deputy Minister, DFA. Other members of the Action Team are:

Jim Baird, Regional Director, Fisheries Management, DFO
Bruce Atkinson, Regional Director, Fisheries Science, Oceans and Environment, DFO
John Collins, Regional Director, Policy & Economics Branch, DFO
Barry Rashotte, Associate Director General, Fisheries Management, DFO (Ottawa)
Denis Rivard, Director, Fisheries Research, DFO (Ottawa)
David Tinley, Senior Policy Advisor, Intergovernmental Affairs, DFO (Ottawa)

Mike Warren, Executive Director, Policy & Planning Branch, DFA
Tom Dooley, Director, Resource Policy & Development, DFA

Dr. George Rose, Senior Chair, Fisheries Conservation Chair, MUN

The Team will be supported by a coordination secretariat with representation from DFO and DFA. The DFO representative will be Ken Carew, Chief, Policy and Economic Analysis Division; and the DFA representative will be Paul Glavine, Resource Policy and Development Officer. The employment of contractual staff to assist in research, planning, and administrative activities will also be considered.

To assist the Team, an External Advisory Committee will be established with representation from the FFAW, fish processors, aboriginal and community organizations. The Advisory Committee will act as a sounding board for the team in the identification and implementation of stock recovery measures.

Objectives

The primary and foremost objective of the cod recovery initiative is to prepare a strategy that will contribute to the rebuilding and management of cod stocks adjacent to Newfoundland and Labrador.

In achieving this objective, the Action Team will also work to achieve the following sub-objectives:

- To build understanding on the current status of cod stocks;

- ∃ To identify and evaluate current science priorities and information with respect to the management of these stocks; and
- ∃ To increase cooperation between the two levels government, fishing industry and other industry stakeholders in the identification and implementation of conservation management measures to rebuild cod stocks.

Scope

The Action Team will focus its activities on three cod stocks adjacent to Newfoundland and Labrador: the 2J3KL cod stock (including 2GH); the 3Ps cod stock, and the 3Pn4RS cod stock.

The Action Team is directed to produce a long-term strategy for cod recovery. It is understood that it is not within the Team's mandate to provide annual recommendations to the Minister of Fisheries and Oceans on cod stock management (e.g. the Cod Stock Management Plan for 3Pn4RS in 2004). However, the Cod Recovery Strategy will be used for the future management of fish stocks as it relates to the re-opening, expansion, or reduction of commercial cod fisheries. It is also not within the mandate of the Action Team to address cod access and allocation or historical share issues within the Atlantic cod fishery.

The team will not undertake new scientific research but will instead rely on existing research and reports. The analyses will review, but will not be limited to, the following reports: DFO stock status reports, FRCC reports including its draft conservation plans, Harris Panel Report, Dunne Task Force Report, the All-Party Committee Report on Cod Fisheries and the Royal Commission of Renewing and Strengthening Our Place in Canada. The Team will also consider the various resource recovery initiatives recently announced by DFO including: increased seal science, seal exclusion zones, the Fisheries Science Collaborative Program, and area closures.

The Action Team will also consider the recent endangered/threatened species designations for Atlantic cod by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). If these stocks are listed, the Action Team will consider any requirements of the new federal ***Species at Risk Act*** (SARA) in developing the Cod Recovery Strategy.

Methodology/Approach

The Action Team will complete its work in two phases:

Phase One - will be a scoping phase to identify the objectives, process and timeline of activities to be undertaken to prepare the Cod Recovery Strategy, including stakeholder participation. Deliverables for this phase include: TOR including rationale for the exercise, a work plan; identification of a multi-lateral approach with other provinces; a communications/consultations plan; an inventory of work completed on the targeted stocks; and a summary of each stock including a chronology of stock status.

Phase Two - will consist of the preparation of the Cod Recovery Strategy. The strategy will be aimed at reducing fish mortality, increasing biomass, and improving fish growth. The success of the strategy will be increased through consensus building aimed at achieving agreement on the state of the cod stocks, key stock recovery goals/objectives and the measures, and timelines required to achieve the recovery objectives.

Recognizing that the cod stocks under review, especially the 3Pn4RS cod stock, are of multi-jurisdictional interest, the Action Team will work with other provincial governments through bi-lateral and multilateral arrangements.

The Canada-NL Action Team will coordinate its work with the work of the Canada-Quebec and Canada-Maritimes bilateral cod recovery teams. Required coordination will include the collection and analyses of information, the identification of recovery measures, and the implementation of the recovery strategies.

Existing structures which may be utilized for multi-lateral arrangements include: the Atlantic Fisheries and Aquaculture Ministers Council (ACFAM) and the Federal-Provincial Deputy Ministers' Committee on Cod Recovery. If necessary, the Action Team may also consider the organization of multi-lateral meetings with other affected stakeholders, First Nations, etc.

Considerations

As part of the Phase Two process, the Action Team will take the following into consideration:

- ∃ the need to develop clear stock rebuilding objectives;
- ∃ the requirement for an ecosystems approach - particularly as it pertains to the role of seals and capelin, and climate change in cod recovery;
- ∃ the importance of identifying the most effective (cost and operational) and achievable recovery measures;
- ∃ any necessary trade offs which may be required between conservation management measures which promote the recovery of cod stocks and the impact of such measures on the abundance of shellfish stocks.
- ∃ the identification and evaluation of current science priorities and constraints;
- ∃ the national and international aspects and considerations associated with the identified recovery measures; and
- ∃ the need to include education and awareness activities in the recovery strategy.

The strategy should also include the identification of performance measures or indicators which may be utilized to evaluate the success of the strategy. Related to this, it is understood that the strategy must include a flexible or adaptive approach to allow for the adjustment to successful (or unsuccessful) management measures.

Stakeholder Consultation

The Action Team recognizes that a cooperative and collaborative approach involving government and industry stakeholders represents the best approach to preparing a successful cod recovery strategy. Given this, consultations with industry stakeholders will form a vital contribution to the Cod Recovery Strategy.

The Team will organize consultation meetings with selected industry stakeholders, including representation from industry participants, environmental organizations, aboriginal groups, community organizations, and regional development groups. Consideration will also be given to holding a conference or workshop on the cod recovery strategy.

Budget and Schedule

Both parties agree to contribute resources to the project as required, with appropriate sharing arrangements to be determined. The draft Cod Recovery Strategy will be completed by June 15, 2004.