

SOCIOECONOMIC CONSIDERATIONS

TO INFORM A DECISION WHETHER OR NOT TO LIST THREE POPULATIONS OF ATLANTIC COD UNDER SARA

Technical Document

**Policy Sector
Fisheries and Oceans Canada**

October, 2005



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada

CONTENTS

ACRONYMS	iii
LIST OF TABLES	v
LIST OF FIGURES	vii
1. INTRODUCTION	1
1.1 Scope of Analysis	1
1.2 SARA Process	2
1.3 Requirements for a Listed Species	4
1.3.1 Immediate Protection and the “No Sale” Prohibition	4
1.3.2 Recovery Strategies and Management Plans	4
1.3.3 Allowable Harm Assessments	5
2. SOCIO-ECONOMIC IMPORTANCE OF THE COD FISHERY	7
2.1 Harvesting	7
2.2 Fish Processing	12
2.3 Social Considerations	16
2.4 Cultural Significance	20
3. METHODS	21
3.1 Overview	21
3.2 Analytical Considerations	24
3.3 Harvest Sector	26
3.3.1 Methods	26
3.3.2 Assumptions	28
3.3.3 Limitations	28
3.4 Fish Processing Sector	29
3.4.1 Methods	29
3.4.2 Assumptions	33
3.4.3 Limitations	34
3.5 Communities	35
4. CHARACTERIZATION OF REFERENCE YEAR	36
4.1 Atlantic Cod Harvest in 2004	36
4.2 Cod Processing in 2004	42
4.3 Aboriginal Fisheries	45
4.4 Additional Context for Assessing Impacts	47
4.4.1 Status of Shellfish Resources	47
4.4.2 International Issues	48
4.4.3 Significant Conservation Efforts Already in Place	49
4.4.4 Stewardship	49

5. SCENARIOS AND IMPACTS	51
5.1 Newfoundland and Labrador Population	53
5.1.1 Division 2GH	53
5.1.2 Division 2J3KL	53
5.1.3 Division 3NO	59
5.2 Laurentian North Population	65
5.2.1 Division 4RS3Pn	65
5.2.2 Division 3Ps	76
5.3 Maritimes Population	79
6. COMBINED IMPACTS: HARVESTING, PROCESSING AND ADDITIONAL IMPACTS	81
6.1 Harvest and Processing Impacts Summarized by Cod Population	82
6.2 Harvest and Processing Impacts Summarized by Province	84
6.3 Other Impacts	85
6.3.1 Indirect and Threshold Effects	85
6.3.2 Effects of Dislocation	85
6.3.3 Effects on Transfer Payments	85
6.3.4 Potential Costs To Government	86
6.3.5 Exogenous Economic Factors	86
6.3.6 Impacts on Aboriginal Groups	86
6.3.7 Potential Restrictions due to Critical Habitat Designation	87
6.3.8 Potential Benefits Beyond Future Realized Harvests	87
6.4 Concluding Notes	88
BIBLIOGRAPHY	89
APPENDICES	92
A. Map of Atlantic cod populations	92
B. Least-cost Implementation of Bycatch Reduction	93
C. Long Term Implementation of Scenarios	96
D. Selected Socio-economic Indicators for Communities	104
E. Community Profiles	106
F. Atlantic Cod Dependence in 2004	134

ACRONYMS

AHA	Allowable Harm Assessment
CFAR	Canadian Fisheries and Adjustment Restructuring Plan
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans Canada
EEZ	Exclusive Economic Zone
EI	Employment Insurance
EN	Endangered
FAO	Food and Agriculture Organization
FAM	Fisheries and Aquaculture Management (DFO)
FIN	Fisher Identification Number
FRCC	Fisheries Resource Conservation Council
FSC	Food, Social and Ceremonial
GDP	Gross Domestic Product
LRP	Limit Reference Point
NAFO	North Atlantic Fishing Organization
NAICS	North American Industry Classification System
NRA	North Atlantic Fishing Organization Regulatory Area
PV	Procés-verbal
SARA	<i>Species at Risk Act</i>
SC	Special Concern
SSB	Spawning Stock Biomass
TAC	Total Allowable Catch

TH	Threatened
\$M	Millions of dollars
\$K	Thousands of dollars

LIST OF TABLES

Table 1.1:	Atlantic cod populations in Canada	2
Table 2.1:	Recent Management History for Three Atlantic Cod Populations ...	9
Table 2.2:	Number of Employer Establishments in Atlantic Provinces and Quebec, by Employment Size Category and Province.	13
Table 2.3:	Employment and Employment Benefit Statistics for Fish Processing Workers, 1990 and 2000	16
Table 3.1:	Multipliers for Crew Members According to Vessel Size, by Region	
Table 4.1:	Groundfish licence holders, by province, in 2004	36
Table 4.2:	2004 Landings and Landed Value of Atlantic Cod, by Cod Population and NAFO Division, Directed Fishery and Bycatch	37
Table 4.3:	2004 Landings and Landed Value of Cod, by Cod Population and Province of Landing	38
Table 4.4.a:	Dependence of Licence Holders on Cod Revenue	39
Table 4.4.b:	Cod Dependence for Groundfish Licence Holders Earning <\$3,000 Total Fishing Revenue	40
Table 4.4.c:	Cod Dependence of Licence Holders Earning >=\$3,000 Total Fishing Revenue	40
Table 4.5.a:	Newfoundland and Labrador Groundfish Licence Holders: Dependence on Cod Revenue by Stock	41
Table 4.5.b:	Quebec Groundfish Licence Holders: Dependence on Cod Revenue by Stock	41
Table 4.5.c:	Nova Scotia, New Brunswick, and Prince Edward Island Groundfish Licence Holders: Dependence on Cod Revenue, by Stock	42
Table 4.6:	Estimated processing jobs supported by Atlantic cod in 2004, in Quebec and Newfoundland and Labrador	42
Table 5.1:	Management options assessed for area 2J3KL	55
Table 5.2.a:	Immediate Annual Impact Estimates for Area 2J3KL	57

Table 5.2.b: Long-term (20-year) Impact Estimates for Area 2J3KL	58
Table 5.3: Management options assessed for area 3NO	60
Table 5.4.a: Immediate (first year) Impact Estimates for Area 3NO.	62
Table 5.4.b: Long-term (20-year) Impact Estimates for Area 3NO	63
Table 5.5: Management options assessed for area 4RS3Pn	66
Table 5.6.a: Immediate (first year) Impact Estimates for Area 4RS3Pn	70
Table 5.6.b: Long-term (20-year) Scenario Results for Area 4RS3Pn	72
Table 5.7: Management options assessed for area 3Ps	76
Table 5.8.a: Immediate (first year) Impact Estimates for Area 3Ps	78
Table 5.9: Main Fisheries in which Atlantic cod Maritimes Population is Harvested	79
Table 6.1: Selected Scenarios for Total Regional Impact Summary	81
Table 6.2: Newfoundland and Labrador Cod Population: Immediate Direct Annual Impacts in Harvest and Processing Sectors	82
Table 6.3: Laurentian North Cod Population: Immediate Direct Annual Impacts in Harvest and Processing Sectors	83
Table 6.4: Potential Direct Annual Impacts of Listing Both Populations	84
Table 6.5: Direct Annual Impact in Harvest and Processing Sectors, by Province	84

LIST OF FIGURES

Figure 2.1: Harvests in NAFO Zones 0-4, 1960-2003 (FAO Data)	8
Figure 2.2: Atlantic Coast Fishery Value, by Species Group, 1986 - 2002.	10
Figure 2.3: Landings and Landed Value for three Atlantic cod Populations	11
Figure 2.4: Hours Paid to Production Workers in Seafood Preparation and Packaging, by Province, 1990 and 1999. Statistics Canada Annual Survey of Manufactures.	14
Figure 2.5: Population by Strategic Economic Zones in Newfoundland and Labrador, 1991 - 2016.	18
Figure 4.1: Total Employment and Cod Dependence for Plants Processing Cod in 2002, Provinces of Quebec (40 plants) and Newfoundland & Labrador (64 plants).	44
Figure 5.1: Projected Spawning Stock Biomass by Scenario, under 15% annual stock growth (4RS3Pn).	74
Figure 5.2: Cumulative Difference in Revenue, Scenario vs. Baseline, under 15% annual stock growth (4RS3Pn).	74

1. INTRODUCTION

The objective of this report is to assess the range of socio-economic impacts that could be experienced in Atlantic Canada and Quebec if Atlantic cod (*Gadus morhua*) is listed on Schedule 1 of the *Species at Risk Act* (SARA). Four populations of cod are currently under consideration for listing: 1) Newfoundland and Labrador, 2) Laurentian North, 3) Maritimes, and 4) Arctic. This analysis pertains to the first three populations. The Arctic population is under consideration separately.

This analysis is one contribution towards informing the SARA listing process, along with public consultations and the status report prepared by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The socioeconomic considerations outlined in this report are a key component of the decision making process.

At the time this report is being prepared, no decision has been made regarding the listing of any population of cod. The particular management scenarios examined in this report should therefore be considered *illustrative only*. SARA-compliant recovery strategies and action plans would be developed with extensive stakeholder participation and public comment, so that a variety of options beyond those presented in this report would most certainly be considered.

1.1 Scope of Analysis

This analysis is directed first, and primarily, towards assessing **regional economic impacts**. Information is presented regarding:

- the foregone landed value and production value that would result from harvest restrictions,
- the number of licence holders and crew that would be affected,
- processing employment foregone due to harvest restrictions on cod and other species,
- potential implications for groundfish processing plants,
- socio-economic indicators from potentially affected communities, and a descriptive assessment of the additional implications for communities;
- Aboriginal groups that may be affected;
- potential costs to government; and,
- additional impacts that may arise from requirements other than the reduction of fishing mortality.

Both the immediate and longer term impacts of various management scenarios are examined. Long term implications are examined by simulating cod population growth under a range of productivity and management regimes. Scenarios are implemented dynamically over a 20-year period, and results are compared to a projection of current conservation practices over the same time frame. The net effect of near-term costs, plus the benefits from enhanced future harvests are then embodied in a single number: the

discounted present value of the difference in revenue streams. However, even if recovery is only partial during the 20-year projection and increased harvests are not yet realized, the benefits of a higher spawning stock biomass are still considered.

The analysis focuses upon direct regional impacts in the harvest and processing sectors, as these are the impacts most readily quantified, and because they include both the costs of foregone economic activity and potential future benefits from enhanced stocks. Additional impacts are quantified where possible, and discussed qualitatively where reliable statistics are not currently available.

For this analysis, Fisheries and Oceans Canada (DFO) compiled information regarding the commercial and Aboriginal fishing sectors, along with the key characteristics of some potentially affected communities. Provincial governments contributed important information on the fish processing sector, and also provided background materials in the form of previously published studies.

1.2 SARA Process

The COSEWIC completed a biological assessment of Atlantic Cod in May 2003. Within that assessment, four Atlantic cod populations were identified and assessed at various degrees of risk (Table 1.1). A map of these populations and the North Atlantic Fisheries Organization (NAFO) areas which comprise them is found in Appendix A.

Table 1.1 : Atlantic cod populations in Canada

COSEWIC Population	COSEWIC Designation	NAFO Fishing Areas
Newfoundland and Labrador	Endangered	2GH, 2J3KL, 3NO
Laurentian North	Threatened	4RS3Pn, 3Ps
Maritimes	Special Concern	4TVn, 4VsW, 4X, 5ZEj,m
Arctic	Special Concern	0A, 0B, land-locked lakes

Note: Atlantic cod, Arctic population is not included in this report.

Endangered species are those that are at imminent risk of extinction. Species listed as Threatened are those that are likely to become endangered if limiting factors are not reversed. Species of Special Concern are those that may become Threatened or Endangered if precautions are not taken, due to a combination of biological characteristics and identified threats.

The Newfoundland and Labrador, Laurentian North and Maritimes populations are examined in this report. The Arctic population is considered separately, as the issues associated with that population are distinct from the other three. COSEWIC (2003) has identified fishing as the primary threat to all three populations covered in this report, and further provides the following rationale for its respective designation of the three Atlantic cod populations:

Newfoundland and Labrador population, Atlantic cod:

“Cod in the inshore and offshore waters of Labrador and northeastern Newfoundland, including Grand Bank, having declined 97% since the early 1970s and more than 99% since the early 1960s, are now at historically low levels. There has been virtually no recovery of either the abundance or age structure of cod in offshore waters since the moratoria imposed in 1992 and 1993. Threats to persistence include fishing (now halted), predation by fish and seals, and natural and fishing-induced changes to the ecosystem.”

Laurentian North population, Atlantic cod:

“Cod in the Northern Gulf of St. Lawrence and along the south coast of Newfoundland comprise an assemblage of stocks within which there is considerable mixing. They are currently at low levels as a group and overall have declined by about 80% over the past thirty years. However, there is evidence that current levels of abundance are not unprecedented for cod along the south coast of Newfoundland, and the population Threats to persistence include fishing (now halted in the Northern Gulf), predation by fish and seals, and natural and fishing-induced changes to the eco-system.”

Maritimes population, Atlantic cod:

“Cod in the Southern Gulf of St. Lawrence, across the Scotian Shelf and into the Gulf of Maine comprise a heterogeneous assemblage of stocks that are at low levels of abundance as a group. These levels are not unprecedented for the cod in the Southern Gulf, Southwest Scotian shelf, Bay of Fundy and George’s Bank, but those on the Eastern Scotian shelf are at historic lows and have continued to decline in the absence of directed fishing. Overall, cod in the entire region have declined 14% in the past 30 years, and have demonstrated a sensitivity to human activities. Threats to persistence include directed fishing, bycatch in other fisheries, natural predation, and natural and fishing-induced changes to the ecosystem”

Under SARA, the Governor in Council has three options with respect to adding a species to Schedule 1, the List of Wildlife Species at Risk, once the COSEWIC assessment is received:

1. accept the COSEWIC assessment and add the species to the legal list;
2. decide not to add the species to the legal list; or
3. refer the matter back to COSEWIC for further information or consideration.

The entire population as defined by COSEWIC is the smallest indivisible unit subject to one of these three choices; that is, it is not possible to form separate decisions for subsets of a population. For example, one cannot list 2GH cod without also listing 2J3KL and 3NO cod, as these stocks are all part of the Newfoundland and Labrador Atlantic cod population. However, recovery strategies can provide for different management regimes among subpopulations within a single COSEWIC-defined population. This latter point is important for assessing potential impacts, as will be seen in subsequent chapters.

1.3 Requirements For a Listed Species

1.3.1. Immediate Protection and the No Sale Prohibition

Adding a species to the List of Wildlife Species at Risk set out in Schedule 1 of SARA as Extirpated, Endangered or Threatened leads to the application of prohibitions that make it an offence to kill, harm, harass, capture or take an individual of these listed species, or to damage or destroy the residence of one or more individuals of these species. It also leads to the application of prohibitions that make it an offence to possess, collect, buy, sell or trade individuals of an Extirpated, Endangered or Threatened species. These prohibitions do not apply to species of Special Concern.

SARA includes provisions to allow for the incidental or directed harvest of species listed as Extirpated, Endangered or Threatened, through exempting mechanisms that may be employed if survival or recovery of the species is not jeopardized. These exempting mechanisms include permits issued by the Minister of Fisheries and Oceans for bycatch under Section 73 of SARA. In addition, SARA allows for an incidental or a directed harvest in the recovery strategy or action plan for these species, provided that such incidental or directed harvest is also authorized under an Act of Parliament. Finally, SARA provides for the making of regulations exempting persons who possess an individual of a listed Extirpated, Endangered, or Threatened species from the application of the prohibitions on possessing, buying, selling, collecting or trading an individual of these species.

The harvesting of a listed cod population could therefore be permitted to proceed after it has been added to Schedule 1; however, a regulation would have to be made under SARA to exempt possessors of legally harvested cod from the aforementioned prohibitions. Unless regulations are made, fisheries in which cod is caught incidentally could continue to operate, but the cod bycatch could not be bought and sold in the commercial chain. The potential incremental impact of the Act's "no sale" prohibition, in the absence of an exempting regulation, will be examined in this report.

1.3.2. Recovery Strategies and Management Plans

For species listed as Endangered (Threatened), a recovery strategy must be developed within one (two) years of listing. The recovery strategy identifies population goals and

broad approaches to population recovery, including timelines where possible. If a recovery strategy recommends it, critical habitat could also be identified and the destruction of any part of this critical habitat would be prohibited. Recovery strategies are developed in consultation with stakeholders.

An action plan is developed from the recovery strategy, and includes the detailed measures for implementing the recovery strategy. In general, at least one action plan must be prepared based on the recovery strategy. An evaluation of the socio-economic benefits and costs of the implementation is also included in the action plan. Like the recovery strategy, action plans are developed in consultation with those likely to be affected.

For species listed of Special Concern, a management plan must be prepared within 5 years of listing which will include measures for the conservation of the population in order to prevent the population from becoming threatened or endangered.

1.3.3. Allowable Harm Assessments

Allowable harm assessments (AHA) are used to determine the basis for application of the exempting mechanisms discussed above. These assessments determine the breadth of harm that can be permitted, without further jeopardizing the long-run survival or recovery of the population/species. Although a decision whether or not to list Atlantic cod has not been made, DFO conducted assessments (October, 2004) of allowable harm under a hypothetical legal listing for the Newfoundland and Labrador and Laurentian North populations. The objective of these scientific assessments was to establish the basis for the issuance of incidental fishing harm permits under a legal listing. Generally, the assessments concluded that over a one to two year period, current practices would not further jeopardize survival or recovery of either of these populations. The specifics of the assessments for each population are given below.

Regarding the Laurentian North population, the 4RS3Pn stock was not considered to be recovered; however, it was determined that current removals could continue for one to two years without jeopardizing recovery of this stock. The assessment concluded that the 3Ps stock was recovered, and should continue to be managed through current measures.

With respect to the Newfoundland and Labrador population, the assessment notes that as the offshore component of 2J3KL has not declined below mid-1990's levels, current fishing practices could be sustained over one to two years. Fishing could also continue at current levels (for one year) over the inshore population of 2J3KL, given that cod abundance there seems to be increasing. The assessment notes there is no evidence that current fishing practices in 2GH have caused recent declines, and can therefore continue over a one year time frame. However, with respect to the 3NO cod fishery, only the Canadian catch was examined; it was noted that including the impact of non-Canadian activity would result in a further overall decline in the stock which could jeopardize

recovery. In recent years, the majority of harvested 3NO cod appears to have been taken by foreign fleets outside Canada's Exclusive Economic Zone.

These DFO assessments provide scientific advice on allowable harm for one year only, the SARA permitting period. However, the recovery period is much longer for most of the cod stocks that comprise these populations. Under a SARA listing, conservation measures beyond current management practices may ultimately be required. This report provides an assessment of the magnitude of socio-economic impacts that such measures may bring about.

2. SOCIO-ECONOMIC IMPORTANCE OF THE COD FISHERY

This section provides an overview of the cod fishery, including the harvesting and processing sector. More importantly, this provides context as to the social and cultural importance of Atlantic cod to communities in Atlantic Canada and Quebec.

2.1 Harvesting

Atlantic cod was once the backbone of the fishery in Atlantic Canada and Quebec, supporting the livelihoods of thousands of individuals in hundreds of rural communities. The cod fishery of the past provided a foundation for the social and economic structure in Atlantic Canada, especially in Newfoundland and Labrador, where harvesting began in the 1500s. By the 1800s, annual cod landings in Canada ranged between 150,000 and 400,000 tonnes (t).¹

In more recent history, cod harvests in the Northwest Atlantic peaked towards the end of the 1960's, at which point Atlantic cod accounted for more than 60% of the total harvest in NAFO zones 0 through 4 (Figure 2.1). Much of this harvest was taken by distant water fleets from European nations, but during the 1970's, there was a dramatic decline in the harvests by foreign fleets. At about the same time, domestic fleet capacity increased substantially with the establishment of Canada's 200-mile Exclusive Economic Zone, and cod harvests stayed relatively constant through the 1980's.

Gradual depletion of the Atlantic groundfish stocks probably occurred over a prolonged time period, as an intense harvest was sustained over many decades. However, the observed dramatic decline of the fishery was quite rapid in the late 1980's and early 1990's, as improvements in technology and the associated further increase in fishing capacity ultimately overwhelmed stock productivity. In addition, unusual environmental conditions may have contributed to higher mortality at this time. In the early 1990's it became clear that groundfish populations were in serious distress and Atlantic cod in particular. Many stocks were closed to fishing in 1992/93. The collapse of the cod fishery has been considered "the largest industrial shutdown in Canadian history. A crisis of similar magnitude in Ontario, a province with a population of approximately 8 million people would mean that 800,000 people would lose their jobs overnight"²

¹ http://www.dfo-mpo.gc.ca/kids-enfants/map-carte/map_e.htm

² Patricia Canning and Charlotte Strong. "Children and Families Adjusting to the Cod Moratorium" in *The Resilient Outport: ecology, economy, and society in rural Newfoundland*. R.E. Ommer (ed.). Memorial University of Newfoundland, Institute of Social and Economic Research. 2002.

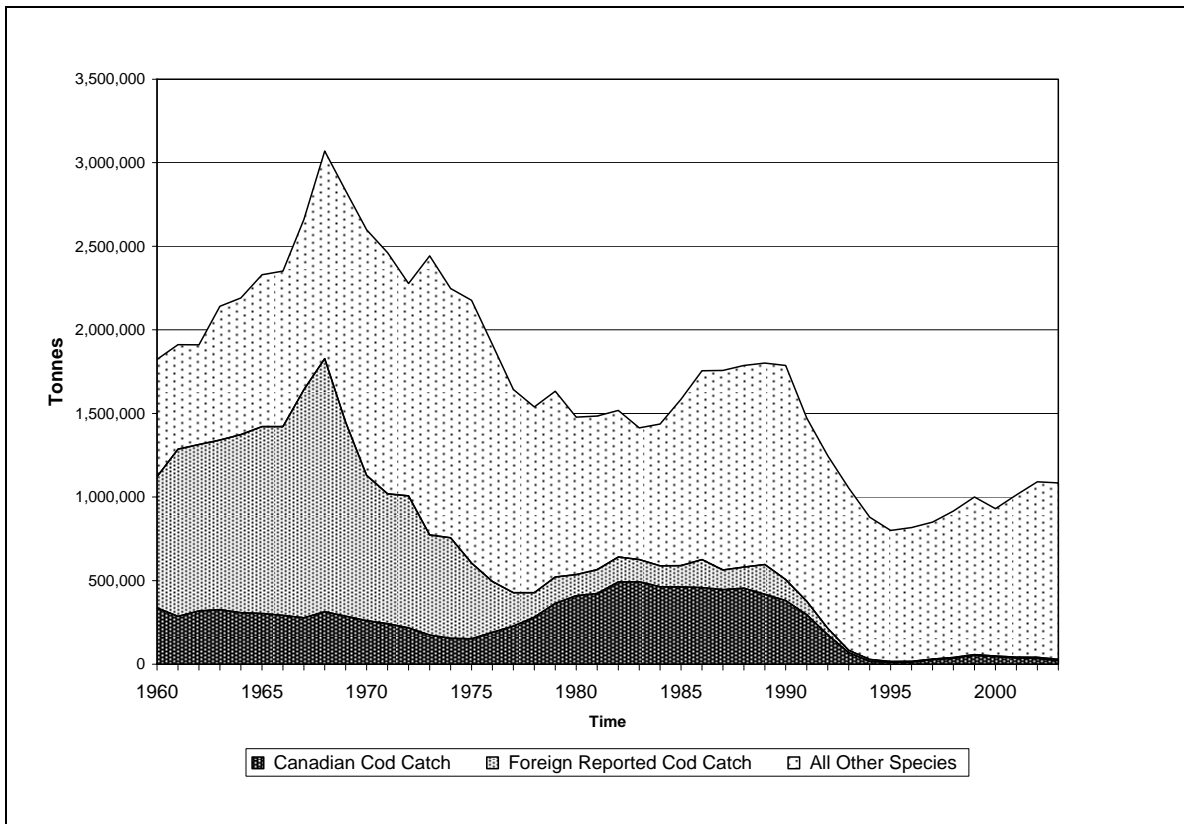


Figure 2.1: Harvests in NAFO Zones 0-4, 1960-2003 (FAO Data)

Cod management through the 1990's and into the early 2000's focused on the recovery of a collapsed fishery (Table 2.1). Moratoria on the directed fishing of many cod stocks prevail to this day. Three cod stocks (2GH, 3NO, and 4VsW) have been under continuous moratorium since the early 1990s (Table 2.1) while limited fisheries were reopened in several other areas in 1997/98.

In 2003, the government once again announced a fishery closure for three Atlantic and Gulf cod stocks (2J3KL, 4RS3Pn, and 4TVn) which included several recovery measures, as follows:

- cessation of commercial and recreational cod fishing in three areas;
- reduction of the capelin catch, a key prey species for cod;
- closure of sensitive cod habitat areas to trawling (closure of cod spawning areas to shrimp trawling); and,
- assessment of seal populations, and their role as a predator of cod.

Subsequently in 2004, upon the advice of the Fisheries Resource Council of Canada (FRCC), limited fishery re-openings were announced in the Gulf of St. Lawrence. The Newfoundland and Labrador cod population remains entirely under moratorium (2GH, 2J3KL, 3NO), as does the East Scotian Shelf portion of the Maritimes cod population

(4VsW). Where directed fisheries are ongoing, the total allowable catches are generally low compared to historic levels.

Table 2.1: Recent Conservation History for Three Atlantic Cod Populations

Cod Population	NAFO Division	Closure History
Newfoundland and Labrador	Northern Labrador (2GH)	1994 to 2005 : moratorium
	Northern (2J3KL)	1992 to 1997 : moratorium 1998 to 2002 : reopened, low TAC ($\leq 9,000t$) 2003 to 2005 : moratorium, by-catch only
	Southern Grand Bank (3NO)	1994 to 2005 : moratorium
Laurentian North	St Pierre Bank (3Ps)	1993 to 1996 : moratorium 1997 : TAC 10,000t reopened, 1998 to 2000 : TAC $\leq 30,000t$ 2001 to 2005 : TAC 15,000t
	Northern Gulf (4RS3Pn)	1994 to 1996 : moratorium, limited bycatch 1997 to 2002 : reopened, low TAC ($\leq 7,500t$) 2003 : moratorium, bycatch only 2004 : TAC 3,500 t 2005 : TAC 5,000 t
Maritimes	Southern Gulf, Cabot Strait (4TVn)	1993 to 1997 : moratorium 1998 : reopened, low TAC 3,000t 1999 to 2002 : TAC 6,000t 2003 : moratorium 2004 : reopened, low TAC 3,000t 2005 : TAC 5,000t
	East Scotian Shelf (4VsW)	1993 to 2005 : moratorium
	Bay of Fundy, West Scotian Shelf (4X)	(no moratoria, reduced quota only) 1994 to 1997 : TAC $\leq 13,000t$ 1998 to 1999 : TAC $\leq 9,300t$ 2000 to 2004 : TAC 6,000t 2005 : TAC 5,500t
	Georges Bank (5Z)	(no moratoria, reduced quota only) 1994 : 6,000t 1995 to 1997 : TAC $\leq 3,000t$ 1998 to 2004 : low TAC $\leq 2,100t$ 2005 : low TAC 740t

In spite of the groundfish moratoria of the 1990's, the total value of the fishery in Atlantic Canada and Quebec has risen substantially over the same time period (Figure 2.2). This new wealth has come from shellfish, with a 215% increase in the nominal value of landings (177% increase in real value) from lobster, crab, shrimp, and molluscs from 1990 to 2002. In Atlantic Canada and Quebec, four major shellfish species alone (lobster, snow crab, shrimp and scallop) now account for about 80% of the region's total landed value. However, the expanding shellfish fisheries have not mitigated the economic stresses imposed by groundfish stock declines. Not all groundfish harvesters

have access to lucrative shellfish licences, and shellfish earnings are not evenly distributed among communities.

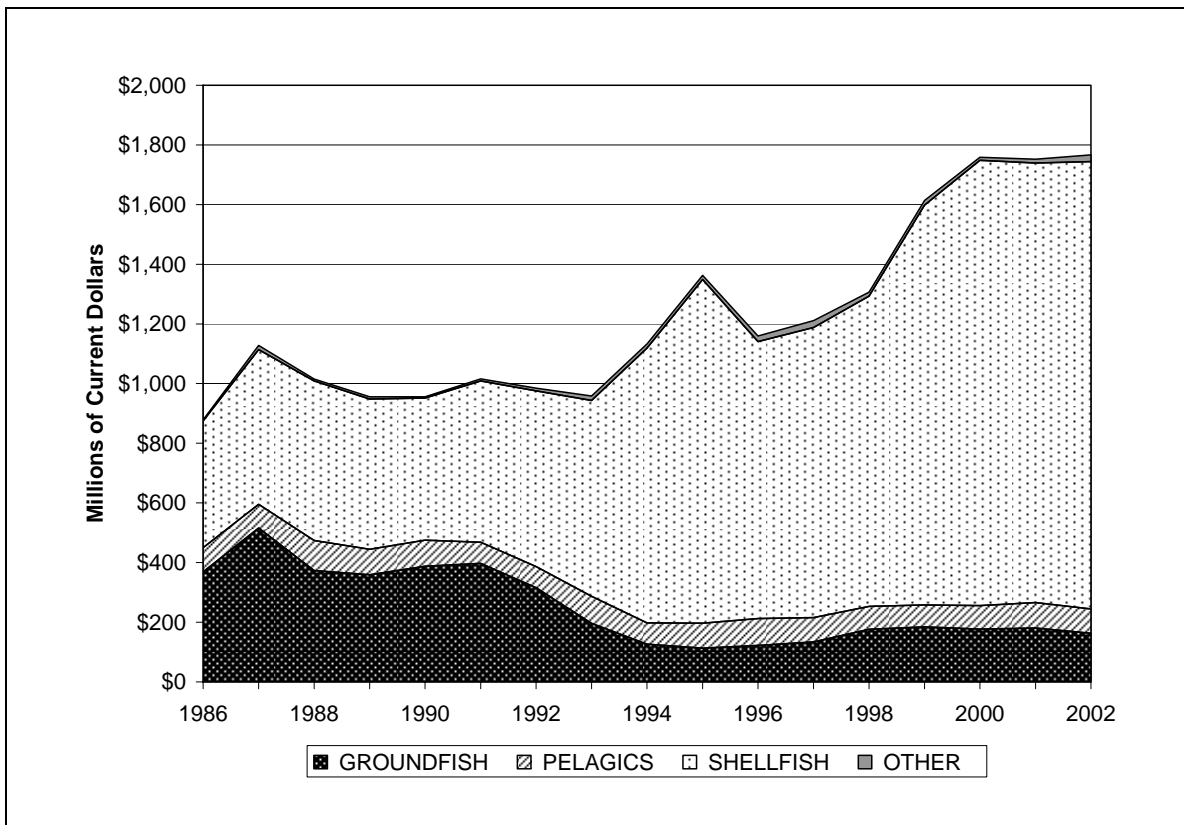


Figure 2.2: Atlantic Coast Fishery Value, by Species Group, 1986 - 2002.

Cod now represents just 2% of the value of Canada’s domestic Atlantic and Gulf fishery. With moratoria persisting in many areas, much of the total is caught incidentally in other groundfish fisheries (Figure 2.3). However, Figure 2.3 also shows that the amount of cod bycatch has decreased significantly over time. Although a number of factors are responsible for this decline, including reduced overall Total Allowable Catches (TACs) in groundfish fisheries where cod bycatch is most common, there has been a significant and meaningful effort by harvesters to reduce the incidental harvest of cod. The conservation and stewardship efforts of the harvesting community cannot be overlooked, even though cod recovery has proven more problematic than originally hoped.

Not surprisingly, the landed price for Atlantic cod has risen as the supply has fallen (Figure 2.3)³. From 1986 to 1992, the average landed price was \$0.78/kg (measured in 2002 constant dollars), but since the moratoria first began, the price has averaged \$1.44/kg.

³ Prices can be seen on Figure 2.3, as the axes are scaled so that when the line (total value) coincides with the top of the bars (total quantity), the price is equal to \$1 per kg.

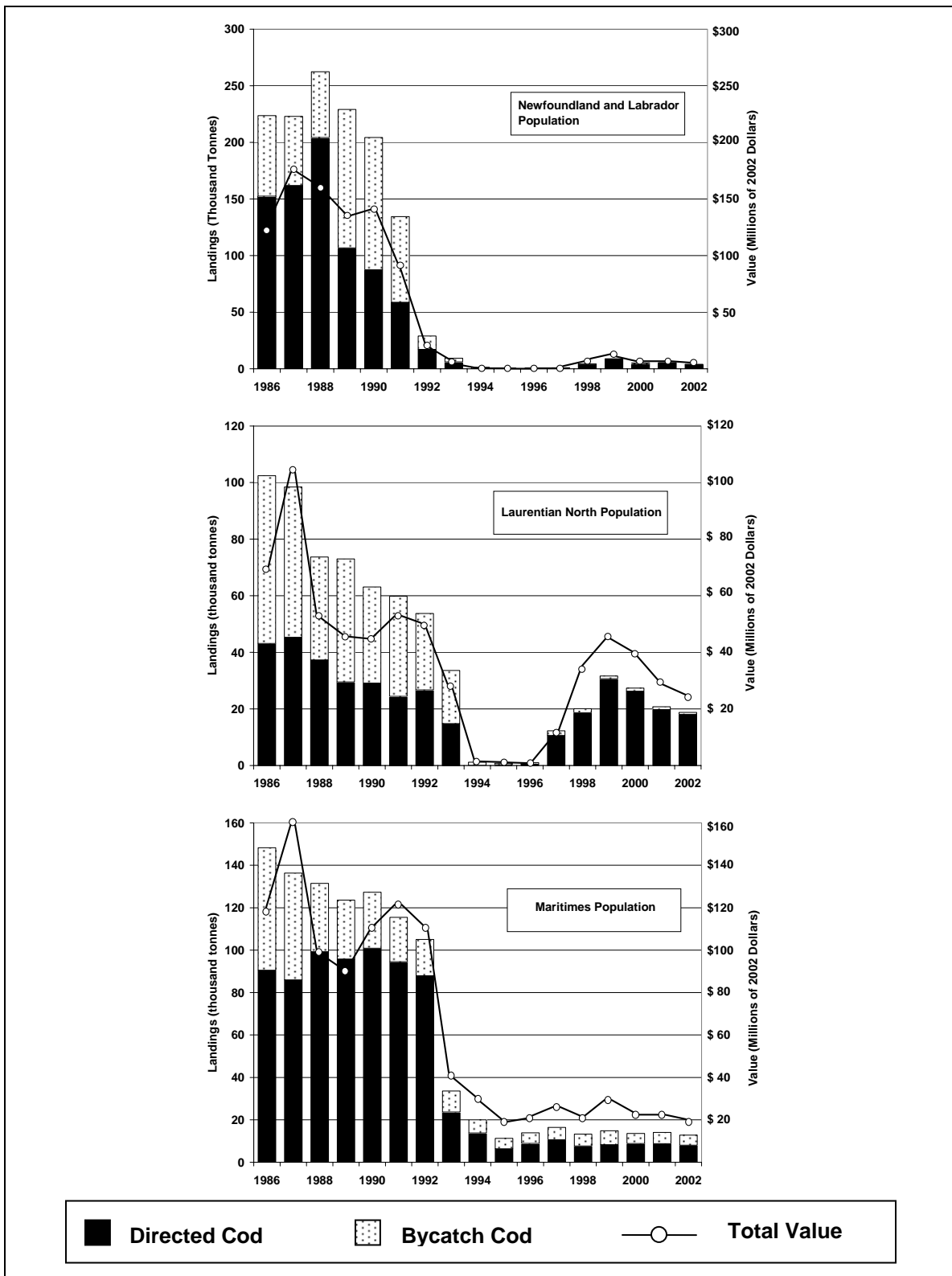


Figure 2.3. Landings and Landed Value for Three Atlantic Cod Populations

Throughout the moratorium years, a number of restructuring programs were implemented within the harvest sector by the Federal Government, to reduce capacity and to provide early retirement options for harvesters who met eligibility requirements. Among these were:

- the Atlantic Fisheries Adjustment Program/Quebec Federal Fisheries Development Program (1990 - 1995)
- the Northern Cod Adjustment and Recovery Program (1992 - 1994)
- the Atlantic Groundfish Adjustment Program (1993 - 1994)
- the Atlantic Groundfish Strategy (1994 - 1998), and
- the Canadian Fisheries and Adjustment Restructuring Plan (1998 - 2003)⁴

Also, new requirements and limitations on entry to the fishery were established in the mid-1990s, in recognition of the status and rights of the core group of professional harvesters who were substantially attached to, and dependent upon, the fishery. Through these programs and normal attrition, there are now about 40% fewer groundfish licences than in the early 1990's.

The offshore fleet has maintained its focus on the groundfish sector throughout restructuring and in the ensuing years, while access to the growing fisheries for lobster, crab, and scallop was granted almost exclusively to independent, inshore owner-operators with core status.⁵ This has left a number of non-core licence holders in a particularly precarious position with respect to additional restrictions on groundfish harvests, as they do not have access to shellfish quota as an alternative source of income. However, many non-core fishers did not opt to retire their licences when presented with that alternative, apparently because the conditions placed upon licence retirement would have required total exit from the fishery, precluding their ability to earn income as crew with other enterprises.

2.2 Fish Processing

Trends in the fish processing sector have in large part paralleled those in the harvest sector. When domestic fishing capacity increased upon the creation of Canada's Exclusive Economic Zone, there was also rapid investment in processing capacity. Even before the collapse of the groundfishery, it was clear that excess processing capacity had accumulated. As is common in many industries after a period of rapid proliferation, a period of restructuring and consolidation took place during the 1980's. But with the additional challenges of the groundfish moratoria during the 1990's, changes in the

⁴ CFAR was the largest licence retirement program, and details of its implementation and success can be found in *Evaluation of the Canadian Fisheries Adjustment and Restructuring Program Licence Retirement Programs* at : http://www.dfo-mpo.gc.ca/communic/cread/evaluations/02-03/fisheries_e.htm.

⁵ The Canadian Council of Professional Fish Harvesters has prepared an analysis of the fish harvesting labour force in Canada, describing in detail the restructuring that has taken place in recent years. This report can be found at: <http://www.ccpfh-ccpp.org/cgi-bin%5Cfiles%5CSS-PhII-Final-RPT-E.pdf>

industry took on a great deal more urgency.

The number of processing plants in Newfoundland and Labrador has decreased by 40% since 1990, and consolidation has led to more concentration of production in large plants in Newfoundland and Labrador than in other provinces (Table 2.2).

Table 2.2: Number of Employer Establishments in Atlantic Provinces and Quebec, by Employment Size Category and Province

Seafood Product Preparation and Packaging (NAICS 3117). December 2003

Province	Employment Size Category (Number of employees)			
	Micro 1-4	Small 5-99	Medium 100-499	Large 500+
Newfoundland and Labrador	33	59	47	8
Quebec	44	39	18	0
Nova Scotia	151	190	20	2
New Brunswick	52	59	36	1
Prince Edward Island	25	19	8	0

Statistics Canada data from strategis.gc.ca

Although there are ongoing struggles for many companies, the aggregate value of outputs and exports has generally recovered and is actually higher than ever. With the development of new shellfish harvesting activity, the processing sector has benefited by shifting from high-volume and low-value groundfish to more lucrative shellfish and value-added products. The result has been considerable growth in the value of Canadian seafood exports, from \$2.6 billion in 1990 to \$4.7 billion in 2002.

Some groundfish processing plants were able to secure new sources for raw inputs, taking advantage of low cost sources abroad (such as groundfish from Russia's Barent's Sea) and increased aquaculture production. Although imported inputs were beneficial for a short time, recent trends in competition on the world market for these inputs have decreased their availability to Canadian plants. Plants without access to crab or shrimp are particularly vulnerable to any decline in access to groundfish.

Shorter operating periods each year mean that fixed costs account for a larger share of revenues, leaving less flexibility for owners to invest in capital improvements. Some plants undertook major capital investments for increasing plant efficiency in recent years, but overall, investment has often been insufficient to maintain the net capital stock in the processing sector. Low levels of investment have kept financing costs low, but in the long run, this trend must reverse or unproductive plants will be forced out of the market.

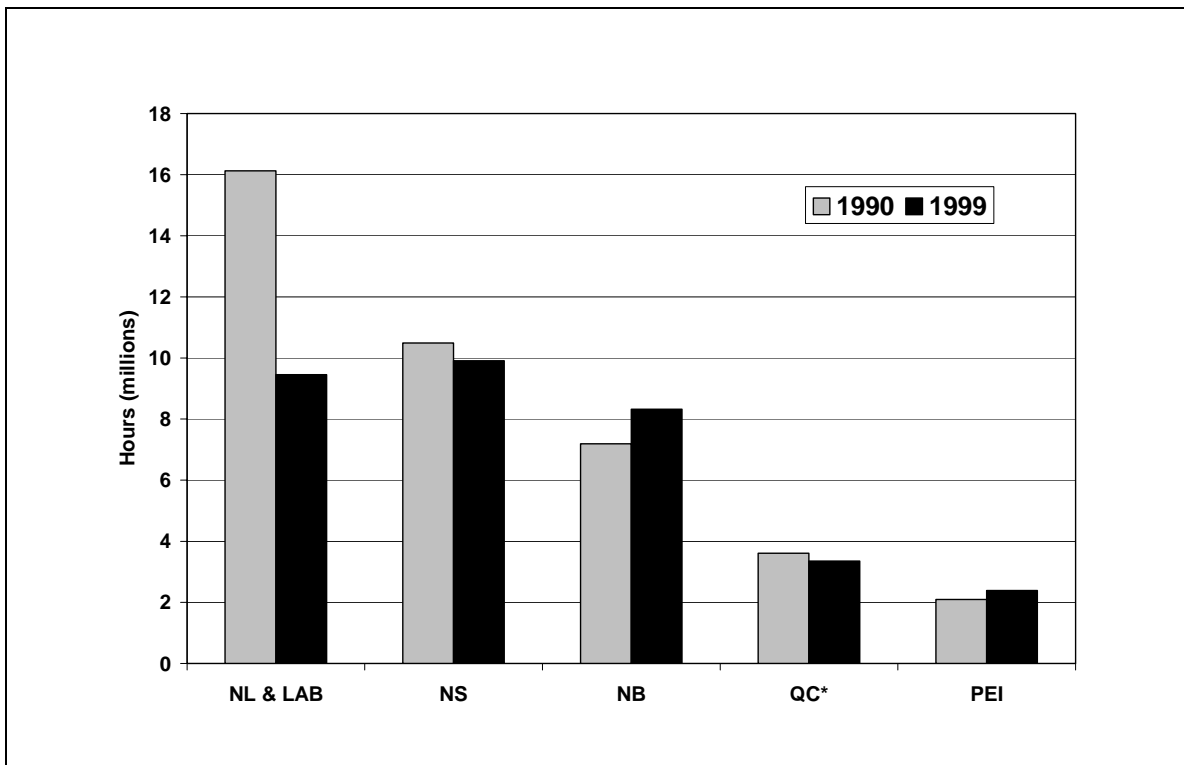


Figure 2.4: Hours Paid to Production Workers in Seafood Preparation and Packaging, by Province, 1990 and 1999

Statistics Canada Annual Survey of Manufactures. (* Quebec data are for 1990 and 1997. Post-1997 data for Quebec not available in Statistics Canada time series.).

The labour force in the processing sector has been particularly hard-hit by the reduced groundfishery. The decrease of groundfish landings (80% since the early 1990's) has negatively affected overall plant throughput, and the shellfish production which has largely replaced groundfish production is less labour intensive. As a result, processing employment has decreased. The reduction is most dramatic in Newfoundland and Labrador, where groundfish processing was most important (Figure 2.4). Since the jobs that remain are concentrated at fewer plants, many workers in fish processing have had to relocate in order to keep their jobs. These transitions have been very costly to individuals and communities, causing decreases in property values and disrupting community structure. Since most marine fish processing is concentrated in rural areas, there are few alternatives for employment. Often, a processing plant may represent the only opportunity for employment in a remote community, and the socio-economic impacts of plant closures are severe.

Against this background, processors in remote communities face future labour shortages due to out-migration and the general aging of the population. In stark contrast to dramatic improvements for many harvesters, real incomes have declined for many fish plant workers since the moratorium, and it is difficult for processors to attract and maintain a skilled workforce. This trend is continuing. A thorough study of the important

human resources issues faced by the fish processing sector has been prepared by the National Seafood Sector Council, and is available for download from the internet⁶.

At the provincial level, a detailed account of the status of the fish processing labour force in Newfoundland and Labrador can be found in the Province's 2003 *Fish Processing Policy Review*⁷. The total number of individuals working in fish processing declined from more than 25,000 in 1990 to fewer than 13,000 in 2000. The aggregate income received by fish processing workers declined 31% from \$218M in 1990 to \$151M in 2001, and total employment insurance benefits decreased comparably (by 32%) from \$132M to \$89M. At the individual level, the average income (from processing) declined markedly for these workers through the early 1990's, recovering somewhat along with the development of shellfish resources. By 2001, average real income from processing for a typical worker had approximately recovered to 1990 levels; however, this average does not necessarily reflect the situation for groundfish processing workers.

In Quebec, trends for the sector as a whole are less dramatic due to the lower general reliance on groundfish; however, trends for workers in groundfish processing are likely to be similar to those in Newfoundland and Labrador. In the Magdalen Islands, the average number of jobs in processing declined from 1,030 (1990-1995 average) to 835 (1996-2001 average). In Gaspé, the decrease was smaller (from about 2,500 in the early 1990's to 2,300 in 2003). On the North Shore, processing employment has actually increased from about 820 to almost 1300 between 1990 and 1995, remaining approximately stable at about 1,200 jobs since that time. This growth is attributable to the expansion of crab, molluscs, and shrimp.

Table 2.3 presents statistics for the years 1990 and 2000 on employment and Employment Insurance (EI) benefits in the "Seafood Product Preparation and Packaging" Industry (NAICS 3117). Again, one observes a general decline in processing employment; however, the percentage uptake of employment insurance benefits is somewhat higher in 2000 than in 1990. On average, the workers remaining in the industry are working more weeks, and are generally working significantly more than the minimum required to qualify for EI (Table 2.3), but average EI benefits are generally lower in 2000 than in 1990. For all provinces other than Newfoundland and Labrador, average employment income has risen substantially. These other provinces have a greater concentration of shellfish in their production, and if shellfish trends are similar in Newfoundland, the more modest increase in income for that province is likely the result of less favourable trends for workers in groundfish processing.

⁶ *Meeting the Challenge: Canada's Seafood Processing Industry Labour Market in the 21st Century*. National Seafood Sector Council, Ottawa, Canada. December 2004. Available for download at http://www.nssc.ca/NSSC_LMI_spread_E.pdf

⁷ Final Report of the Fish Processing Policy Review Commission. Eric Dunne (Commissioner). December, 2003.

Table 2.3: Employment and Employment Benefit Statistics for Fish Processing Workers, 1990 and 2000. Currency in 2000 constant dollars.

Province:	NL	QC	NS	NB	PEI
1990 Industry Statistics¹					
Number of individuals	26,960	4,130	13,140	11,650	2,840
Number with EI benefits	20,820	2,850	7,620	7,850	1,800
Percent with EI benefits	77%	69%	58%	67%	63%
Avg. employment income ³	\$11,439	\$9,248	\$15,941	\$9,735	\$9,248
Avg. employment insurance benefits	\$6,450	\$8,032	\$3,529	\$5,598	\$6,206
Avg. insured weeks	19.8	17.4	28.6	19.1	17.8
2000 Industry Statistics²					
Number of individuals	12,455	3,860	7,415	8,390	2,305
Number with EI benefits	10,280	2,995	4,070	6,495	1,755
Percent with EI benefits	83%	78%	55%	77%	76%
Avg. employment income ³	\$12,940	\$13,575	\$17,000	\$13,605	\$12,854
Avg. employment insurance benefits	\$6,194	\$5,879	\$4,280	\$5,270	\$4,916
Avg. weeks worked	21	22	33	25	29
Weeks required to qualify for E.I. ⁴	12	12	12 or 16	12 or 17	14

¹ From Tables 18 and 25-2 in *Charting a New Course: Towards the Fishery of the Future* (the Cashin Report). November 1993. Original taskforce tabulations from taxfiler data, income converted to 2000 constant dollars for this report.

² From the Statistics Canada 2001 Census, Labour Force Statistics.

³ Average employment income may include earned employment income outside of fish processing.

⁴ From Human Resources and Skills Development *2000 EI Monitoring and Assessment Report*

2.3. Social Considerations

To understand the social importance of the cod fishery, it is necessary to return to the more distant history of the fishery. Prior to the stock collapses of the early 1990s, cod fisheries were a mainstay of the rural coastal economy in Atlantic Canada, sustaining hundreds of communities. In some areas, cod provided the foundation of the entire economy. In the province of Newfoundland and Labrador, one person in five was employed in the fishery.

Outside of St. John's, the majority of the population of Newfoundland and Labrador has historically settled in small towns, primarily for cod fishing. It has been noted that "This is not a new stock recently discovered but the stock that has provided the basis for a large inshore cod fishery along southern Labrador and the east coast of Newfoundland. It has been fished for over three centuries and has been the main determinant of settlement

patterns along the coast. It has been and continues to be the principal economic base for all the communities along the coast".⁸

While the fishery and economy of Newfoundland and Labrador continue to diversify, any changes that could be brought about, should Atlantic cod be listed under SARA, will deeply affect regions and communities which have a strong attachment to the fishery. This reality applies equally to the maritime regions of Quebec, where economic activity along the North Shore, the Gaspé Area and on the Magdalen Islands depends heavily on fishing activity, and where the importance of cod is also particularly strong.

When considering the level of cod dependence for communities with regard to a SARA listing, it is clear that economic effects associated with both the processing and harvesting sectors must be analysed. However, even after considering such data it is difficult to estimate total impacts since it is not only fishing ports, processing plants or fish markets that will be affected, but also a vast network of economic activity which directly and indirectly supports the fishing sector. It cannot be overstated that where fishing is important, fishing is very important. Such areas tend to be further away from the urban and economic centers, and it is common for these communities to have fewer non-fishing related economic opportunities.

In many coastal communities, there is:

- declining birth rates combined with high out-migration;
- a lower average income and lower education levels (hence low mobility);
- a higher dependence on government transfers;
- a strong informal economy;
- an existing high unemployment rate;
- few to no alternative fishing opportunities; and,
- few other economic opportunities.

Against this backdrop, it is easy to see that many factors reduce the range of potential options of those that could be adversely affected should cod be listed under SARA. There are few economic opportunities in rural areas, and due to the remoteness of many communities, commuting to another job is often not an option. Migration may be the only alternative for pursuing a livelihood. The extent to which these trends have affected the demographics of Newfoundland and Labrador are shown in Figure 2.5. The picture is one of overwhelming population decline which is expected to continue in all but a handful of areas.

⁸ From *Toward a Policy for the Utilization of Northern Cod: A Discussion Paper*, Department of Fisheries and Oceans, September 28, 1979.

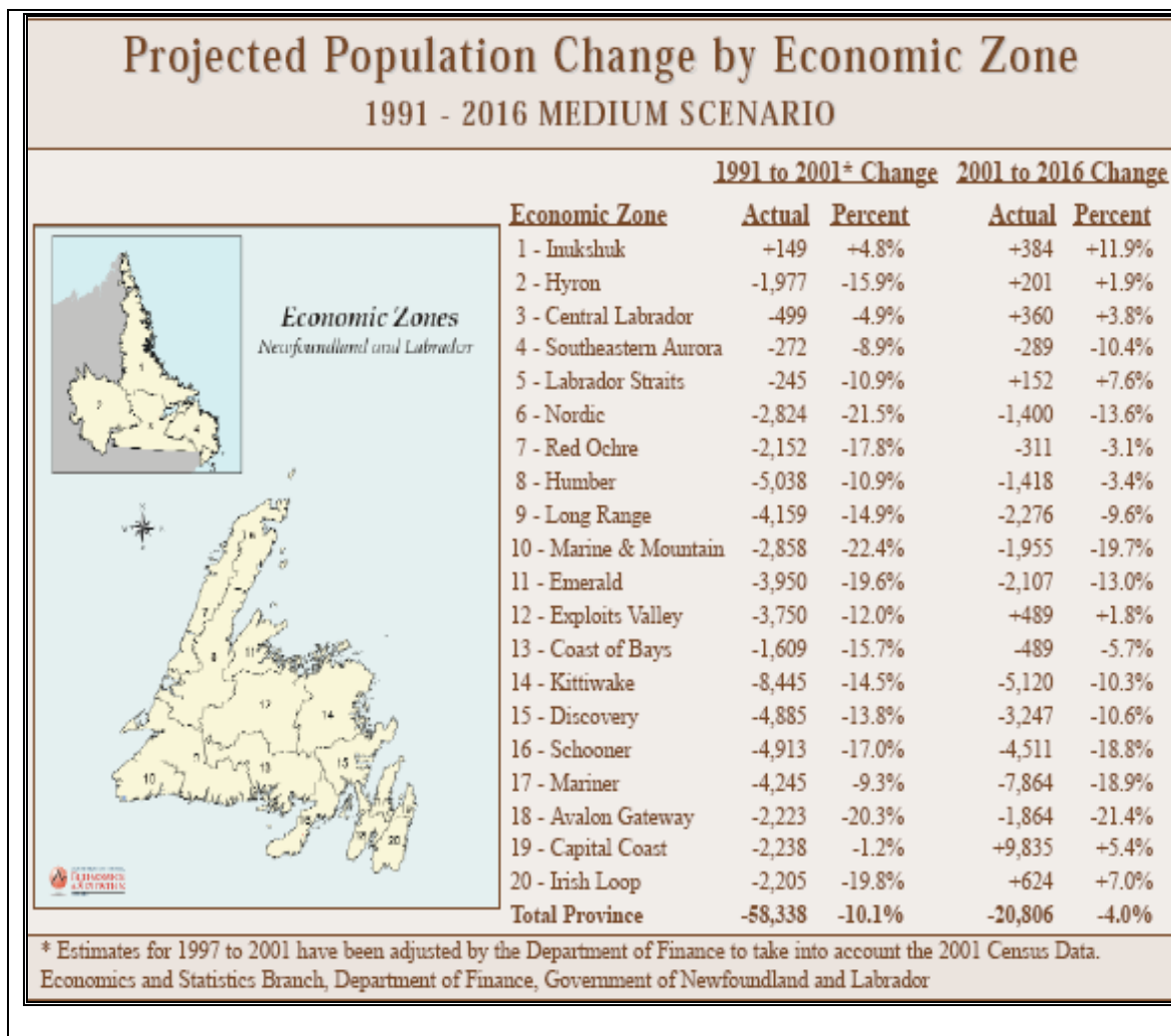


Figure 2.5: Population by Strategic Economic Zones in Newfoundland and Labrador, 1991 - 2016.⁹

Individuals that may be most affected by reductions in groundfisheries tend to be older and with fewer years of formal education. They also tend to have firm roots to their community. There is a very high rate of debt-free home ownership in many rural areas and despite the recent significant out-migration there are still strong family and community support networks in place.

As in many small communities, essential services and supports are often provided through the occupational diversification of individuals in the community who provided these services – sometimes on a volunteer basis, but often through the unreported economic activity. The scale of the informal economy in these communities is not known, but does provide a buffer against economic shocks which is not represented in official statistics.

⁹ Figure taken from p.9 of *Demographic Change, Newfoundland and Labrador: Issues and Implications*. Government of Newfoundland and Labrador, April 2002.

The economy of Atlantic Canada, as a whole, has begun an important transition, expanding into other sectors of economic activity. Over much of the last decade, fishing and fish processing have accounted for roughly 2% of provincial GDP and an estimated 5% of employment in the Atlantic Provinces and maritime regions of Quebec. However, the contribution at the sub-regional level can be much more significant. Appendices D and E provide a summary of select socio-economic indicators for a non-exhaustive list of communities that exemplify those most likely to be affected by the scenarios examined in this report, in Newfoundland & Labrador and the maritime sector of Quebec¹⁰.

Appendix D provides a quick reference for key demographic indicators of the selected communities. It is apparent from this list that local populations continue to decline, some more significantly than others. Only one community (L'Anse au Loup) of the 28 listed, recorded any growth, with only a modest population increase (2.3%). As noted above, the declining rural population dominates the current demographic challenges facing communities, as the weight of an aging population continues to increase in the wake of out-migration and declining birth rates.

The unemployment rates recorded in the 2001 Census provide only a snapshot of a particular period in the calendar year. Still, they highlight the dependence on declining fisheries, and the inability of rural communities to significantly diversify local economic activity. Each community in Quebec recorded an unemployment rate well above the provincial rate, with Cloridorme, in particular, having a very high unemployment rate. Similarly, in Newfoundland and Labrador, the rates are again very high, ranging in excess of 40% in communities such as Burgeo and Burnt Islands and in excess of 50% in Harbour Breton and Rose Blanche. There are a suite of social challenges that commonly accompany high unemployment rates.

Appendix D also provides information on education levels for the various example communities. What is immediately obvious from the list, is the high percent of adults 20 years and older who do not hold a high school diploma. Such a high proportion of low educational attainment suggests a more narrow skill set, which may impede efforts towards economic diversification; however, absence of economic opportunities may, in turn, discourage individual investment in higher education. It should be noted that higher levels of education (trade certificates, college or university) are not uncommon, but that this statistic is heavily dominated by trade certificates currently held in the region. Looking at the community data, it is quite common to see a significant jump in the proportion of residents who held a trade certificate from the 1996 to the 2001 Census.

A final consideration presented in Appendix D is the variable importance of cod as a source of fishing income for communities across Newfoundland and Labrador, and the coastal Quebec region. The proportion of total fishing income derived from cod

¹⁰ Additional detail regarding communities in Newfoundland & Labrador can be found at www.communityaccounts.ca. To obtain a free copy of the CD-ROM, *The Fishing Industry in Quebec – Socio-Economic Profiles 2004*, you may call the Regional Policy and Economics Branch of Fisheries and Oceans Canada, Quebec Region at (418) 648-3817 or send an email to: peportque@dfo-mpo.gc.ca.

highlights communities such as Rose Blanche, Burnt Islands and Port-aux-Basques in Newfoundland, as clearly relying on the cod fishery as an important source of income and fishing activity. These communities have some of the highest unemployment rates in Atlantic Canada.

Fishing income itself is not the only indication of a community's vulnerability, as the presence of fish processing plants also indicates dependence. Marystown and L'Anse au Loup, for example, are both home to groundfish processing plants and so the effects are potentially significant in these communities as well, if Atlantic cod is listed under SARA. Harvest restrictions brought about by SARA could have serious repercussions for the long-term viability of certain processing plants. The effect of reduced harvests has already become a reality in Harbour Breton, where the closure of a plant was recently announced, eliminating some three hundred jobs from the local economy. Job losses and/or plant closures will only increase hardship in remote communities which have already been faced with significant social and economic challenges.

2.4 Cultural Significance

The cultural importance of cod in many coastal communities in Atlantic Canada and maritime Quebec is not reflected in its economic importance relative to other species. While cod accounts for only a minor percentage of the value of the current fishery, it was the historical basis for the original settlement of the colony of Newfoundland. Cod received special consideration in Newfoundland and Labrador's Terms of Union with Canada and, as previously emphasized, it was once the singular driving force behind the rural coastal economy. In both pre- and post-confederation times, prosecution of the cod fishery resulted in seasonal migration patterns throughout Newfoundland and Labrador (and the north shore of Quebec). As a result of these factors, much of the culture and folklore of the region is based on fishing, and specifically fishing for cod. Although urban areas - most notably St. John's - have experienced population growth, most of that growth has been a result of emigration from these rural areas (those migrants who did not leave the province). The cultural importance of cod is therefore not solely a rural phenomenon, but one that is felt and understood in all parts of the province.

3. METHODS

The methods for assessing regional socio-economic impacts are both quantitative and qualitative in this report. The quantitative portion of the analysis focuses mainly on direct impacts within the commercial harvest and processing sectors; however, these two sectors alone do not provide a comprehensive picture of the overall expected impacts. There are indirect and induced impacts that will be realized in community economies, with the potential for additional effects upon Aboriginal communities and other sectors/industries. Many of these impacts are difficult to monetize, but they are potentially significant.

Most of the impacts in the commercial harvest and processing sectors will be concentrated within the more vulnerable economies of rural fishing communities, further degrading the foundation upon which those societies were built. Social impacts at the community level are examined mainly through a series of profiles that describe the prevailing socio-economic conditions in representative communities (outlined in Chapter 2), along with a descriptive analysis of the additional effects that could be brought about if Atlantic cod is listed under SARA (Chapter 6).

The methods outlined in the present chapter pertain mainly to the analysis of the commercial harvest and processing sectors.

3.1 Overview

Examples of plausible management scenarios that represent a range of harvest restrictions were obtained from the Fisheries and Aquaculture Management and Science Sectors of DFO. The scenarios specify reductions in harvest mortality through the closure of directed fisheries (where such fisheries exist) and through bycatch restrictions on other fisheries. The scenarios include cod conservation measures that may be considered with or without the addition of Atlantic cod to Schedule 1 of SARA, as well as some scenarios that would be difficult to implement without the legal force of SARA.

The scenarios were developed in relation to the most recent management year at the time of this writing. Goals for, *e.g.*, bycatch reduction were therefore defined in relation to 2004 bycatch levels. Consequently, 2004 is also used as the reference year for the estimation of socio-economic impacts. The reference year is characterized in Chapter 4, and the details of the alternative scenarios are outlined in Chapter 5.

For the purpose of this impact analysis, all scenarios are implemented as direct reductions in the TAC. A number of other conservation measures may be possible, including time-area closures and gear restrictions. This wider range of alternatives would be considered in the event that additional conservation measures are required, beyond those already in place. Furthermore, stakeholders would be invited to contribute their expertise towards the development of effective conservation measures that would minimize negative socio-

economic impacts. Therefore, the scenarios discussed in this report are meant to be illustrative only, and are not specific proposals for recovery measures.

For each management scenario, two levels of impact were examined. First, the immediate impacts were assessed under the assumption that, without any management changes, the year in which impacts are realized would be identical to the reference year (that is, all other factors are held constant). Second, long term impacts were projected over a 20-year horizon to determine how an alternative management scenario might perform, relative to the continuation of conditions in the reference year. Although it is obvious that the future cannot be predicted, analyzing the longer term is the only approach available to quantify the possible *benefits* of harvest restrictions. Benefits can only be realized through the accumulation of cod biomass, and that can only occur over multiple years. The 20-year horizon was chosen because it represents approximately three generations of cod, and is comparable to the time frame used by COSEWIC to assess the decline of cod populations.

Indicators of Immediate Impacts

The immediate impacts focus on the near-term costs of management changes that may accompany a legal listing under SARA. The following are estimated:

- a) **Foregone revenue in the harvest and processing sectors.** Foregone revenue is approximated in a simple way for these sectors, as the i) landed value and ii) processed value of the foregone harvest. To avoid double counting, the landed value is subtracted from the processed product value. No other costs are netted from the totals.
- b) **The number of affected individuals.** For harvesters, the affected individuals are those who actively participated, in 2004, in the fisheries proposed for management changes in each hypothetical scenario. An attempt is also made to characterize the degree to which harvesters depend on the affected fisheries, using an arbitrary definition of “dependent”, which is described below in section 3.3.1. For the processing sector, the number of affected individuals is estimated as the number of jobs that are no longer supported, due to a reduction in raw material inputs to the sector. In the seasonal processing industry, a “job” is not equivalent to a person year. The estimates are therefore better described as “job equivalents”, and the details of their estimation are described in section 3.4.1.

For each management scenario, the impacts on revenue and jobs were first estimated based upon the scenario’s harvest restrictions only, and secondly with the added impact of the potential SARA “no sales” restriction on cod. For example, a scenario for 4RS3Pn might call for closure of the directed fishery. In that case, foregone revenue was estimated as the value of the directed cod fishery in 4RS3Pn in 2004. This included the value of the cod that was targeted in that fishery, plus all species caught incidentally while cod was targeted. When the “no sales” prohibition was added to this scenario, foregone revenue was estimated as the value of the cod fishery and all bycatch in that fishery (as above) PLUS the value of all cod caught incidentally in *other* fisheries in

4RS3Pn (such as the flounder, Atlantic halibut, redfish, and Greenland halibut fisheries). These other fisheries would operate normally (if not subject to harvest restrictions themselves) but the cod caught incidentally would generate no revenue.

Long Term Impacts

For the 20-year impacts, dynamic models of the cod stocks in each of NAFO zones 2J3KL, 3NO, and 4RS3Pn¹¹ were obtained from DFO Science Sector. The models were parameterized with the most recent estimates of growth and spawning stock biomass (SSB). Each of the 2004 harvest quotas (TACs, bycatch levels) in the management scenarios were converted to an exploitation rate (percentage of the SSB), rather than absolute tonnage. Harvests and stock biomass were then projected over the 20-year horizon, and the harvests were monetized using the landed and processed unit values from the immediate impact calculations.

If the spawning stock biomass recovered sufficiently in a scenario to reach a critical threshold, the annual harvest was thereafter allowed to proceed at a higher rate, which we assume to be consistent with precautionary management. The threshold chosen for this analysis is the Limit Reference Point (LRP) for spawning stock biomass, as determined by DFO Science Sector. The LRP represents a lower limit on spawner biomass, and under precautionary management, actions should be taken to prevent a stock from falling as low as this limit. Nonetheless, most cod stocks are already well below their LRPs. Many of the LRP's have only been estimated on an interim basis, and the use of the LRP as a lower threshold for establishing a directed fishery is not DFO policy. The Department's approach to precautionary management using reference points is under development, and in the absence of alternative established guidelines, the LRPs provided a threshold that could be applied consistently across the cod stocks considered in this report.

The 20-year projections produced a separate time series of revenue and biomass for *current conservation*¹² and each alternative. The discounted present value of the **difference** in revenue was calculated for *current conservation* versus each alternative, along with the corresponding non-monetized difference in terminal biomass.

Enhanced future harvests are one source of benefits in the long term scenarios. Biomass is a second source of benefits, in that a larger fish stock is of higher value as capital, even if it is not sufficiently large to be harvestable. Although it may be preferable to assign a dollar value to the spawning stock biomass, only biomass units are reported in this document. Convincing estimates are not yet available for either the

¹¹ Long term impacts were not assessed for stocks where alternative management scenarios were not developed. As discussed in the text for each stock, no scenarios were developed for 2GH because there is no cod harvested there, nor for 3Ps because current management would be expected to continue given the current state of the stock.

¹² "Current conservation" represents a continuation of the current regime (for example, ongoing levels of bycatch expressed as a percentage of the spawning stock biomass). "Current conservation", "status quo", and "baseline" management may be used interchangeably in the text of this report.

capital value of the stock to harvesters and processors, or the willingness of Canadian households to pay for enhanced cod stocks.

The models for long term impacts are described in greater detail in Appendix C. Also included in Appendix C are all parameter estimates and the sources from which those estimates were obtained.

It is very important to note that long-term scenarios must be interpreted with extreme caution. They represent simple, stylized futures under a set of hypothetical conditions, and they are *not* predictions. No formal probability is assigned to any of the outcomes. The utility of the long term analysis lies in characterizing the range of conditions under which benefits *might* be realized. For example, in some cases it is shown that significant benefits from short-term harvest restrictions can very plausibly be realized in the near future, while in other cases the analysis suggests that no appreciable benefits are likely to occur within the next 20 years. Conclusions can be drawn only at a very general level.

In addition, the establishment of reference points for good management is ongoing in DFO Science Sector, and for some stocks the LRP used in this analysis is a preliminary estimate. The use of the Limit Reference Point as a lower critical threshold for establishing a directed fishery is simplistic, and not necessarily in accord with the requirements of SARA. Even outside the context of SARA, cod stocks are not likely to be considered recovered until some higher threshold such as a Target Reference Point is reached. However, these targets have not yet been established. The use of LRP's is valid for the purpose of comparing the *relative* effects of the different scenarios, in a manner which is consistent across stocks.

3.2 Analytical Considerations

Delisting Criteria and the Automatic "No Sale" Prohibition

COSEWIC has well-defined criteria by which species are recommended for listing, but criteria for delisting are less explicit. This complicates the long-term analysis, as it is impossible to determine a timeframe over which the "No Sale" Prohibition would prevail. The effect of the "No Sale" prohibition is therefore assessed for the immediate impacts only. As more information becomes available on either delisting criteria or the legal possibilities for exemptions from the buy/sell prohibition, this information could be incorporated explicitly into the long term scenarios.

Reference Year

The reference year for this analysis is 2004, chosen because it represents the most recent complete year for which landings statistics are available, and because the alternative management scenarios were developed relative to 2004 practices. The choice of a baseline also depends upon the desired focus of the analysis. In this report, emphasis rests upon the potential marginal impacts of SARA, which are best measured in relation to the most current conditions prior to SARA's constraints on management.

Any baseline is likely to deviate from “average” conditions in some respect. For example, temporary shellfish allocations were issued to some Quebec groundfish harvesters in 2004. These allocations were designed to provide economic relief to fish harvesters experiencing difficulties, and may have also temporarily reduced their dependence on cod. Wherever a departure from the norm such as this is known, it is identified explicitly in the discussion of impacts.

An additional point of concern is the timing of this analysis. The SARA decision for Atlantic cod will not be made until April of 2006. Thus, to the extent that 2005 management (and harvest) differs from 2004, the marginal impact estimates would differ. For example in area 4RS3Pn, the 2005 TAC for cod was raised from 3,500 tonnes to 5,000 tonnes. The analysis in this report would therefore underestimate the marginal effects of harvest restrictions, if SARA restrictions are put into place for the 2006 season. Where such differences are known and substantial, they are discussed in the relevant portion of the impact assessment.

Prices

Constant real prices are assumed over the 20-year projection period. This is a standard assumption in analyses of this kind.

Gross versus Net Revenue

Production costs (fishing costs, factory overhead, *etc.*) are not subtracted from the impact estimates. The estimates are therefore more inclusive than an accounting of lost profits to harvesters and processors. They include revenue that would flow from harvesters and processors to supporting industries for, *e.g.*, fuel and material supplies, equipment maintenance and repair, and the wages for crew and labourers. To the extent that these factors of production would be put to alternative use in the economy, the impacts could be overstated. However, there are generally few alternatives within the communities where the brunt of these impacts would be concentrated.

While it is preferable to obtain estimates of net income and/or value added, and to apply appropriate multipliers from input/output models to those estimates, neither fishing cost data nor regional multipliers of sufficient specificity were available for all provinces included in this analysis. Total revenue was used as the next best alternative, though it does not appropriately account for the net flow into or out of the regional economy.

Discount Rate

In order to compute the present value of future cash flows, a discount rate is used. A pure discount rate expresses the time preference for money, and is essentially the inverse of an interest rate. Individuals who save money give up opportunities to use that money today, and they are only willing to do so if they will have access to greater consumption in the future. Hence, they demand interest on their savings. Looking in the other direction, a person may feel equally well off if they get \$100 today rather than \$105 in one year; thus,

\$105 in 2006 is “equal” to \$100 in 2005. The pure discount rate is the ratio of the two payments (today versus next year or some future period many years away) between which an individual would feel indifferent, in an inflation- and risk-free environment. The many interest rates observed in the market include expectations of risk and inflation, and are therefore higher than the pure rate of time preference.

Because there are many interest (or discount) rates in the market, there is considerable discussion among economists regarding the appropriate rate to use for public decision-making. The social discount rate will differ from an individual’s discount rate because, it is argued, public investment should be more patient and should put greater weight on the well-being of future stakeholders. A common discount rate used in benefit cost analysis is the rate on long term government bonds whose maturity is about the same as the time period of analysis. The Treasury Board Secretariat of Canada’s *Benefit Cost Analysis Guide* suggests a social discount rate of 10%; however, this rate is much higher than the average return on 20-year federal bonds (<3%) and exceeds the social discount rates considered by economists in the current literature. For this impact analysis, a discount rate of 5% was applied; this rate is currently commonly accepted in Canada. A sensitivity analysis using discount rates of 3% and 7% was also carried out in order to assess the robustness of the results.

Independence of Impacts in Different NAFO Divisions

The impacts assessed for various management scenarios are presented separately by cod population and by NAFO divisions within populations. However, the overall regional socio-economic impacts are unlikely to be a simple additive function of these separate sub-regional effects. For example, if the cumulative effect of the impacts in several NAFO divisions exceeds some threshold that causes a processing plant to close down, then the overall impact could be more severe than the sum of the individual impacts assessed in this report. Similarly, fishermen who derive income from more than one cod stock may not be identified as dependent on either of those stocks in isolation, but the combined income may represent a substantial part of his or her livelihood. In that case, the particular combination of management scenarios put into place for both stocks could again have more severe implications than would be identified by the sum of the independent impacts.

3.3 Harvest Sector

3.3.1. Methods

Data on the 2004 harvesting sector was compiled by DFO. The main sources of data are the catch and effort databases in the relevant DFO Regions (Newfoundland and Labrador, Quebec, Maritimes, and Gulf), with FINs (fisher identification number) added, in order to associate landings across licence holders. All records with unknown vessel IDs or FINs were removed, as it was not possible to associate them with an individual fisher. Most of these “unknown” records pertain to non-vessel based harvests of species such as clams

and seaweeds and, to a limited extent, the estimated amount of fish consumed on-board or in the home. Thus the impact of deleted records is negligible.

The total population of licence holders considered in the analysis were those who held groundfish licences *or* who reported cod landings in 2004, from any of the five NAFO areas that comprise the Newfoundland and Labrador or Laurentian North cod populations (2GH, 2J3KL, 3NO, 4RS3Pn, and 3Ps). The population of potentially affected fishers was not identified for the Maritimes cod population, as *status quo* management is expected for that population under the current Fisheries Management Plan, even if added to the SARA legal list.

For each management scenario considered for the Laurentian North or Newfoundland and Labrador cod populations, the “**Affected Licence Holders**” were identified as those who participate in any of the directed fisheries slated for harvest restrictions.

The number of **affected crewpersons** was identified using a multiplier for the maximum number of crew per vessel, according to vessel size, and was applied to each affected vessel/licence. The multipliers were developed in consultation with DFO Regional staff in 2002 and are detailed in Table 3.1.

Table 3.1: Multipliers for Crew Members According to Vessel Size, by Region

Multipliers shown in this table include the skipper. For example, a Quebec groundfish vessel 45-65’ is estimated to have 3 crew + 1 skipper, for total vessel head count of 4.

Vessel size	Newfoundland and Labrador	Quebec	Gulf	Maritimes
Under 35 feet	1.5	2	2	1.5
35 to 45 feet	3	3	3	3
45 to 65 feet	5	4	4	3
65 to 100 feet	7	5	5	6
Over 100 feet ¹	variable	-	13	15

¹ The offshore fleet in Newfoundland and Labrador has undergone significant investment in the past two to three years so as to replace older vessels with newer more modern vessels. To address the issue of mid-year replacement of vessels and the associated reorganization, a separate estimate of affected and dependent crew was generated for this fleet.

“**Dependent**” **licence holders** were identified using the following criteria. First, the licence holder must earn at least \$3K in fishing revenue. This criterion would remove most individuals who do not have substantial ties to the fishery. The second criterion is that the licence holder must stand to lose at least 25% of his/her total fishing revenue under the scenario analyzed. These criteria are meant only to provide an index of dependence, since the true effect on the well-being of each individual harvester cannot be quantified in a report such as this.

Dependent crew are counted as the number of crew members associated with a dependent licence holder.

3.3.2. Assumptions

Several assumptions were made in order to estimate the potential impact that closures could have on licence holders. They are:

- All income is returned to the licence holder's homeport, regardless of where the fish were either caught or landed. Inter-regional effects have therefore been taken into account. For example, cod landed in Newfoundland and Labrador by Quebec fishers are included in Quebec fishers' landings.
- Under the resource rebuilding scenarios considered in Section 5:
 - if a directed cod fishery is closed, all revenue from both the directed cod catch and the bycatch of other species in this cod fishery would be lost.
 - if other (non-cod) directed fisheries were restricted in order to reduce cod bycatch, all participants and revenue involved in those fisheries are subject to proportional reduction.
- Under the SARA scenario where the sale of cod is prohibited if listed, all fisheries in which cod is caught incidentally could continue to operate at the level specified in the management scenario, but the bycatch cod would generate no revenue. One exception occurs for area 3Ps, where the directed fishery is not closed by a management scenario. However, we assume that the prohibition on cod sales would force closure of the 3Ps cod fishery, and that the revenue from other species caught incidentally in that fishery would also be lost.

3.3.3. Limitations

There are several issues that could not be taken into account with the available data when estimating impacts:

- The harvest database does not distinguish commercial catch from catch in the sentinel fishery. If the sentinel fishery is continued for scientific purposes regardless of other management changes, the income lost to fishers who participate in the sentinel program would be overstated in this analysis.
- A company licence holder often has multiple vessels operating across multiple stock areas. The total impact on these licensees will therefore depend upon the particular combination of management regimes that are put in place for each NAFO zone. In the present analysis, however, scenarios for each zone are examined in isolation.
- A single year of data was used as the reference for impact analysis, and 2004 was chosen as it was most relevant to the current management environment. Although it may be preferable to use the average from a (short) time series to assess the consistency of dependence on cod in recent years, time constraints precluded such

extensive data preparation. Some groundfish licence holders may have a particularly high or low catch in 2004, but the overall dependency profile for the fishing population is not suspected to be unusual.

- Inactive licence holders have been removed from the analysis, regardless of the reasons for their inactivity. In some instances, a fisher licensed for groundfish with a temporary shellfish allocation may have chosen not to fish groundfish, and if that individual did not catch any cod incidentally, he or she was not included in the database used for this analysis. Nonetheless, efforts were made to identify groundfish harvesters who were less dependent upon cod as a direct result of holding a temporary shellfish allocation.
- No information is available on crew rotation (*i.e.*, whether or not a skipper uses more than one crew during a season), or if a crew member works on several vessels during a season. The number of crew members required to operate each vessel is well documented, but the precise number of individual people is less clear. The estimates of crew numbers are therefore better viewed as “job equivalents” rather than as counts of people.

3.4 Processing Sector

The fish processing sector is directly dependent upon activities in the harvest sector. Restricted groundfish harvests will result in fewer raw inputs for processing plants, and the resulting socio-economic impacts are on a scale comparable to those in the harvest sector itself. Processing sector impacts are therefore estimated explicitly in this report, in a manner as consistent as possible with the methods used for harvest impacts.

3.4.1 Methods

As in the harvest sector, impacts in the processing sector are estimated in terms of both foregone revenue and the number of people (jobs) potentially affected by changes in fisheries management. However, unlike the harvest sector, a comprehensive database on fish processing activities is not available for all affected provinces or regions. Data are therefore drawn from a heterogeneous set of sources, including DFO-managed databases, provincially-managed databases, import/export statistics, and Statistics Canada’s Annual Survey of Manufactures data.

Impacts in the processing sector were estimated based directly upon the changes in harvested quantities under the proposed management scenarios. First, 2002 processing data (the latest complete data available) were used to develop unit values for estimating:

- a) the approximate number of processing jobs supported per landed tonne of each fish species (an “employment factor”), and,
- b) the additional product value generated through processing each tonne of a given fish species (an “added value factor”).

The latter measure is called “added product value” in the subsequent text, but note that it is not a conventional value-added measure. It is simply the difference between final product value (using the average product form) and the landed value of the unprocessed (or minimally processed at sea) input. A higher “added product value” cannot be interpreted as a larger profit to processing firms, since none of the production costs (wages, energy, raw materials other than fish) have been subtracted.

The employment and added-value factors were then applied to foregone harvests under each management scenario to obtain the impact estimates.

Species- and province-specific data were used wherever possible to estimate the impacts of specific harvest restrictions upon processing jobs and added product value. Average factors for the processing sector as a whole would generally underestimate impacts, since groundfish landings generate more processing jobs than shellfish. Even among groundfish species, the intensity of processing varies by species and product type. Furthermore, differences in the overall composition of the fisheries among provinces have led to different levels of plant specialization, as well as differences in the seasonality of employment for fish processing workers.

Employment

Identifying what constitutes a “job” in the seasonal fish processing industry is not trivial, since a job is not generally equal to a person-year in seasonal industries. An empirically-based definition might equate a job to the *average* duration of employment in fish processing. However, the average number of weeks worked varies among provinces, and the data were not always available to consistently apply such a definition. The best available information was used for each province, as described in the following paragraphs.

In general, the methods for estimating employment factors fell into two categories. In the first category, total employment at each processing plant was divided among the species processed there, according to the proportions (by weight) in the plant’s inputs. It was then standardized to a unit value (*eg.*, jobs per thousand tonnes). In the second category, an industry estimate of the labour hours or person-years required to process a unit quantity was obtained, and the total was then converted to job-equivalents based upon the average duration of employment in the relevant province. The choice of method depended upon the data available.

Quebec

Data on peak employment and the quantities processed (by species) were obtained from the DFO Statistics and Licensing Division, Regional Fisheries Management Branch, for each groundfish processor in Quebec. Therefore, the first method described above was applied. For each plant, employment was attributed to various fish species according to the relative quantities (by weight) purchased as inputs. Jobs were then summed across

plants and divided by the total quantity processed at all plants, to get an estimate of jobs per thousand tonnes. Species-specific employment factors were calculated in this way for cod and 3 other species (Greenland halibut, Atlantic halibut, and redfish).

The relationship is not known between peak employment and the actual number of job-equivalents at processing plants in Quebec. According to the Statistics Canada Labour Force Survey (2001), the average duration of employment in fish processing in Quebec is 22 weeks; however, no data were available on the hours or weeks of employment at the relevant groundfish processing facilities in Quebec. Additional data are required to examine the relationship between peak employment and average employment.

Newfoundland and Labrador

Data on plant throughput, weeks of operation, and total employment hours were obtained from the provincial government. Both methods were used to estimate cod processing jobs in Newfoundland and Labrador, producing similar results (for species other than cod, only the first method was used). First, industry estimates were available for the number of person-years required to process 1,000 tonnes of several fish species. Person-years were then converted to seasonal job-equivalents based upon the observed duration of employment in a) tax filer data, and b) a surveyed sample of processing plants. These sources indicated that a seasonal fish processing job is approximately 20 weeks of employment in Newfoundland and Labrador, so that 1 person-year is equal to 2.6 jobs. This agrees well with the Statistics Canada (2001) Labour Force Survey tabulation (21 weeks).

The second method estimated the total number of jobs at each plant, and then calculated cod-related jobs as proportional to the amount of cod in each plant's total inputs. Only plants that processed 25 tonnes cod or more were included in the sample (these are the plants with a minimum of one job-equivalent from cod). To estimate the jobs at each plant, data on total annual employment hours were divided by the weeks of operation for each plant, to obtain employment hours per week. Hours per week, divided by 35 hours/job-week, gave an estimate of the number of jobs associated with all species processed at the plant. This number was then pro-rated by the proportion of cod in the plant's inputs. Jobs were summed across plants to obtain a region-wide estimate of cod-related employment. The details of the cod calculations are available in a separate report prepared by DFO-Newfoundland and Labrador Region.

Species-specific employment factors for Newfoundland and Labrador were developed for cod and several other species, including flounders, Atlantic halibut, Greenland halibut, redfish, pollock, hake, and haddock.

Nova Scotia, New Brunswick, and Prince Edward Island

The second general method was used for these provinces, as specific employment data by plant were not available. A reliable industry estimate (from DFO-Gulf region) for the labour required to process one tonne of cod was converted to job-equivalents, dividing hours per tonne by the average number of hours worked by labourers in fish processing.

This latter number was calculated from the Statistics Canada Labour Force Survey statistics on the average weeks of employment for workers in fish processing, by province, and assuming a 35-hour work week.

A species-specific employment factor was developed only for cod for these three provinces, as the expected impacts beyond cod are generally low in these provinces, and additional data were not readily available.

General Fish Processing Employment Factors

For the cases where province- or species-specific employment data were not available, a general employment factor was developed. Statistics Canada Labour Force Survey statistics (2001 Census) provided estimates of the total number of individuals that a) received any income from fish processing and b) received income from fish processing and also received Employment Insurance benefits. Each of these totals was divided by an estimate of the inputs to production for the year represented by the Census data (2000), and the average of the two ratios was used as the general employment factor. Inputs to production were estimated as the sum of commercial landing statistics, including aquaculture production, and imports of whole fish, fresh or frozen.

Although this general estimator is somewhat crude, it was applied to only a small proportion of the foregone harvest quantities, and the number calculated falls well within the range of factors calculated using the more specific methods described.

Added Product Value

In addition to foregone jobs, impacts in the processing sector will be felt as foregone revenues to fish processing firms. Thus, added-value factors were developed to estimate the final product value associated with foregone harvests. However, to eliminate the double counting of impacts, the harvested value was subtracted from final product value, as described at the beginning of this section. Once again, species- and province-specific data were used wherever possible, but the heterogeneity of the available data required different assessment methods. The best available information was used in each situation.

Quebec

The value of input purchases and output sales from individual processing plants was available, by species, for Quebec. Determining added product value was thus a simple matter of calculating the difference between purchased landings and outputs. Data from 2002 were used.

Newfoundland and Labrador

The province of Newfoundland and Labrador publishes aggregate production quantities by species and product type each year. However, the product value is not published. To estimate the total value of processed output, Statistics Canada export prices were applied to provincial output quantities for the year 2002.

Export data are categorized by six product types: whole/dressed fresh, whole/dressed frozen, fresh fillets, frozen fillets, block, and salted. For each product listed in the provincial data, the export price with the best correspondence to the product type was applied. Values were summed across products to give the total output value of the processed fish, by species, for the province as a whole.

To subtract the value of inputs, it was necessary to recognize that these inputs include the landings recorded in DFO data, as well as imported whole fish and aquaculture. Import data by species were not sufficiently reliable to be confident that they represented the actual volume of inputs to Newfoundland and Labrador production¹³. To avoid a mismatch of input and output quantities, standard product conversion rates were instead applied to the output product volumes to determine the appropriate volume of round weight input. Average landed prices from DFO data were then applied to the estimated input volumes. Although this method did not account for any differences in the price of imports, imports of species other than cod are a relatively small proportion of total production. For cod, specific data were obtained from the province on imported inputs to production.

Nova Scotia, New Brunswick, and Prince Edward Island

There were no specific output data available for the processing sectors in these regions. Because the expected impacts are relatively small, it was not undertaken to collect additional data. Instead, only the general added value factor described below was applied.

General Factor for Added Product Value

For cases where no data were available to calculate an estimate of added product value, a general added value factor was developed from Statistics Canada industry-level data on the costs of production and the sales of manufactured goods for Seafood Product Preparation and Packaging (NAICS 3117). This is expected to be a very rough approximation, but is applied to a very small proportion of the processed quantities in the analysis.

3.4.2 Assumptions

Several assumptions were made in applying the employment and added-value factors to landed quantities, and in using the resulting values as impact estimates:

- Factors developed from 2002 data are applicable in 2004. Processing plant technology, the general product mix, and prices must be similar between those two years for this assumption to be valid.

¹³ Import (export) data are recorded according to the point of entry (exit) from the country, but do not represent the final destination of the goods. Thus, imports entering Newfoundland ports may actually be destined for another province, and vice versa.

- Processing revenue is realized in the province where fish are landed (unlike harvest revenue, which is realized in the home province of the harvester).
- The processing sector as a whole cannot mitigate the impact of reduced domestic landings by obtaining sufficient raw inputs from abroad. Recent observed trends support this assumption (*e.g.* reduced whitefish imports to Canada due to competition from China on the world market).

3.4.3 Limitations

- Information on the processing sector is generally lacking for this kind of analysis. Although the best available numbers were used in this assessment, the impacts should be regarded as **order-of-magnitude approximations**. More precise estimates would require a multi-provincial survey of groundfish processing plants.
- It is not generally possible to assess the impact of harvest restrictions upon individual processing plants, as there are at least some opportunities for reallocation of existing inputs among competing plants. However, the general level at which a plant depends upon groundfish can be assessed.
- It is not generally possible to assess *which* specific harvest restrictions (*e.g.* restrictions in 2J3KL versus 3NO) will affect which specific processing plants. This is particularly true in Newfoundland where substantial trucking of dockside purchases is known to occur. Nonetheless, some cases of fisheries-specific dependence are characterized, where known, in the text of the following chapters.
- Indirect economic impacts will spread beyond the commercial harvest and processing sectors, and these indirect effects are not explicitly taken into account in the employment and added-value factors used here. To the extent that the gross revenue to processing plants includes money that would be paid out to supporting industries for additional inputs to production, indirect effects are taken into account. However, the regional effects of job losses leading to lower consumer expenditures are not taken into account in the factors. These effects and others are discussed qualitatively in Chapter 6 where a wider range of impacts are discussed.

3.5 Communities

Communities were identified where fishing income from cod could be decreased by 25% under the most restrictive fisheries management scenario, along with those that have a processing plant with a minimum of 25% production of cod. Key socio-economic indicators were compiled. Additional communities which did not strictly meet these criteria, but which still recorded a relatively significant proportion of fishing and processing income from cod were also examined. This is not an exhaustive list of the communities that may be affected should Atlantic cod be listed under SARA, but the selected communities are illustrative.

For each community, Census data were used to create a brief profile of:

- a) demographic trends,
- b) labour force and income,
- c) primary, secondary, and tertiary economic sector activity,
- d) employment in the fishery,
- e) education, and,
- f) household/family structure.

These profiles are intended to provide a picture of the degree to which communities depend upon the fishery and the alternative economic opportunities available. They also describe, to some extent, the cumulative impacts already experienced in recent years, embodied in statistics such as unemployment and emigration rates.

The community profiles are presented in Appendices D and E.

4. CHARACTERIZATION OF REFERENCE YEAR

For this analysis, the reference year represents the current socioeconomic condition and performance of the Atlantic cod fishery given the existing fisheries management plans. The characteristics of the fishery for the reference year of 2004 are described in this section.

4.1. Atlantic Cod Harvest in 2004

Licences

In 2004, approximately 9,574 individuals held groundfish licences in the Atlantic Provinces and Quebec (Table 4.1). Licence holders are classified into core versus non-core enterprises, where core enterprises are those with an ongoing level of attachment and dependence upon the fishery. Core status was granted to qualifying enterprises in the mid-1990's during license policy revisions aimed at conserving the fishery, limiting entry, and protecting the livelihoods of professional harvesters substantially attached to the fishery¹⁴. Groundfish licence holders may or may not hold licences for other fisheries as well, and not all groundfish licence holders were active in the fishery in 2004.

Table 4.1: Groundfish licence holders, by province, in 2004

Some licence holders may own more than one licence, so that the total number of licences is greater than the numbers presented here. [Note: DFO-Gulf Region Data are from 2003]

Province	Groundfish Licence Holders		
	Core	Non-Core	Total
Newfoundland and Labrador	3,916	736	4,652
Quebec	402	17	419
Nova Scotia	2,649	103	2,752
New Brunswick	807	53	860
Prince Edward Island	870	21	891
Total	8,644	930	9,574

Landings

A total of 23,980 tonnes of cod were landed from the three Atlantic cod populations in 2004, of which approximately 23% was landed as bycatch in other directed fisheries (Table 4.2).

¹⁴ For more information on licensing policy, please see *Commercial Fisheries Licensing Policy for Atlantic Canada, 1996* at http://www.dfo-mpo.gc.ca/communic/lic_pol/ch1_e.htm. In brief, core and non-core enterprises are subject to different conditions upon operation, access, and transferability, with core enterprises retaining more privileges. Non-core enterprises are not transferable, and will ultimately disappear through attrition.

Harvests from the Newfoundland and Labrador cod population were essentially all bycatch, with small directed quantities in sentinel fisheries (Table 4.2). The main bycatch fisheries were winter and yellowtail flounder, with winter flounder accounting for 94% of the cod bycatch in 2J3KL, and yellowtail accounting for 84% of the domestic bycatch in 3NO (Appendix B).

Table 4.2: 2004 Landings and Landed Value of Atlantic Cod, by Cod Population and NAFO Division

Directed Fishery and Bycatch shown separately. Includes sentinel fisheries.

Cod Population	NAFO Division	Directed Cod		Cod Bycatch	
		Landed Weight (t)	Landed Value (\$,000)	Landed Weight (t)	Landed Value (\$,000)
Newfoundland and Labrador	2GH	0	0	0	0
	2J3KL	5.7	7	513.3	667
	3NO	0	0	479.7	649
	TOTAL	5.7	\$ 7	993.0	\$ 1,317
Laurentian North	4RS3Pn	2,938.0	3,840	202.5	273
	3PS	10,648.1	14,497	820.2	1,220
	TOTAL	13,586.1	\$ 18,338	1,022.7	\$ 1,492
Maritimes	4T	2,091.4	2,845	163.5	226
	4VN	225.0	412	14.7	25
	4VSW	17.4	32	29.9	55
	4X	2,332.8	4,292	2,385.7	4,390
	5Ze _{i,m}	263.7	485	848.7	1,562
	TOTAL	4,930.2	\$ 8,067	3,442.5	\$ 6,257
ALL (Grand Total)		18,522.1	\$ 26,411	5,458.2	\$ 9,066

The Laurentian North cod population had the largest directed cod fishery of all three populations in 2004, mostly within area 3Ps (Table 4.2). The absolute amount of bycatch was comparable to that from the Newfoundland and Labrador population, but was distributed among more fisheries. In 4RS3Pn, cod bycatch is concentrated within the Atlantic halibut, witch flounder, and American plaice fisheries, while in 3Ps, cod is most often taken incidentally in the redfish and witch flounder fisheries (Appendix B).

The Maritimes cod population supported moderate directed fisheries in areas 4T and 4X (Table 4.2), with significant bycatch of cod in the haddock fisheries in 4X and 5Z, and in the 4X pollock fishery.

The provinces of Newfoundland and Labrador and Nova Scotia recorded the greatest volume of cod landings (Table 4.3). All landings in Newfoundland and Labrador came from the two populations currently under consideration for addition to the SARA list as either Endangered or Threatened. Most landings in Nova Scotia originated from the proposed Special Concern Maritimes population, and of the landings originating from the

other two cod populations, close to half were actually caught by harvesters originating from Newfoundland and Labrador. Landings in Quebec were harvested from the Laurentian North population (Northern Gulf - 4RS) and the Maritimes population (Southern Gulf - 4T). Cod landings in New Brunswick and Prince Edward Island were quite low in volume, and all originated from the Maritimes cod population.

Table 4.3: 2004 Landings and Landed Value of Cod, by Cod Population and Province of Landing

Province of Landing	Newfoundland & Labrador Cod Pop'n		Laurentian North Cod Population		Maritimes Cod Population	
	Landed Weight (t)	Landed Value (\$,000)	Landed Weight (t)	Landed Value (\$,000)	Landed Weight (t)	Landed Value (\$,000)
Newfoundland and Labrador	957	\$ 1,248	13,281	\$ 17,754	0	0
Quebec	0	0	627	\$ 789	893	\$ 1,208
Nova Scotia	41	\$ 76	700	\$ 1,288	6,601	\$ 11,827
New Brunswick	0	0	0	0	590	\$ 917
PEI	0	0	0	0	288	\$ 371
TOTAL	999	\$ 1,324	14,609	\$ 19,830	8,373	\$ 14,323

The licence holders who fished for cod in 2004 could have fished for, and received income from, groundfish and a number of other non-groundfish species. Thus, their reliance on cod as a source of revenue is variable. Tables 4.4.a through 4.4.c provide a picture of the importance of cod revenue, for the population of licence holders who earned at least \$1 in revenue from cod.

The province of Newfoundland and Labrador had the greatest number of licence holders earning revenue from cod, and also the greatest number (and proportion) receiving more than 25% of their fishing revenue from cod (Table 4.4.a). Forty-three percent of licence holders from Newfoundland and Labrador who earned some revenue from cod also relied upon cod for more than 25% of their total fishing revenue. The next highest level of dependence was seen in Quebec, where 20% of licence holders obtain more than 25% of their fishing revenue from cod. However, the level of dependence on cod in Quebec is temporarily lower due to temporary shellfish allocations (see Section 4.4.2).

Table 4.4.a: Dependence of Licence Holders on Cod Revenue. Includes all groundfish licence holders who landed at least \$1 in Atlantic cod in 2004, directed or bycatch.

Home Province	Proportion of Licensee's Fishing Revenue from Cod						Total by Province	% Licence Holders > 25% cod
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%		
Newfoundland and Labrador	1,048	424	600	201	214	78	2,565	43 %
Quebec	230	28	23	20	5	16	322	20 %
Nova Scotia	391	145	67	21	18	3	645	17 %
New Brunswick	87	33	6	5	1	2	134	10 %
Prince Edward Is.	178	5	1	0	0	3	187	<1 %
Total Licensees by Dependence	1,934	635	697	247	238	102	3,853	33 %

Table 4.4.a does not indicate total earnings in the fishery, but simply the proportion attributable to cod. However, many individuals with a high proportion of cod in their landings may have very low landings overall, and may therefore be less reliant on the fishery as a primary source of income. To examine this issue, Tables 4.4.b and 4.4.c separate the licence holders from Table 4.4.a into two groups: those that obtained less than \$3,000 revenue from all their fishing activity in 2004, and those that earned \$3,000 or more¹⁵. Approximately 6% of the licence holders in this population earned less than \$3,000 gross revenue from the fishery, and most of these individuals live in Newfoundland and Labrador (Table 4.4.b). Reliance upon cod revenue was high within this group - 88% of the 218 licence holders from all 5 provinces relied on cod for 25% or more of their fishing revenue.

For the remaining 94% of the licence holders in this group, reliance on cod revenue was somewhat lower on average, but was still particularly high in Newfoundland and Labrador (Table 4.4.c). As many as 922 licence holders (39%) obtained 25% or more of their fishing revenue from Atlantic cod. For Quebec and Nova Scotia, there were 54 and 105 licence holders, respectively, exhibiting this level of reliance on cod revenue. For these two provinces, this amounts to 17% of the groundfish licence holders considered. As before, the level of dependence on cod is much lower in New Brunswick and Prince Edward Island.

¹⁵ The threshold of \$3,000 is somewhat arbitrary, but falls within the range of typical (lower) thresholds to qualify for Fishers Employment Insurance. The actual level of income to qualify for Fisher's EI varies by the regions defined by Human Resources and Skills Development Canada, and is based upon income, not gross revenue; however, \$3K is a useful threshold that has been used previously in a Federal-Provincial analysis of the impacts of the 2003 cod moratorium.

Table 4.4.b: Cod Dependence for Groundfish Licence Holders Earning <\$3,000 Total Fishing Revenue. Sampled from the population of groundfish licence holders who landed at least \$1 in Atlantic cod in 2004, directed or bycatch.

Home Province	Proportion of Licensee's Fishing Revenue from Cod						Total # by Province	% Licence Holders > 25% cod
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%		
Newfoundland and Labrador	5	11	15	15	79	62	187	91 %
Quebec	0	0	0	1	1	8	10	100 %
Nova Scotia	7	4	0	1	1	2	15	27 %
New Brunswick	0	0	0	1	0	2	3	100 %
Prince Edward Is.	0	0	0	0	0	3	3	100 %
Total Licensees by Dependence	12	15	15	18	81	77	218	88 %

Table 4.4.c: Cod Dependence of Licence Holders Earning >=\$3,000 Total Fishing Revenue. Sampled from the population of groundfish licence holders who landed at least \$1 in Atlantic cod in 2004, directed or bycatch.

Home Province	Proportion of Licensee's Fishing Revenue from Cod						Total by Province	% Licence Holders > 25% cod
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%		
Newfoundland and Labrador	1,043	413	585	186	135	16	2,378	39 %
Quebec	230	28	23	19	4	8	312	17 %
Nova Scotia	384	141	67	20	17	1	630	17 %
New Brunswick	87	33	6	4	1	0	131	8 %
Prince Edward Is.	178	5	1	0	0	0	184	< 1%
Total Licensees by Dependence	1,922	620	682	229	157	25	3,635	30 %

Tables 4.5.a through 4.5.c examine the licence holders from each province separately, showing the cod stocks upon which dependence was most important in 2004. In Newfoundland and Labrador (Table 4.5.a), it is not surprising that harvesters were most dependent upon the stocks with directed cod fisheries (areas 4RS3Pn and 3Ps). The level of dependence on the other stocks (2J3KL and 3NO) was at one time high, but this source of revenue has already been lost to harvesters who once had access to that resource. The

fishers of Quebec (Table 4.5.b) show somewhat more dependence upon the Laurentian North stock (area 4RS) than on the Maritimes cod population (area 4T), but once again, reliance is temporarily lower overall, due to shellfish allocations that are not expected to continue indefinitely.

Table 4.5.a: Newfoundland and Labrador Groundfish Licence Holders: Dependence on Cod Revenue by Stock. Sampled from the same population of licence holders used in Table 4.4.a.

Stock	Proportion of Licensee's Fishing Revenue from Cod						Total Licence Holders by Stock*
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%	
2J3KL	707	18	15	11	53	30	834
3NO	23	0	0	0	0	0	23
4RS3Pn	196	211	181	58	73	37	756
3Ps	106	200	419	132	152	40	1,049

* The total number of licence holders exceeds the total for NL in Table 4.4.a, as licence holders appear more than once in Table 4.5.a if they fish more than one cod stock.

Table 4.5.b: Quebec Groundfish Licence Holders: Dependence on Cod Revenue by Stock. Sampled from the same population of licence holders used in Table 4.4.a.

Stock	Proportion of Licensee's Fishing Revenue from Cod						Total Licence Holders by Stock*
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%	
4RS3Pn	72	15	22	18	3	12	142
4TVn	163	7	8	4	4	4	190

* The total number of licence holders exceeds the total for QC in Table 4.4.a, as licence holders appear more than once in Table 4.5.b if they fish more than one cod stock.

Dependence upon cod in the remaining three Atlantic Provinces (Table 4.5.c) fell almost entirely upon the Maritimes cod population (which has not been separated in to individual stocks in Table 4.5.c). Few of the licence holders from these provinces fished the stocks within the Laurentian North or Newfoundland and Labrador cod populations, and only 3 earned more than 25% of their fishing revenue from those stocks.

Appendix F provides more detailed tables of total gross fishing revenue versus dependence upon cod. Tables are provided for groundfish licence holders from the provinces of Newfoundland and Labrador and Quebec only, since these are the licence holders with earnings concentrated in the cod populations considered for listing as either Endangered or Threatened.

Table 4.5.c: Nova Scotia, New Brunswick, and Prince Edward Island Groundfish Licence Holders: Dependence on Cod Revenue, by Stock. Sampled from the same population of licence holders used in Table 4.4.a.

Stock	Proportion of Licensee's Fishing Revenue from Cod						Total Licence Holders by Stock*
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%	
3NO	6	1	1	0	0	0	8
4RS3Pn	1	0	0	0	0	0	1
3PS	6	2	2	0	0	0	10
Maritimes Population	653	180	73	24	19	9	958

* The total number of licence holders exceeds the total for NS, NB, and PEI in Table 4.4.a, as licence holders appear more than once in Table 4.5.c if they fish more than one cod stock.

4.2 Cod Processing in 2004

Estimates of employment attributable to cod in 2004 were obtained from regional DFO offices in Newfoundland and Quebec (Table 4.6). The jobs are attributed to the stocks in each NAFO division based upon relative landed quantities.

Table 4.6: Estimated processing jobs supported by Atlantic cod in 2004, in Quebec and Newfoundland and Labrador

NAFO division	Newfoundland and Labrador	Quebec
2J3KLNO	20	-
4RS3Pn	103	50
3Ps	499	-
4TVn	-	87
Imported cod	385	n.a.
Total	1,006	137

Based on cod landings from all three cod populations, the total regional processing employment attributable to *domestically-caught* cod in Atlantic Canada and Quebec (5 Provinces) was likely in the range of 1,000 to 1,200 jobs in 2004.

Processing plants exhibit different levels of dependence upon cod as an input. Comprehensive data for 2004 are not available, but 2002 data can be used to illustrate some select points. Figure 4.1 uses 2002 data to show the importance of cod as an input to production, in terms of plant volume, at groundfish processing plants in Quebec and Newfoundland and Labrador. Plants are divided into 5 categories along the horizontal axis, according to the percentage of cod in the plants' throughput (by weight). The dark bars indicate the percentage of plants in the province falling into each category; for example, about 8% of groundfish processing plants in Quebec had a total throughput consisting of more than 80% cod in 2002. The lighter bars show the percentage of the province's total cod production that is processed by plants within each category.

Continuing the previous example, the same 8% of Quebec plants processed about 15% of all cod processed in Quebec. Looking to the circle above the histogram bars, there were 11 jobs in total at this group of plants.

The plants that rely on cod for a high proportion of their inputs tend to be smaller plants with low overall employment, with the exception of a small number of larger plants in Newfoundland and Labrador that processed 60 - 80 % cod in their total throughput, much of it imported (Figure 4.1). These plants supported over 600 total jobs in 2002, not all of which are cod related. There were 64 plants in Newfoundland and Labrador supporting at least one cod-related job in 2002.

Most of the cod in Quebec is processed at two or three medium-sized plants that relied on cod for just over 20% of their total inputs in 2002 (Figure 4.1). These plants, plus others in that same dependence category, supported a total of about 380 jobs, not all cod-related. In Quebec, there were 40 plants with cod throughput in 2002.

If cod becomes scarcer as an input to production, there are few alternatives for groundfish plants and all of the jobs at a given plant may be at risk due to a plant closure. Many groundfish plants have been operating on slim margins since the groundfish moratoria began in the early 1990's. More than 1,100 people were employed by plants where cod accounted for more than 40% of throughput in 2002. The future of this source of employment is vulnerable to greater harvest restrictions on cod and many more plants and jobs are vulnerable when one takes into account potential bycatch restrictions on other groundfish fisheries.

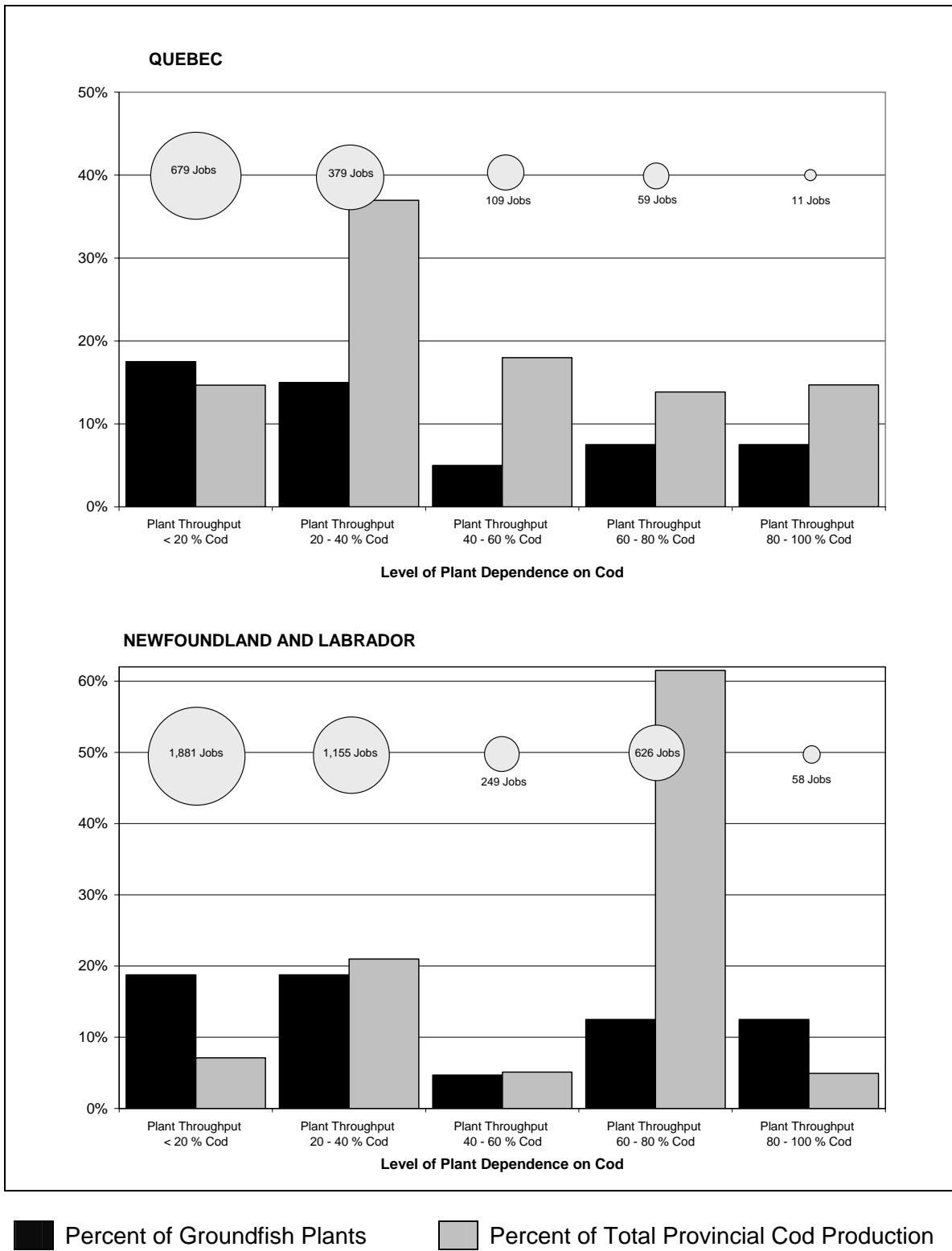


Figure 4.1: Total Employment and Cod Dependence for Plants Processing Cod in 2002, Provinces of Quebec (40 plants) and Newfoundland & Labrador (64 plants)

4.3. Aboriginal Fisheries

DFO has established programs to retire commercial fishing licences and transfer them to Aboriginals, purchase vessels and gear, and increase Aboriginal capacity to fish, as well as develop other fish-related projects to increase their economic autonomy. Some Aboriginal peoples have also been provided groundfish allocations (some of which include Atlantic cod), for food, social and ceremonial (FSC) purposes. Commercial and FSC allocations are described below, by province.

Quebec:

Four (4) First Nations in the Gaspé region of Quebec have commercial groundfish licences that may include cod. In addition, seven (7) Aboriginal communities on the North Shore of Quebec hold a total of seven groundfish licences that were acquired through the Aboriginal Fishing Strategy. These North Shore communities also have access to a total allocation of 79 tonnes of cod for food, social and ceremonial purposes.

Newfoundland:

In the Newfoundland and Labrador Region, fifteen (15) communal commercial groundfish licences, that could include cod, are issued or available to Aboriginal groups. On the Island of Newfoundland, the Miawpukek First Nation (Conne River Band), adjacent to NAFO Division 3Ps, holds six (6) licences and the Federation of Newfoundland Indians (FNI) has three (3). In Labrador, the Labrador Métis Nation (LMN) has one (1), the Labrador Inuit Association (Nunatsiavut Government) holds four (4), and the Innu Nation has one (1) licence.

Currently, the Conne River Band has access to cod for food, social and ceremonial purposes.

Nova Scotia:

In Nova Scotia, there are twelve (12) First Nations with commercial groundfish access through either license or quota (Acadia, Annapolis Valley, Chapel Island, Glooscap, Indian Brook, Eskasoni, Membertou, Millbrook, Pictou Landing, Paqtnkek, Wagmatcook, & Waycobah). Seven (7) of these First Nations have access to cod or a groundfish fishery (which can include cod) for food, social and ceremonial purposes (Annapolis Valley, Chapel Island, Eskasoni, Glooscap, Membertou, Wagmatcook, & Waycobah). In addition, the Native Council of Nova Scotia has both commercial groundfish access and food, social and ceremonial access.

New Brunswick:

In New Brunswick, there are twelve (12) Aboriginal groups with commercial groundfish access through either license or quota. There are eleven (11) First Nations (Burnt Church, Eel Ground, Eel River Bar, Elsipogtog, Fort Folly, Indian Island, Kingsclear,

Madawaska, Oromocto, Pabineau, & Tobique) plus the New Brunswick Aboriginal Peoples' Council. There is one First Nation (St. Mary's) with access to cod or a groundfish fishery (which can include cod) for food, social and ceremonial purposes.

Prince Edward Island:

In Prince Edward Island, there are three (3) Aboriginal groups with commercial groundfish access through either license or quota. There are two (2) First Nations (Lennox Island and Abegweit) plus the Native Council of Prince Edward Island. The two First Nations of Lennox Island and Abegweit also have access to cod or a groundfish fishery (which can include cod) for food, social and ceremonial purposes.

Other:

Finally, there are additional people of Aboriginal descent who hold commercial groundfish licences as individuals (or are part of the crew for other enterprises), independent from their Aboriginal organization or government.

During public consultations, in the autumn of 2004, several concerns were expressed by aboriginal groups (or representative thereof) regarding the potential listing of Atlantic cod. For example, the extent to which critical habitat designations would impinge upon current fishing activities was a concern expressed by the Labrador Métis Nation, as was the possible loss of access to a food fishery for cod.

The direct commercial impacts upon Aboriginal groups are included within the impacts assessed in Chapter 5 of this report. Indirect impacts that may result from critical habitat designation have not been assessed in this report for any fishery or group of harvesters, but these effects are potentially large.

Aboriginal peoples from all regions of Canada have always claimed special relationship with the sea, which is a connection that is not just economic, but also social, cultural and spiritual. Resources from the sea have always served not just food and economic needs but also social and cultural needs. SARA would allow for a food, social, and ceremonial (FSC) fishery, if it is included within an approved recovery strategy. The ongoing allowance of FSC fisheries would undergo review and negotiations during the course of recovery strategy development in the case that Atlantic cod is added to the SARA legal list. Presumably, the outcome could depend to some extent upon the level of harvest restrictions imposed on the commercial fishery. For example, if commercial bycatch is allowed to continue at some level, then FSC fisheries are far less likely to be restricted. Whatever measures are ultimately undertaken, they must take into consideration a number of standing agreements with Aboriginal peoples regarding allocations and access.

4.4. Additional Context for Assessing Potential Impacts

4.4.1. Status of Shellfish Resources

In the past, the crab and shrimp fisheries have provided an important alternative source of revenue for many harvesters displaced from access to groundfish. Crab has contributed about 65% of the landed value to the combined inshore and nearshore fleets of Newfoundland and Labrador in recent years. In Quebec, the total landed value of snow crab accounted for 50% of all the fisheries in 2004. The relatively high price and lower harvesting costs for crab have meant that its proportional contribution to profit has been even higher than this.

In Newfoundland and Labrador, many harvesters who once depended upon groundfish have found economic relief through access to shellfish quota. In Quebec, a temporary shellfish allocation program has allowed fishermen who were disadvantaged by the groundfish moratoria in the early 1990s to continue fishing-related activities. However, this program does not guarantee crab and/or shrimp quotas each year due to the fact that quota availability is directly related to the availability of resources.

Numerous factors affect the availability of resources: stock status, natural variation of crab and shrimp stocks, market conditions and the economical viability of traditional fleets. It is in fact the case that the shrimp and crab fisheries are showing signs of decreasing viability in Atlantic Canada and Quebec. Many crab fishing areas appear to have reached the peak of their supply cycle and the subsequent declining period will likely span over the upcoming years¹⁶. This may compound the impacts of adding cod to the SARA legal list, for these alternative income sources may become scarcer at the same time. In Quebec, this would first affect disadvantaged fishermen with temporary allocations who are already facing an uncertain future.

Factors contributing to the declining viability of the shrimp and crab fisheries are outlined below.

Crab

- The resource is in decline; catches have peaked and have been showing continuous decline since 2002.
- Further quota cuts are likely in some areas.
- Landed price has declined significantly in the last year (for example, in Newfoundland and Labrador the price dropped from about \$2.45/lb. in 2004 to about \$1.45/lb. in 2005, a 40% decline);
- Price decline appears to be due to a number of factors including, market resistance to recent year's high prices, quality issues, and foreign exchange rates which do not favour exports;

¹⁶ DFO 2005: *Southern Gulf of St. Lawrence Snow Crab (Areas 12, E and F)*, Canadian Science Advisory Secretariat, Science Advisory Report 2005/022, and *Snow Crab of the Estuary and Northern Gulf of St. Lawrence (areas 13 to 17 and 12A, 12B and 12C) in 2004*, Canadian Science Advisory Secretariat, Science Advisory Report 2005/027.

- Stronger Canadian dollar, especially in relation to the \$US - 30% gain since the beginning of 2003;
- Rising fuel costs - up about 36% over last 2 years before the latest Hurricane Katrina related price spikes.
- Fuel had been about 40% of the non-labour variable fishing costs of the average crab enterprise - it's now about 50%.

Shrimp (Nearshore)

- Since 1999, the price for landings has fallen almost 30% for the nearshore fleet of Newfoundland, and by 22% for the Quebec fleet;
- Price decline appears to be mostly due to the high global supply of shrimp including aquaculture shrimp, and the relatively strong Canadian dollar;
- Canadian dollar has gained 30% against the \$US and 13% against the Euro since the beginning of 2003;
- European tariff of 20% on Canadian cooked and peeled shrimp effectively keeps Canadian shrimp out of this market. The UK market has a high demand for cold water shrimp and would be a preferred destination for Canadian shrimp.
- Rising fuel cost - up about 36% over last 2 years before the latest Hurricane Katrina related price spikes.
- Fuel had been about 60% of the non-labour variable fishing costs of the average nearshore shrimp enterprise in Newfoundland - it's now approximately 70%.¹⁷

Although shrimp contributes about 15% of the landed value to the fleet of vessels < 65ft. in Newfoundland and Labrador, it is considered to be marginally profitable to both the harvesting and processing sectors. In recent years, the industry has invested close to \$200 M in harvesting and processing for, at best, marginal returns. In Quebec, the shrimp fleet has not even fished actively for much of 2005, as the price has been sufficiently low to make operations unprofitable.

4.4.2. International Issues

For some cod stocks, notably 3NO cod but also in 2J3KL, the efficacy of any stock management measure depends largely on the activity of vessels outside the 200 mile limit. In other words, any management measure to protect the stock under SARA will only be effective if catches of the stock outside the 200 mile limit are also restricted. Consequently, for some stocks, protective measures will require coordination with the Northwest Atlantic Fishery Organization (NAFO) and compliance of fleets fishing in the NAFO Regulatory Area (NRA) to adhere to quotas, eliminate unreported catches and reduce by-catch. These matters are discussed in the context of domestic impacts in Chapter 5, where relevant.

¹⁷ Estimates of costs vary depending upon methodology. This estimate was developed on a per-trip basis, because the nearshore shrimp fleet in Newfoundland and Labrador is generally not dedicated to shrimp fishing alone. Estimates developed for the more single-purpose fleet of Quebec attribute 32% of overall, non-labour costs to fuel; however, trips also tend to be shorter for the Quebec fleet (~2 days for the QC fleet versus 4-5 days for the NL fleet).

Increased monitoring and enforcement by Canada has already led to a decrease in the incidence of overfishing in the NRA. It is unknown at this time if additional measures would be required, if cod is listed under SARA.

The 3Ps stock is a stock which Canada co-manages with France, as per the 1994 Process-verbal (PV), an international legally binding instrument. St. Pierre and Miquelon, possessions of France, have harvesting rights within Canadian waters according to this treaty - including 15.6% of the Total Allowable Catch in area 3Ps, plus some smaller amounts in the Gulf of St. Lawrence. The relationship between SARA obligations and those under the PV is being investigated.

4.4.3. Significant Conservation Efforts Already in Place

As discussed previously within the context of choosing a reference year for this analysis, significant measures have already been put into place for the conservation of Atlantic cod, and additional recovery measures are being developed collaboratively by industry and federal and provincial governments, independent of pressure from the SARA. Thus, it is not clear how to identify the specific marginal impacts of cod conservation due to SARA. By not counting the efforts already undertaken, the impacts of cod conservation appear to be smaller, and industry is in a sense penalized for having already undertaken and accepted harvest and bycatch restrictions.

4.4.4. Stewardship

Following the 2003 Gulf and Northern cod closures, the Minister of Fisheries and Oceans announced a reopening of the Gulf of St. Lawrence cod fisheries in May of 2004. At that time, the Minister invited resource users to work with the Department to develop shared stewardship in the management of these fisheries. It was emphasized that governments, resource users, and others with an interest in the fisheries share responsibility for the sustainable use and economic viability of fisheries. Shared stewardship is also a key objective of the recently released *A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast*, which was developed to modernize how the Atlantic fisheries are managed.

Industry has embraced the concept of sharing both decision-making power and accountability. In its 2004 advice for Gulf of St. Lawrence groundfish stocks, the Fisheries Resource Conservation Council stated the following in its preambulatory letter to the Minister:

“Shared stewardship requires both responsibility and accountability. Responsibility requires that the Minister allow decision-making to be as inclusive as possible and as close to the harvesters as practical. Responsibility also means that the parties establish goals and ensure measurement of progress towards stated goals.”

Accountability means accepting the outcomes arising from shared decision-making, both positive and negative. It will be challenging for all stakeholders to adapt to such a new approach. The evolution towards this new regime will take many years and require goodwill, commitment and teamwork.”¹⁸

Industry has also made clear its view that the listing of Atlantic cod under SARA would seriously undermine efforts towards collaboration and shared stewardship. At stakeholder meetings regarding the socioeconomic implications of listing, industry representatives emphasized that DFO should not assume levels of stewardship and compliance will remain the same in the event of a listing. The key issue, they said, is not the resistance to a closure which will be exhibited on the water, but the loss of interest on the part of stakeholders in stewardship. It should be taken under consideration that a listing of Atlantic cod under SARA could lead to problems for the Government of Canada in advancing with stakeholders its fisheries renewal and stewardship agendas.

¹⁸ 2004 / 2005 Conservation Requirements for Groundfish Stocks in the Gulf of St. Lawrence: Report to the Minister of Fisheries and Oceans. Fisheries Resource Conservation Council Document FRCC.2004.R3, April 2004. <http://www.frcc.ca/2004/Gulf2004.pdf>

5. SCENARIOS AND IMPACTS

This chapter assesses the range of direct impacts that might be expected within the harvest and processing sectors under a variety of fisheries management scenarios. Impacts are assessed according to the methods described in Chapter 3. The scenarios analysed in this report are meant to provide examples of possible management measures, and do not represent the entire set of alternatives that could be considered in response to a listing decision. They were developed by DFO's Science Sector in consultation with Fisheries and Aquaculture Management, and span a range of measures that could be undertaken to conserve cod populations, depending in part upon developments regarding SARA.

The scenarios presented here are confined to Total Allowable Catch (TAC) reductions and fishery closures. A number of other options could be considered, such as time-area closures and technical measures (such as gear restrictions) to reduce bycatch. Time constraints prevented the investigation of such alternatives for this report; but this in no way precludes their consideration as alternatives in the future. Indeed, they should be considered as potentially lower-cost means by which fishing mortality could be reduced. It should therefore be re-emphasized here that if a decision is taken to list any population of Atlantic cod under SARA, then the development of a) the recovery strategy and b) the action plan would both involve the participation of those likely to be affected. Harvesters, the processing industry, Provincial governments, Aboriginal groups and others would be invited to help develop the means by which conservation goals would be achieved, and formal public comment periods would precede final acceptance.

Even though the scenarios are hypothetical, it is nonetheless necessary to clearly define the details of how the harvest targets for each scenario could be met through TAC reductions, in order to assess impacts in this report. For example, a scenario may call for a 50% reduction in the bycatch of cod, and if several fisheries are responsible for cod bycatch, there may be a number of ways to achieve the target. One method would be to reduce the TAC of all relevant fisheries by 50%. Another would be to restrict the fisheries with the highest bycatch rates first, until the target reduction is achieved. Thirdly, one might choose to restrict the fisheries that would result in the lowest aggregate losses to the harvest sector as a whole. None of these methods take into account the distribution of losses among individuals. Even a 50% closure of all fisheries is not necessarily "fair", as the actual income losses (on both an absolute and percentage basis) may still differ greatly among fishermen. Deciding the issue of fairness would require the participation of stakeholders, so for the purpose of this analysis, we simply implement the TAC reductions with the lowest cost to the harvest sector as a whole.

There are two characteristics of a fishery that make it a lower cost "target" for protecting cod: either the rate of cod catch is high in that fishery (a directed fishery being the ultimate example of this), and/or the average unit value of the fishery, in which cod is incidental, is low. By first restricting fisheries with the lowest foregone value per kg cod conserved, one achieves the combined goal of targeting the fisheries with the highest bycatch *and* avoiding impacts on highly lucrative fisheries such as shrimp and crab.

However, if a lucrative fishery is responsible for a great deal of bycatch, it may still be included among the restricted fisheries. The details of how harvest restrictions were determined for each scenario are presented in Appendix B.

Any one management scenario does not necessarily pertain to an entire cod population, as defined by COSEWIC. The COSEWIC populations are somewhat different from the traditional designations employed by NAFO and DFO for stock assessment and management. Each COSEWIC population is comprised of more than one DFO/NAFO management unit. Even under SARA, management decisions will likely continue to be made based upon these longstanding NAFO stock divisions, so different scenarios were developed by DFO's Fisheries and Aquaculture Management for each stock.

Current Conservation Scenarios

For each stock, the baseline reference is defined as a continuation of the current management approach. For the short-term immediate impacts, this is readily identified as the 2004 management plan. The baseline is also called the "current conservation" scenario, especially where significant restrictions are already in place¹⁹. For the longer term analyses the harvest is converted from an absolute TAC to a percentage of spawning stock biomass (SSB), based upon 2004 levels. If the stock grows under current management, and a certain threshold stock biomass is achieved within the 20-year timeframe of the analysis, the scenario allows for an increase in the harvest.

Alternative Scenarios

The alternative scenarios may involve TAC reductions or the complete closure of directed cod fisheries where such fisheries exist, and/or increased measures to reduce cod bycatch in the directed fisheries for other species. For assessing immediate impacts, the harvest restrictions for each alternative scenario are first examined alone, and then by imposing the additional "no sale" provision that could take effect if Atlantic cod is listed as either Endangered or Threatened. A description of the "no sale" provision and the legal interpretation of it are provided earlier in this report (Section 1.3). To reiterate, SARA does not currently permit the sale or purchase of individuals or derivatives from a listed species, but does allow the harvest of such species so long as the harvests are consistent with an incidental harm permit or recovery strategy.

The range of plausible scenarios for each stock depend upon conditions which affect the productivity of the stock. These factors are uncertain and beyond human control, more so than many other variables that affect future outcomes. Since the productivity regime affects the rate at which a cod stock is expected to grow over time, it is not an issue for the short-term impact analyses. However, assumptions about productivity are important for estimating the long-term impacts. Long-term scenarios are therefore carried out over a range of assumptions about the productivity regime.

¹⁹ The words "*status quo*" may also be used interchangeably with "current conservation".

Finally, it should also be noted that the scenarios apply only to the management of Canada's domestic fisheries. The Newfoundland and Labrador cod population is also harvested by foreign vessels in NAFO waters outside of Canada's Exclusive Economic Zone (EEZ). The implications of the jurisdictional division are discussed within the relevant scenarios below.

5.1 Newfoundland and Labrador Population

5.1.1 Division 2GH

The 2GH cod fishery has been very small since the 1970's, and this NAFO division most likely comprises the periphery of the range for the Newfoundland and Labrador Atlantic cod population. Natural factors may be the over-riding determinant of reduced cod density in this area. There is currently no commercial directed fishery for cod in area 2GH, and bycatch has been virtually zero since 1991. As a result, a decision to list this population under SARA would require no commercial harvest reductions in 2GH. However, this conclusion rests upon the assumption that in the case of listing, the designation of critical habitat for cod would not affect the existing fisheries in 2GH, which are focused upon shrimp, scallops, and Greenland halibut.

The cod harvests by Aboriginal peoples in 2GH are not well documented, but it is likely that an assessment of the harm that would be scientifically permissible would ultimately support permits for a food, social, and ceremonial (FSC) fishery.

The current stock assessment indicates that the 2GH cod population is not expected to reach a harvestable level within the 20-year timeframe of this analysis. Therefore, there is no rationale for considering long-run scenarios that include a directed fishery. As for bycatch management, the directed fishing activities in 2GH have not included more than a few kilograms of incidental cod catch for over a decade, so scenarios which include bycatch restrictions in 2GH are also not likely to have appreciable impacts in the longer term.

Since both short- and long-term commercial impacts in 2GH are expected to be zero, no further scenario analysis is undertaken for this component of the Newfoundland and Labrador cod population.

5.1.2 Division 2J3KL

There is no directed cod fishery in 2J3KL at this time, and domestic bycatch was just over 500 tonnes in 2004. In the area outside of Canada's EEZ, the reported cod harvest was 5 tonnes in 2004, amounting to about 1% of the total cod harvest for this stock. Unreported foreign catch is not a primary concern in 2J3KL, and the scenarios analysed for this report assume ongoing compliance with the moratorium in the NAFO Regulatory Area (NRA) outside of Canada's exclusive jurisdiction.

The 2J3KL cod stock is comprised of inshore and offshore sub-populations. Historically, the resident inshore sub-population was a small proportion of the stock complex, and most of the inshore harvest consisted of seasonal migrants from offshore. However, current conditions are now very different. Mortality in the offshore population is extremely high, and few individuals survive beyond age 6. The biomass is now so small as to be almost immeasurable - less than 1% of the level observed in the 1980's - and the growth rate is extremely low (less than 2%). As for the inshore population, it is difficult to compare its performance with pre-moratorium levels, since it was never assessed as a separate stock at that time. Nonetheless, the inshore population appears to be faring much better than the offshore population, and the post-moratorium resident inshore biomass may exceed levels from the 1980's. The current estimate of the growth rate for the central inshore population is approximately 40%, though this rate is expected to slow in the coming years.

Because of the current stock dynamics, a situation exists where a visible inshore population appears to be robust and harvestable, despite the dismal status of 2J3KL cod as a whole. However, for the purposes of this impact assessment, the inshore and offshore subpopulations are not viewed as stocks that can be managed as independent units. Additional information is required to analyse such a management option, since little is currently known of the migration and joint biology of these populations. In particular, it is not known whether the inshore population produces migrants that could contribute to repopulation of offshore areas. Nor is it known whether an inshore harvest increases the risk that seasonal landward migrants from offshore are caught incidentally in the inshore fishery. The model used to estimate long term costs and benefits in this assessment does incorporate separate dynamics for the two subpopulations, but because separate limit reference points have not been identified, a directed fishery is not considered in this assessment unless the entire 2J3KL stock exceeds 300,000t. The combined inshore/offshore LRP is believed by stock assessors to lie above this level.

Stock rebuilding is limited by the low productivity of the offshore population. Under a low productivity regime offshore, fisheries managers have proposed two possible domestic management scenarios for comparison against current conservation in 2J3KL - prioritized rebuilding and maximum rebuilding (Table 5.1). **Prioritized rebuilding** decreases the current cod bycatch by 50%, through a partial closure of the winter flounder fishery. A more restrictive **maximum rebuilding** scenario, which closes the winter flounder fishery entirely, would reduce the 2004 cod bycatch in 2J3KL by 94%.

Under a high productivity regime, which is not foreseen for the near-term, only current conservation measures would be considered (Table 5.1). However, even if the actual growth rate of the offshore population were to increase substantially, the regime may not be considered "high productivity" until sufficient spawning biomass had been established to sustain an appreciable amount of growth in *absolute* terms.

Winter flounder is an inshore fishery, and is responsible for nearly all of the cod caught in 2J3KL. Landings data for several recent years indicate that the current rate of bycatch is unusually high, suggesting that cod mortality in the winter flounder fishery could be

readily reduced without imposing a closure, through the use of more stringent by-catch restrictions. Therefore, the impacts of the rebuilding scenarios assessed here may be higher than what could be achieved upon careful consideration of alternative measures to reduce bycatch in this fishery. However, it is unclear whether the remaining catches in this fishery would be of sufficient value to warrant the continuation of the directed winter flounder fishery.

Table 5.1: Management options assessed for area 2J3KL

Productivity Regime	Scenario	Directed Fishery	Bycatch
Low (<10% annual growth)	1. Current Conservation	None	Current level
	2. Prioritized Rebuilding	None	50% reduction, achieved through 53% reduction of winter flounder fishery
	3. Maximum Rebuilding	None	Maximum reduction, achieved through closure of the winter flounder fishery.
High (≥ 25% ann. growth)	1. Current Conservation	None	Current level

It should be noted that current conservation measures in 2J3KL already represent a substantial level of commitment towards stock rebuilding, and that severe economic impacts have already been imposed upon harvesters, processors, and communities who have a longstanding dependence upon this stock.

Immediate Impacts of Additional Conservation Measures

All of the impacts of cod conservation measures in area 2J3KL will be experienced in the province of Newfoundland and Labrador. Because the rate of cod bycatch in the winter flounder fishery is so high, the amount of revenue foregone to reduce bycatch is similar to that of closing a small directed fishery (Table 5.2a). The immediate annual impacts are assessed at less than \$2 M for both prioritized and maximum rebuilding, including the value foregone from both harvesting and processing (Table 5.2a).

Although the impacts are not large in the context of an entire industry, they will clearly be significant to the affected households and communities. The number of harvesters who participate in the winter flounder fishery and stand to lose income is large - just over 800 licence holders and an additional 1,400 crew (Table 5.2a). Non-core harvesters may be particularly hard hit by the cod bycatch reductions proposed here. Earnings from the winter flounder fishery are an important component of income for this group. Non-core fishers do not have access to lucrative shellfish quota, and alternative inshore groundfish opportunities are extremely limited in 2J3KL. The incomes of non-core harvesters are therefore often pieced together from activities both inside and outside the fishery, and tend to be low overall. Of 119 non-core participants in the 2004 2J3KL winter flounder fishery, 96 obtained more than 25% (and 75 earned 100%) of their fishing revenue from

that fishery. However, 91 of the 96 earned less than \$3K in total from fishing, and therefore do not appear in the “dependent” estimates of Table 5.2a.

Within the processing sector, more than 25 fish processing jobs could be lost under a complete closure of the winter flounder fishery.

The “no sales” prohibition that currently accompanies a SARA listing results in impacts very similar to those of the winter flounder closure alone (maximum rebuilding). This is because there is very little cod bycatch outside of the winter flounder fishery, and so an additional restriction on the sale of that bycatch contributes only a small amount to the overall impacts. However the number of potentially affected harvesters and crew is larger. A prohibition on the sale of cod could essentially force a closure of the winter flounder fishery even under the less stringent “prioritized rebuilding” scenario, if the remaining fishery was no longer viable. In that case, the impacts for prioritized rebuilding would be higher - the same as for maximum rebuilding. If fishermen could adjust their harvest technology to reduce bycatch and increase the catch of other allowed species, then the impacts of prioritized rebuilding would be lower than those indicated.

Table 5.2.a: Immediate Annual Impact Estimates for Area 2J3KL. Immediate impacts are the same for high and low productivity regimes.

Scenario	Region/Province	Licence Holders Affected (Dependent)	Crew Affected (Dependent)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
harvest restrictions only:							
Prioritized Rebuilding ^a	Newfoundland and Labrador	811 (1)	1,419 (2)	15 jobs (6 PY)	\$ 390 K	\$ 630 K	\$ 1.0 M
Maximum Rebuilding ^b	Newfoundland and Labrador	811 (5)	1,419 (8)	27 jobs (11 PY)	\$ 725 K	\$ 1,170 K	\$ 1.9 M
harvest restrictions plus “no sales” provision:							
Prioritized Rebuilding ^a	Newfoundland and Labrador	838 (5)	1,690 (8)	25 jobs (10 PY)	\$ 725 K	\$ 1,140 K	\$ 1.9 M
Maximum Rebuilding ^b	Newfoundland and Labrador	838 (6)	1,690 (9)	28 jobs (11 PY)	\$ 765 K	\$ 1,230 K	\$ 2.0 M

^a Reduction of the winter flounder fishery by 53%.

^b Closure of the winter flounder fishery.

Table 5.2.b: Long-term (20-year) Impact Estimates for Area 2J3KL. The model used for these estimates assumes no mixing of the inshore and offshore sub-populations. Initial population parameters: Inshore SSB = 22,000t, Growth rate=40%; Offshore SSB~12,500t, Growth rate <2%. Combined Inshore/Offshore LRP > 300,000t.

Productivity Regime	Scenario	Years to Reach LRP ^d	Annual Cod Harvest in Year 20 ('000 t)	Spawning Stock Biomass in Year 20 ('000 t)		\$\$ Impact Relative Current Conservation (NPV @ 5%)	Range (Discount Rates 3% -7%)
				Inshore	Offshore		
2% Growth Offshore	Current Conservation ^a	> 20	2.4	96.3	17.5		
	Prioritized Rebuilding ^b	> 20	1.2	98.2	17.5	- \$ 39 M	- \$47 to -\$33 M
	Maximum Rebuilding ^c	> 20	0.1	99.8	17.5	- \$ 75 M	- \$90 to -\$62 M
5% Growth Offshore	Current Conservation ^a	> 20	2.4	96.3	30.3		
	Prioritized Rebuilding ^b	> 20	1.2	98.2	30.3	- \$ 39 M	- \$47 to -\$33 M
	Maximum Rebuilding ^c	> 20	0.1	99.8	30.3	- \$ 75 M	- \$90 to -\$62 M

^a Current conservation scenario. Current winter flounder fishery continues; inshore cod harvest is continued at approximately 2.5% of the spawning stock biomass (SSB).

^b Prioritized rebuilding is implemented as an ongoing complete moratorium in the offshore component (annual harvest = 0% offshore SSB), with a 50% reduction of harvest in the inshore component (annual harvest reduced from 2.5% of inshore SSB to 1.25%). The cod harvest reduction is achieved through a 53% reduction of the winter flounder fishery.

^c Maximum rebuilding is implemented as an ongoing complete moratorium in the offshore component (annual harvest = 0% offshore SSB), with a 94% reduction of harvest in the inshore component (annual harvest = 0.15% of inshore SSB). The cod harvest reduction is achieved through a closure of the winter flounder fishery.

^d No definitive LRP has been determined for this population, but current assessments place it in excess of 300,000 tonnes for the 2J3KL population as a whole.

Long-term Impacts

The cumulative costs of the bycatch reduction scenarios for 2J3KL over the next 20 years are large, with few apparent benefits (Table 5.2b). For any realistic offshore growth rate, the limit reference point is not reached within 20 years, so there is no opportunity for enhanced future harvests to offset current costs. The present value of net benefits are negative for both prioritized and maximum rebuilding. At a 5% discount rate, the net present value (NPV) of prioritized rebuilding is assessed at approximately - \$ 39 M compared to current conservation (all other factors held constant). For maximum rebuilding, the assessed cost is nearly double, at \$ 75 M below current conservation.

Furthermore, there are few benefits in terms of *in situ* accumulated offshore biomass as a result of these rebuilding strategies. Table 5.2.b presents projections for 2% and 5% annual offshore growth, and there is no substantial difference between these two productivity regimes. Only a small amount of additional biomass accumulates offshore during the 20-year period of analysis, at either growth rate. Sustained growth above 5% is highly improbable given the recent history of this population.

Once again, the long term assessment cannot be used to estimate *absolute* impacts. Too many factors will change over the 20-year period. However, these assessments are useful for examining the *relative* impacts of different scenarios in the long term. A general conclusion to be drawn from the analysis is that the current moratorium is achieving as much conservation as is possible, given that the limiting factor is offshore growth. Under the assumption of zero mixing between the inshore and offshore populations, few benefits would arise from further restrictions. The choice of discount rate does not affect this conclusion.

5.1.3 Division 3NO

This fishery is located on the southern Grand Bank, off the southeast coast of Newfoundland. Although much of it is within Canada's 200 mile exclusive economic zone, the "tail" section extends beyond that limit, with significant fishing by international fleets occurring there. There has been no directed cod fishery in Division 3NO since 1994. In 2004, the domestic bycatch of cod inside the EEZ was about 480 tonnes, with most of this caught in the yellowtail flounder fishery (390 t). The reported catch by NAFO participants in the NAFO Regulatory Area (NRA) outside Canada's exclusive jurisdiction was reported to be 413 t in 2004; however, underreporting by vessels fishing in the NRA remains a problem. For example in 2003, the 3NO cod harvest outside of the 200 mile zone was estimated to be as high as 5,000 tonnes, based on vessel activities, fisheries science data, and compliance inspections²⁰. The discrepancy between reported and actual catch is particularly important, given that the remaining spawner biomass in 2005 is estimated to fall in the vicinity of just 5,000 t. Canada increased its enforcement presence in 2004 resulting in a significant drop in the number of sea days inside the NRA

²⁰ Some of this harvest was probably smaller fish, perhaps pre-spawner juveniles.

for foreign vessels. There is evidence that the foreign presence decreased further in 2005; however, estimates from 2004 are used as the baseline for this analysis.

A very recent NAFO stock assessment update (as yet unpublished) projects that even if all fishing mortality was eliminated, the spawner biomass in 3NO will decline by 11% by 2010. This revises downward the estimates in the 2003 stock assessment, based on new information regarding the high recent catch rates. Fishing mortality has been especially high for younger fish, reducing projections for recruitment in the near term. If fishing mortality continues at the current estimated rate ($F \sim 0.50$), the assessment projects spawner biomass will decline by about 75% by 2010, to 1,300 tonnes.

The NAFO cod harvest does not affect the immediate domestic impacts, but for the longer term, it is crucial. Domestic efforts towards additional conservation are likely to be of no consequence for stock survival if high fishing mortality persists outside the EEZ. Therefore, long-term scenarios are analyzed both with and without assuming compliance by NAFO vessels. “Compliance” is defined here as concordance between actual and reported harvests in the NRA.

The scenarios for the impact analysis are shown in Table 5.3. Prioritized rebuilding prescribes a 50% reduction in domestic bycatch, while maximum rebuilding pushes for the elimination of domestic bycatch. In the long term assessments, prioritized rebuilding is examined without and with NAFO compliance, while maximum rebuilding would only be considered with NAFO compliance. The scenario of current domestic conservation is also analyzed without international compliance in the NRA.

Table 5.3: Management options assessed for area 3NO

Productivity Regime	Scenario	Directed Fishery	Bycatch (Domestic)
Low (<10% ann. growth)	1. Current Conservation	None	Current level
	2a. Prioritized Rebuilding (NAFO compliance)	None	50% reduction, achieved through a 57% reduction in the yellowtail flounder fishery, and closure of skate fishery*.
	2b. Prioritized Rebuilding (NAFO <i>status quo</i>)	None	50% reduction, achieved as above.
	3. Maximum Rebuilding (NAFO compliance)	None	Maximum reduction, achieved through the following closures: skate*, yellowtail, redfish, and Atlantic halibut.
High (≥25% ann. growth)	1. Current Conservation	None	Current level

* Closure of the skate fishery also has potential consequences for the more lucrative monkfish fishery (see text).

Cod bycatch rates are quite low in all 3NO fisheries, and reducing bycatch is therefore quite expensive (Appendix B). The yellowtail flounder fishery, a large fishery worth

over \$10 M in landed value annually, accounts for about 85% of all domestic cod bycatch in 3NO. It is therefore necessary to restrict the yellowtail fishery in order to reduce domestic bycatch to any significant extent. Some bycatch can be reduced (<3%) at a lower cost by closing the domestic skate fishery, but the yellowtail fishery is the next lowest cost target. Closure of the skate fishery may also reduce the viability of the more lucrative monkfish fishery, thus making this management option relatively expensive. However, this effect was not captured in the reference year of 2004, since unusual market conditions left the monkfish fishery temporarily less active.

In this assessment the 50% bycatch reduction for **prioritized rebuilding** is achieved by closing the skate fishery and reducing the yellowtail flounder fishery by 57% (Appendix B), but for a different reference year, the skate fishery would be a less likely target for inclusion in the harvest reductions. In reality, it may also be possible to reduce bycatch in the yellowtail fishery through other means such as time/area closures, but for illustration, a TAC reduction is assessed here.

Maximum rebuilding is achieved by full closure of the following domestic fisheries: skate, yellowtail flounder, Atlantic halibut, and redfish. Together these closures could achieve a 97% reduction in domestic cod bycatch, based on 2004 data. In the absence of compliance in the NRA, this would represent only a 15% decrease in the quantity of cod landed. Compliance by NAFO countries would be a prerequisite to the success of any additional Canadian stock rebuilding efforts.

Immediate Impacts

The immediate impacts in 3NO are large, ranging from about \$ 13 M in foregone revenue for prioritized rebuilding, to about \$ 27 M in foregone revenue for maximum rebuilding (Table 5.4.a). The fisheries affected in 3NO are offshore fisheries, and as a consequence, there are generally fewer licence holders affected than for a comparable inshore fishery. However, each offshore vessel has a relatively large crew complement. Several vessels may fall under a single licence, but the economic status of each vessel may be affected somewhat independently. Therefore for this fleet, individual vessels are counted separately among the affected and dependent entities, even if they are operated under a single licence holder.

Discussions with industry have indicated that a partial but substantial closure of the yellowtail fishery, such as that proposed for prioritized rebuilding, is not likely to leave intact a viable fishery. Thus, the impacts would likely be similar to those of maximum rebuilding. For maximum rebuilding, 30 licence holders/vessels and about 425 crew are vulnerable to direct impacts, with 13 licencees/vessels and 263 crew exhibiting substantial dependence on the affected fisheries (Table 5.4.a).

Table 5.4.a: Immediate (first year) Impact Estimates for Area 3NO. Immediate impacts are the same for high and low productivity regimes, and with/without compliance in the NAFO Regulatory Area.

Scenario	Province	Licence Holders/Vessels Affected (Dependent)	Crew Affected (Dependent)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
harvest restrictions only:							
Prioritized Rebuilding ^a	NL & LAB	14 (6)	306 (200)	307 jobs (124 PY)	\$ 4,680 K	\$ 7,795 K	\$ 12.5 M
	Nova Scotia	3 (0)	19 (0)	1 job (<1 PY)	\$ 90 K	\$ 85 K	\$ 0.2 M
	TOTAL	17 (6)	325 (200)	~ 310 jobs	\$ 4.8 M	\$ 7.9 M	\$ 12.7 M
Maximum Rebuilding ^b	NL & LAB	24 (12)	386 (257)	647 jobs (261 PY)	\$ 9,870 K	\$ 15,620 K	\$ 25.5 M
	Nova Scotia	6 (1)	39 (6)	13 jobs (8 PY)	\$ 620 K	\$ 525 K	\$ 1.1 M
	TOTAL	30 (13)	425 (263)	~ 660 jobs	\$ 10.5 M	\$ 16.1 M	\$ 26.6 M
harvest restrictions plus “no sales” provision:							
Prioritized Rebuilding ^a	NL & LAB	32 (6)	412 (200)	315 jobs (127 PY)	\$ 4,940 K	\$ 8,200 K	\$ 13.1 M
	Nova Scotia	8 (1)	45 (6)	2 jobs (1 PY)	\$ 145 K	\$ 155 K	\$ 0.3 M
	TOTAL	40 (7)	457 (206)	~ 315 jobs	\$ 5.1 M	\$ 8.4 M	\$ 13.4 M
Maximum Rebuilding ^b	NL & LAB	35 (12)	431 (257)	647 jobs (261 PY)	\$ 9,880 K	\$ 15,650 K	\$ 25.5 M
	Nova Scotia	9 (1)	52 (6)	13 jobs (8 PY)	\$ 625 K	\$ 530 K	\$ 1.2 M
	TOTAL	44 (13)	483 (263)	~ 660 jobs	\$ 10.5 M	\$ 16.2 M	\$ 26.7 M

^a Closure of the skate fishery and reduction of the yellowtail fishery by 57%.

^b Full closure of the following 3NO fisheries: yellowtail flounder, redfish, Atlantic halibut, and skate.

Table 5.4.b: Long-term (20-year) Impact Estimates for Area 3NO. Initial population parameters: SSB = 5,000t ; Growth rate = 20%; provisional LRP = 60,000 t.

Growth Rate	Baseline: Current Domestic Conservation (no NAFO compliance)	Current Domestic Conservation (with NAFO compliance)	Prioritized Rebuilding (no NAFO compliance)	Prioritized Rebuilding (with NAFO compliance)	Maximum Rebuilding (with NAFO compliance)
Biomass at Year 20^a					
2 %	extirpated	100 t	extirpated	400 t	1,200 t
15 %	extirpated	1,700 t	extirpated	5,000 t	13,400 t
20 %	extirpated	4,200 t	extirpated	11,800 t	31,100 t
25 %	extirpated	9,800 t	extirpated	26,900 t	62,200 t
Difference in Present Value of Revenue Stream^b					
2 %	-	\$ 5 M (6, 5)	- \$ 155 M (-182, -135)	- \$ 152 M (-178, -132)	- \$ 342 M (-398, -298)
15 %	-	\$ 12 M (13, 10)	- \$ 155 M (-182, -135)	- \$ 146 M (-171, -127)	- \$ 344 M (-401, -300)
20 %	-	\$ 17 M (20, 14)	- \$ 156 M (-182, -135)	- \$ 141 M (-164, -123)	- \$ 346 M (-402, -301)
25 %	-	\$ 26 M (32, 22)	- \$ 156 M (-182, -135)	- \$ 133 M (-153, -116)	- \$ 328 M (-377, -290)

^a Actual biomass at year 20 is also equal to the difference from baseline, since under the baseline scenario, the population is extirpated.

^b The revenue stream is discounted at 5% and reported as the difference between the baseline and each alternative. Values in parentheses represent the present value using discount rates of (3%, 7%)

The number of processing jobs at stake is large. Prioritized rebuilding could cause the loss of over 300 processing jobs, and more than 650 jobs could be lost under maximum rebuilding (Table 5.4.a). In fact, the near-term job losses under prioritized rebuilding may be underestimated in Table 5.4.a, as the impacts will be concentrated almost entirely upon one large and specialized yellowtail processing plant.

The "no sale" prohibition on cod that would apply if listed under SARA would add little incremental impact to either scenario, in terms of foregone revenue and processing jobs. The value of the remaining cod bycatch in each scenario is small compared to the costs associated with restricting the targeted fisheries. A small number of additional license holders and crew are affected, but none of these are dependent upon revenue from their cod bycatch.

Long Term Impacts

Results from the 20-year projections for 3NO show clearly that the success of Canadian conservation efforts depend critically upon the harvest in the NRA (Table 5.4.b). Without compliance in the NRA, the 3NO stock is projected to be extirpated within 20 years²¹, under the conditions modeled. Maximum rebuilding without NAFO compliance is not shown in the table, but extirpation is the result under that domestic scenario as well.

If Canada continues its current rate of harvest, but NRA harvests are reduced to reported levels, positive domestic benefits can be realized (\$5 to \$26 M compared to baseline, depending upon stock growth, Table 5.4.b). However, rebuilding the 3NO stock would only occur if high growth was sustained.

All other scenarios generate negative revenue streams relative to the baseline. Prioritized rebuilding costs about \$150 M over 20 years, and the revenue losses do not differ enormously whether NAFO compliance is or is not assumed. However, under NAFO compliance the benefit of an extant and growing cod population must be considered. No dollar value is assigned to the *in situ* stock, but clearly it is an important benefit that offsets the negative revenue streams to some measurable extent. Harvest benefits will ultimately be realized, but they will not be realized by the same individuals bearing the costs today.

Under maximum rebuilding with NAFO compliance, the projections suggest that the limit reference point is within reach. This is a tenuous conclusion, as it would require a very long period of sustained high growth, and would impose severe domestic costs. The implementation of this scenario imposes all the legitimate costs of rebuilding on Canadians, as NAFO compliance only requires harvest reductions to reported levels, and not to the restricted levels imposed on domestic fishery participants. This assumes that one does not count foregone revenue from unauthorized harvest as a legitimate cost burden. If the domestic fishery was restricted to the level prescribed by prioritized rebuilding, and the NAFO fishery was required not only to comply but also to reduce

²¹ Extirpation is unlikely to be complete as residual cod biomass is likely to remain as the entire population is not accessible to NAFO vessels. Nevertheless, it would not be viable for a commercial fishery.

bycatch, a level of stock rebuilding similar to maximum rebuilding could be achieved, without bearing all costs domestically.

5.2 Laurentian North Population

5.2.1 Divisions 4RS3Pn

Division 4RS3Pn covers the northern portion of the Gulf of St. Lawrence and the area adjacent to the southwest corner of the Island of Newfoundland. The spawning stock biomass for this Northern Gulf cod stock is currently below its critical limit reference point of 100,000 tonnes²², with the 2004 spawner biomass estimated at 38,000 tonnes (39,000 in 2005). Nonetheless, a small directed cod fishery has been sustained in area 4RS3Pn over the last decade, with a 2004 quota of 3,500 metric tonnes and reported harvest of approximately 3,150 t. For 2005, the total allowable catch was raised to 5,000 tonnes, equal to about 13% of the spawning stock biomass.

Current productivity in 4RS3Pn is 15% annual growth before harvest mortality. This is higher than in previous assessments, due to revised (downward) estimates of natural mortality, retroactive to 1997. A revised time series of growth estimates were not available in the advisory report, but the historic range has previously been estimated at 2% to 25%. The current estimate of 15% is considered to be a medium level of productivity.

The current conservation scenario for 4RS3Pn includes the directed fishery. The reference year chosen for this report is 2004, but the change in TAC for 2005 means that the marginal impact of SARA would be somewhat larger if a listing of the population were to come about in 2006. As a result, both reference years will be discussed. The alternatives to current conservation include **no directed fishery**, **prioritized rebuilding**, and **maximum rebuilding** (Table 5.5).

Under current productivity levels, DFO's Science sector estimates that closure of the directed fishery could bring about a recovery in less than 10 years. Should productivity fall, bycatch restrictions could also be considered. For scenarios in which bycatch must be reduced, several additional directed fisheries must be targeted in order to achieve the bycatch goals. The fisheries principally responsible for cod bycatch in 4RS3Pn are shown in Appendix B. Atlantic halibut accounts for 46% of the bycatch, witch flounder accounts for 22%, and American plaice (mostly in NAFO unit 4R) accounts for 16%.

²² This is an (approximate) average of two different estimates of the LRP from different models (85K and 110K tonnes).

Table 5.5: Management options assessed for area 4RS3Pn

Productivity Regime	Scenario	Directed Fishery	Bycatch
Low: <10% annual growth	1. Current Conservation	Current Rate	Current level
	2. No Directed Fishery	None	Current level
	3. Prioritized Rebuilding	None	50% reduction, achieved through closures on winter and witch flounders, white hake, skate, and the American plaice sentinel fishery, and a 16% reduction in Atlantic halibut.
	4. Maximum Rebuilding	None	Maximum reduction, achieved through a full closure of all fisheries listed above, plus redfish and Greenland halibut.
High: >20% annual growth	1. Status Quo	Current Rate	Current level
	2. No Directed Fishery	None	Current level

Closure of the halibut fishery would be very costly, and the 50% bycatch reduction for **prioritized rebuilding** can be achieved by closing directed fisheries for winter and witch flounders, American plaice, white hake and skate, along with a partial (16%) reduction of the Atlantic halibut fishery (Table 5.5 and Appendix B). To implement **maximum rebuilding**, however, far more severe closures would be required. All of the fisheries listed previously would have to be closed (including a complete closure of the Atlantic halibut fishery) as well as the Greenland halibut fishery and the sentinel fishery for redfish (Appendix B). Cod bycatch could theoretically be reduced 99% by closing these eight fisheries, but in reality, the redistribution of effort could lead to somewhat different bycatch results than what is predicted by current catch statistics. As will be seen in the following analysis, the bycatch reduction scenarios are unlikely alternatives, since closure or reduction of the directed fishery can achieve a great deal of conservation at far lower cost. Bycatch reduction scenarios are presented for comparative purposes.

Immediate Impacts

The immediate impacts of harvest restrictions in 4RS3Pn are large for all of the alternative scenarios considered (Table 5.6.a), and would be felt in both Quebec and Newfoundland and Labrador.

Closure of the Directed Fishery

Using 2004 as the reference year, a closure of the directed cod fishery would reduce revenue by approximately \$10.5 M in the harvest and processing sectors combined.

Approximately one quarter of this impact would be experienced in Quebec, and the rest in Newfoundland and Labrador (Table 5.6.a).

863 licence holders and 1,829 crew would be affected by a closure of the directed fishery in 4RS3Pn. Just over 300 of these licence holders would be considered dependent upon this stock: 253 in Newfoundland and Labrador and 50 in Quebec. Approximately 600 crew members are estimated to have been dependent upon the 2004 directed cod fishery - about 500 in Newfoundland and Labrador, and just over 100 in Quebec.

There are additional fish harvesters, all in Quebec, who had access to cod in 4RS but did not fish for cod in 2004 because of particular restrictions in the fishery. These individuals are not included as “affected” in Table 5.6.a, but could be significantly affected by the closure of the directed cod fishery. In addition, temporary shellfish allocations may have reduced the level of dependence for some individuals who did fish for cod in 2004. If temporary allocations were removed from the 2004 revenues of Quebec fishers in 4RS, then an additional 7 fishers (and 18 crew) would be considered “dependent” upon the cod fishery, although they are now only counted as “affected”.

Approximately 145 processing jobs were estimated to be supported by the 4RS3Pn directed cod fishery (Table 5.6.a), with about 1/3 of these in Quebec (50 jobs) and 2/3 in Newfoundland and Labrador (95 jobs).

The dependence on this fishery is geographically concentrated. In Quebec, 46 of the 50 fishermen identified as dependent (by the criteria in Table 5.6.a) live on the Lower North Shore. Within the primary and secondary sectors, fishing employs more than 80% of the working age population in this area, either directly or indirectly, and the unemployment rate currently exceeds 30%.

Historically, an important part of Quebec’s 4RS cod landings were processed in two regions of Gaspé, the East and South, where the landings from the longliner and mobile gear fleets were processed. For example, in 2002, 10 fixed gear and longliner vessels >50ft. were involved in cod harvesting in 4RS3Pn. These fishermen from Gaspé-East and Gaspé-South could be considered cod-dependent since 42% of their gross revenues were derived from cod (with 82% of their catches from 4RS). Furthermore, these companies are supplying raw materials to the Consortium Gaspé Cured, which has 5 plants in Gaspésie and specialize on the production of dry salted cod. Therefore, the impacts of a decision to list this population under SARA would also strongly affect the fleets and plants located in Gaspé-East and Gaspé-South, even though the more restrictive management measures of 2004 did not permit the longliners to operate in the 4RS3Pn cod fishery. Cod caught by fishermen from the North Shore is processed on the North Shore to a large extent, but is also sold to processors in Newfoundland and Labrador.

There are similar localized regions of dependence on this stock in Newfoundland and Labrador. There is a large concentration of fishermen who are dependent on this stock on the Northern Peninsula in the Port au Choix / River of Ponds area, and points north,

including the Labrador side of the Straits of Belle Isle. Another concentration occurs at the south-west corner of the Island of Newfoundland, in the area from Cape Ray to Grand Bruit. Much of the cod landings are shipped elsewhere in Newfoundland for processing and, while the processing plants local to these areas tend to be small, some are highly dependent upon cod.

The impacts in Table 5.6.a are based on landings from 2004. The higher total allowable catch for 2005 will result in higher landings, and thus higher incremental impacts if Atlantic cod is listed under SARA and additional harvest restrictions are imposed. Landings data for 2005 are not available, and the season is ongoing at the time of this writing. Since the 2005 TAC is 43% higher than the 2004 TAC, the marginal impacts of closing the directed fishery, relative to a 2005 reference year, would likely be proportionately higher (perhaps \$15 M rather than \$10.5 M). This simplistic linear projection applies to harvest revenue, processing revenue, and processing jobs, according to the methods applied in this analysis. However, the effect of the higher quota on fisherman and crew dependence is less straightforward. The change would depend upon the distribution of the new quota, and how it affects harvesters' effort distribution among fisheries. We do not attempt to estimate this, nor do we examine 2005 TAC changes in the bycatch fisheries.

Scenarios for Bycatch Reduction - Prioritized and Maximum Rebuilding

Both prioritized and maximum rebuilding are less likely as immediate options under current biological conditions. The additional costs associated with these strategies are substantial, especially for maximum rebuilding. The costs for prioritized rebuilding are approximately 20% higher than the closure of the directed fishery (\$12.5 M vs \$10.5 M, Table 5.6.a) with a greater incremental impact in Newfoundland and Labrador than in Quebec. For maximum rebuilding, the foregone revenue would more than double (\$23.1 M versus \$10.5 M: Table 5.6.a). These additional effects would be experienced in both Newfoundland and Labrador and Quebec, the closure of the Greenland halibut fishery having a particularly large impact in Quebec (mostly in region of Gaspé-North). Nova Scotia is also impacted by maximum rebuilding, mainly through the Atlantic halibut and sentinel redfish fisheries. Foregone revenue in Nova Scotia would be approximately \$0.5 M.

The closure of additional fisheries also increases the number of fishermen who receive 25% or more of their income from the affected fisheries. Prioritized rebuilding has a modest effect, but under maximum rebuilding there are about 140 additional individuals who would be considered dependent (446 in total). The effect on processing jobs is even greater (435 jobs at risk for maximum rebuilding versus 145 for closure of the directed fishery). The reason for the disproportionate impact in processing is because redfish and Greenland halibut processing are concentrated in a small number of plants in Quebec that have a high employment:throughput ratio, and which are highly dependent upon these two species.

“No Sale” Prohibition

In the event that the Laurentian North cod population is listed under SARA, the “no sale” prohibition would also apply. The second page of Table 5.6.a. shows the total foregone revenue that would arise from the harvest restrictions described above, *plus* the prohibition on the sale of *any* 4RS3Pn cod. The incremental impact is equal to the value of bycaught cod not already eliminated through harvest restrictions. Therefore, the largest incremental impact (approximately \$0.7 M) occurs for the scenario in which only the directed cod fishery is closed, as there are no bycatch reductions in place in that scenario. For prioritized rebuilding and maximum rebuilding, the *no sale* prohibition adds a relatively small amount to the immediate impacts. Much of the revenue from bycatch is already eliminated in those scenarios.

Table 5.6.a: Immediate (first year) Impact Estimates for Area 4RS3Pn. Immediate impacts are the same for high and low productivity regimes.

Scenario	Province	Licence Holders Affected (Dependent)	Crew Affected (Dependent)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
harvest restrictions only:							
No Directed Cod Fishery ^a	NL & LAB	748 (253)	1,541 (498)	94 jobs (38 PY)	\$ 3,240 K	\$ 4,730 K	\$ 8.0 M
	Quebec	115 (50)	288 (108)	49 jobs (21 PY)	\$ 870 K	\$ 1,700 K	\$ 2.6 M
	TOTAL	863 (303)	1,829 (606)	~ 145 jobs	\$ 4.1 M	\$ 6.4 M	\$ 10.5 M
Prioritized Rebuilding ^b	NL & LAB	759 (267)	1,621 (560)	125 jobs (51 PY)	\$ 4,050 K	\$ 5,760 K	\$ 9.8 M
	Quebec	139 (51)	363 (113)	51 jobs (21 PY)	\$ 930 K	\$ 1,730 K	\$ 2.7 M
	TOTAL	898 (318)	1,984 (673)	~ 175 jobs	\$ 5.0 M	\$ 7.5 M	\$ 12.5 M
Maximum Rebuilding ^c	NL & LAB	763 (342)	1,669 (782)	159 jobs (64 PY)	\$ 6,580 K	\$ 7,950 K	\$ 14.5 M
	Quebec	191 (103)	532 (271)	265 jobs (112 PY)	\$ 4,310 K	\$ 3,770 K	\$ 8.1 M
	Nova Scotia	5 (1)	31 (3)	12 jobs (8 PY)	\$ 200 K	\$ 260 K	\$ 0.5 M
	TOTAL	959 (446)	2,232 (1,056)	~ 435 jobs	\$ 11.1 M	\$ 12.0 M	\$ 23.1 M

^a Close directed cod fishery only.

... table cont'd next page

^b Close directed cod fishery; close fisheries for winter and witch flounders, plaice, and white hake; and reduce Atlantic halibut fishery 16%.

^c Close directed cod fishery; close fisheries for winter and witch flounders, plaice, white hake, Atlantic halibut, redfish, and Greenland halibut.

Table 5.6.a (cont'd): Immediate impacts in 4RS3Pn.

Scenario	Province	Licence Holders Affected (Dependent)	Crew Affected (Dependent)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
harvest restrictions plus “no sales” provision:							
No Directed Cod Fishery ^a	NL & LAB	756 (269)	1,631 (574)	100 jobs (41 PY)	\$ 3,480 K	\$ 5,070 K	\$ 8.6 M
	Quebec	142 (50)	381 (108)	51 jobs (22 PY)	\$ 900 K	\$ 1,770 K	\$ 2.7 M
	TOTAL*	899 (319)	2,027 (682)	~ 150 jobs	\$ 4.4 M	\$ 6.8 M	\$ 11.2 M
Prioritized Rebuilding ^b	NL & LAB	759 (282)	1,648 (629)	128 jobs (52 PY)	\$ 4,160 K	\$ 5,920 K	\$ 10.1 M
	Quebec	151 (51)	408 (112)	52 jobs (22 PY)	\$ 960 K	\$ 1,790 K	\$ 2.8 M
	TOTAL*	915 (333)	2,087 (741)	~ 180 jobs	\$ 5.1 M	\$ 7.7 M	\$ 12.9 M
Maximum Rebuilding ^c	NL & LAB	763 (342)	1,694 (807)	159 jobs (64 PY)	\$ 6,590 K	\$ 7,960 K	\$ 14.5 M
	Quebec	195 (103)	548 (271)	266 jobs (112 PY)	\$ 4,310 K	\$ 3,770 K	\$ 8.1 M
	Nova Scotia	5 (1)	31 (3)	12 jobs (8 PY)	\$ 200 K	\$ 260 K	\$ 0.5 M
	TOTAL	963 (446)	2,273 (1,081)	~ 435 jobs	\$ 11.1 M	\$ 12.0 M	\$ 23.1 M

^a Close directed cod fishery; no sale of any cod catch.

^b Close directed cod fishery; close fisheries for winter and witch flounders, plaice, and white hake; and reduce Atlantic halibut fishery 16%. No sale of any cod catch.

^c Close directed cod fishery; close fisheries for winter and witch flounders, plaice, white hake, Atlantic halibut, redfish, and Greenland halibut. No sale of any cod catch.

* Includes some licence holders and crew in Nova Scotia.

Table 5.6.b: Long-term (20-year) Scenario Results for Area 4RS3Pn. Initial population parameters: SSB = 38,000t ; Growth rate = 15% ; LRP = 100,000t.

Growth Rate (productivity)	Baseline: Current Conservation, 2005 ^a	No Directed Fishery	Prioritized Rebuilding	Maximum Rebuilding	Half to Stock ^b
Years to Reach Limit Reference Point					
5 % (low)	> 20	> 20	>20	>20	>20
15 % (med)	> 20	8	8	7	15
20 % (med)	19	6	6	6	12
25 % (high)	10	5	5	5	10
Biomass at Year 20 (thousand tonnes)					
5 % (low)	54.6 ^c	87.5	91.7	96.0	60.0
15 % (med)	46.1	177.0	180.3	166.6	122.8
20 % (med)	106.7	172.6	175.0	177.5	136.0
25 % (high)	127.4	160.2	162.0	163.9	134.0
Difference in Present Value of Revenue Stream^d					
5 % (low)	-	- \$ 50 M (-59, -43)	- \$ 77 M (-91, -66)	- \$ 219 M (-257, -189)	- \$ 8 M (-9, -7)
15 % (med)	-	\$ 69 M (117, 34)	\$ 60 M (109, 25)	- \$ 4 M (38, -34)	\$ 11 M (28, 0)
20 % (med)	-	\$ 187 M (256, 134)	\$183 M (254, 130)	\$ 133 M (204, 80)	\$ 62 M (89, 43)
25 % (high)	-	\$ 187 M (241, 145)	\$187 M (243, 143)	\$ 146 M (203, 103)	\$ 18 M (24, 13)

^a The baseline is set at 13% of spawning stock biomass when below the LRP. Above the LRP, it is set at 5% below the growth rate. When growth is low, the baseline must be redefined or the stock is driven to extinction. In these simulations, the baseline harvest for 5% growth is set to 3%. This is consistent with the 2005 harvest level, which is 2% below the current growth rate.

^b This scenario dedicates half of the annual growth to harvest, and half to stock biomass replenishment. See text on *Long Term Impacts*.

^c Note that baseline growth is actually higher when harvest is 3% and growth is 5% than when harvest is 13% and growth is 15%. This is because half of harvest occurs before growth and half after in this model, so that the net rate of growth is not 2% in both cases, and is lower for the 13% harvest.

^d The revenue stream is discounted at 5% and reported as the difference between the baseline and each alternative. Values in parentheses represent the present value using discount rates of (3% , 7%).

Long Term Impacts

Longer-term projections indicate that benefits could accrue from harvest restrictions in 4RS3Pn, within a fairly short time horizon, so long as growth rates remain sufficiently high. Results from the projections under current productivity are shown graphically in Figures 5.1 and 5.2. At a 15% growth rate (2005 assessment), and with closure of the directed fishery or prioritized rebuilding, the 4RS3Pn cod stock reaches its LRP within 8 years (Figure 5.1). Under maximum rebuilding, the limit is reached in 7 years²³.

In contrast to the rebuilding scenarios, current conservation (2005 baseline²⁴) leads to very little stock growth (Figure 5.1).

The cumulative discounted revenue streams associated with the biomass for each scenario are shown in Figure 5.2. These are expressed as differences from the baseline; that is, the 2005 TAC scenario is normalized to zero. Closure of the directed fishery, prioritized rebuilding, and maximum rebuilding all produce large short term losses. However, the former two scenarios ultimately lead to greater revenue than the baseline. The “break even” point occurs at approximately 15 years.

Two additional scenarios are shown in Figures 5.1 and 5.2. Neither involves a full closure of the fishery, allowing for a reduced TAC instead. The first of these is the original status quo (the 2004 TAC). Under constant 15% growth in spawning stock biomass, the harvest rate associated with the 2004 TAC would allow the stock to reach the LRP in 20 years. The second additional scenario is one in which half of the stock’s annual productivity is allocated for stock biomass growth, and the other half is allocated to harvest. Under this alternative, the LRP is achieved in 15 years. In each of these scenarios, the obvious trade-off is that the stock grows more slowly to the LRP (Figure 5.1) and total 20-year revenue is lower than for the more restrictive alternatives, but there is less short-term revenue loss (Figure 5.2).

Table 5.6.b summarizes how the results change under different population growth assumptions and discount rates. The details of the scenario implementations in different productivity regimes are given in Appendix C.

²³ An apparently counterintuitive result can be seen in Figure 5.1, in that maximum rebuilding results in a lower stock than either closure of the directed fishery or prioritized rebuilding. This is not a general result. In these particular simulations, the LRP is exceeded by only a small amount in the first year it is reached under maximum rebuilding. With closure of the directed fishery and prioritized rebuilding, the threshold is exceeded substantially in the first year it is reached. This extra growth before harvest begins sets these two latter scenarios at a higher initial biomass, which is maintained thereafter.

²⁴ The year 2005 was chosen as the baseline for the long term projections, since it embodies the apparent future direction of *status quo* management.

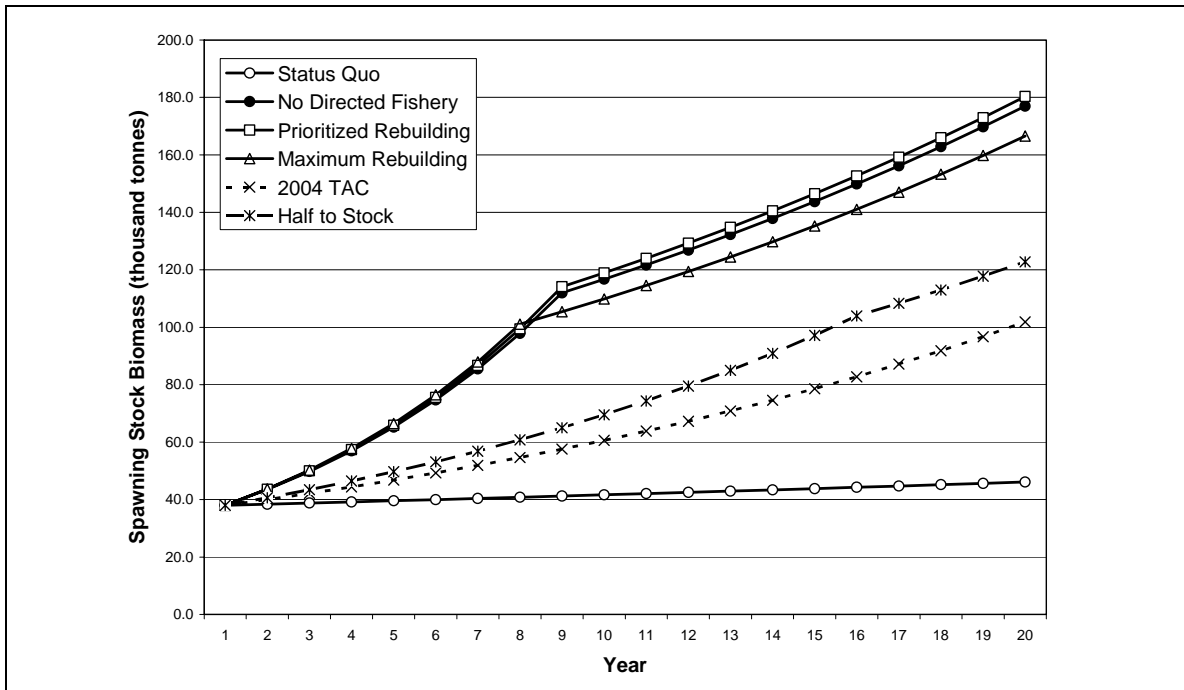


Figure 5.1: Projected Spawning Stock Biomass by Scenario, under 15% annual stock growth

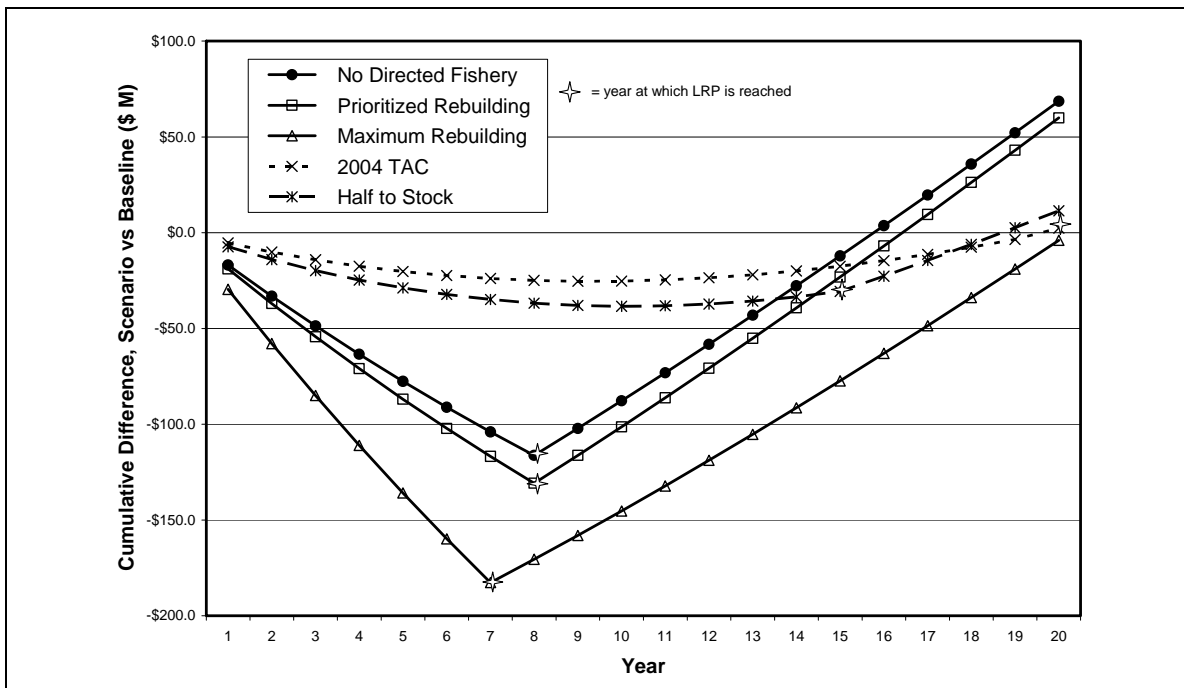


Figure 5.2: Cumulative Difference in Revenue, Scenario vs. Baseline, under 15% annual stock growth

Not surprisingly, higher growth rates and lower harvest rates mean the LRP was reached more quickly (Table 5.6.b). However, the trade-off between biomass and the revenue stream is complex. Higher growth does not always result in higher spawning stock biomass, since greater harvests may be implemented. Similarly, revenue is not always higher at higher growth rates, since it is measured relative to the baseline, which performs differently at higher growth rates²⁵. The general result to note is that closure of the directed fishery generates greater revenue than the baseline, and also greater revenue than prioritized or maximum rebuilding, without a significant trade-off in spawning stock biomass.

In general, the long term results for 4RS3Pn were not sensitive to discount rates. Lower discount rates were generally more favourable towards restricting near-term harvests, in order to obtain long-term benefits (Table 5.6b). However, in the range of discount rates used here (3% to 7%), there is only one case where the interest rate changed net benefits from negative to positive: maximum rebuilding under 15% growth. At a 5% discount rate, the 20-year discounted revenue stream for maximum rebuilding fell slightly below the revenue stream for current conservation (a negative value in Table 5.6.b), but at 3% discounting, it exceeded current conservation.

In summary, the results are quite convincing that if growth rates remain medium to high, harvest restrictions in 4RS3Pn could allow the stock to grow above the critical threshold of its lower limit reference point. After reaching the LRP, if precautionary fisheries (growth minus 5%) are implemented, the stock can continue to recover and the overall benefits, relative to current conservation measures would be positive. In this analysis, the greatest benefits arose from a closure of the directed fishery, for less than 10 years. More restrictive measures that also reduce bycatch have higher immediate costs but do not substantially increase the discounted revenue stream beyond what is achieved by closing the directed fishery.

Less restrictive measures, such as allocating half of annual growth to harvest and half to stock replenishment, do not achieve the same level of enhanced future harvests within the 20-year time frame, but the burdens on today's fishermen are lower.

Possible Mixing with Division 3Ps cod

The preceding population projections assume that the 4RS3Pn cod stock is distinct from the 3Ps stock. Concerns have been raised that seasonal migrants from the 4RS3Pn stock are taken in the 3Ps winter fishery. If this is found to be a significant source of harvest mortality for 4RS3Pn cod, then management strategies for the two stocks must be developed in concert, to take into account the population mixing.

²⁵ If one was to solve for an optimal harvest at each growth rate, the results would be more straightforward to interpret. However, a more complete population model is required to solve for the optimal harvest.

5.2.2 Division 3Ps

Unlike the other cod stocks considered so far, the spawning stock biomass in 3Ps is currently above its limit reference point, and has been sustaining a TAC of 15,000 tonnes. However, much of the current stock productivity is supported by two strong year classes (1997-1998), with weak recruitment in subsequent years²⁶. Current exploitation levels may not be sustainable.

In addition, there remains some question as to how much of the catch in the winter 3Ps fishery is actually comprised of seasonal migrants from 4RS3Pn. If mixing is significant, then conditions in 4RS3Pn would have important implications for the TAC that could be set in 3Ps. Tagging results suggest that the catch of 4RS3Pn cod in 3Ps was low in two recent years²⁷, but the matter is not resolved.

Current conservation (*status quo* management) under the precautionary principle was the only option provided by DFO Science and Fisheries and Aquaculture Management for inclusion in this analysis. The *status quo* would be applied under both low and high productivity regimes (Table 5.7). The implication, then, is that the current conservation could appropriately accommodate any changes in productivity, regardless of the influence of SARA.

Table 5.7: Management options assessed for area 3Ps

Productivity Regime	Scenario	Directed Fishery	Bycatch
Low	Current Conservation	Precautionary Mgmt.	Current level
High	Current Conservation	Precautionary Mgmt.	Current level

Immediate Impacts

With no management scenarios to assess, the only impacts examined are the immediate impacts of the “no sale” provision that could apply if the Laurentian North population was listed as threatened. These impacts would be severe. An immediate revenue loss of approximately \$42.3 M could be realized in harvesting and processing combined, mostly in Newfoundland (Table 5.8.a). Furthermore, this is an inshore fishery supporting a large number of licence holders and crew. Over 1,000 licence holders and almost 3,000 crew would be affected by the closure of this fishery, a closure which would almost certainly result if the catch could not be sold. Nearly 700 of the licence holders are dependent on 3Ps cod for more than 25% of their fishing revenue, and a large proportion of the crew would therefore also be expected to depend on this source of income.

²⁶ DFO, 2004. Subdivision 3Ps Cod. DFO Can. Sci. Advis. Sec. Stock Status Report. 2004/039.

²⁷ Brattley, J and B. Healey. 2004. Exploitation of Atlantic cod (*Gadus morhua*) in NAFO subdivision 3Ps: further updates based on tag returns during 1997-2004. Can. Sci. Advis. Sec. Res. Doc. 2004/089

In the processing sector, close to 500 jobs would be in jeopardy, and there could be more if the closure of this fishery forced the complete closure of processing plants. Plant closures would be quite likely to occur. More than 90% of the impacts are expected to be experienced in Newfoundland and Labrador, and just under 10% in Nova Scotia.

Long Term Impacts

Without specific alternative scenarios to analyse, long term impacts were not examined for area 3Ps. As is true of all stocks considered for endangered or threatened status, the “no sale” issue would cause severe impacts in the long term if not resolved quickly.

Table 5.8.a: Immediate (first year) Impact Estimates for Area 3Ps. Immediate impacts are the same for high and low productivity regimes, and are assessed only for the “no sales” provision.

Scenario	Region/Province	Licence Holders Affected (Dependent)	Crew Affected (Dependent)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
“no sales” provision:							
Status Quo	NL & LAB	1,049 (690)	2,611 (1,504)	476 jobs (192 PY)	\$ 16,150 K	\$ 22,950 K	\$ 39.1 M
	Nova Scotia	10 (0)	113 (0)	36 jobs (23 PY)	\$ 995 K	\$ 2,100 K	\$ 3.1 M
	TOTAL	1,059 (690)	2,724 (1,504)	~ 510 jobs	\$ 17.1 M	\$ 25.1 M	\$ 42.2 M

5.3 Maritimes Population

The Maritimes Atlantic cod population is under consideration as a “Special Concern” population. Current precautionary management is considered sufficient to meet the requirements of that designation, and the “no sale” provision does not apply to listed populations with this status. Therefore, no specific impacts resulting from harvest restrictions were assessed in this report for the fish harvesting and processing sectors associated with the Maritimes cod population. However, a brief profile of the Maritimes population cod fishery is provided below.

Maritimes cod is landed from several NAFO divisions: 4TVn, 4VsW, 4X, and 5Ze_{j,m}. The adjacent area 5Y is not defined by COSEWIC as part of the Maritimes population, but the small landings from this area are included in Table 5.9. In total, approximately 8,624 tonnes of cod were landed from the Maritimes cod population in 2004. Of this 53% (4594 t) was landed in directed fisheries in 4TVn and 4X. An additional 5.8% was landed in sentinel or very small directed fisheries in 4VsW, 5Y, or 5Ze_{j,m}.

The remaining 41.2% (3554 t) was caught incidentally in a number of fisheries, but a full 74% of the total bycatch can be attributed to the haddock fisheries in 4X and 5Z, and the 4X pollock fishery (Table 5.9).

Table 5.9: Main Fisheries in which Atlantic cod, Maritimes Population, is Harvested

NAFO Division	Directed Fishery	Cod Landings (t)
4TVn	Atlantic cod	2295.8
	Atlantic halibut	41.6
	American plaice	90.2
4VSW	Atlantic cod	17.4
4X	Atlantic cod	2297.9
	haddock	1072.8
	redfish	49.3
	winter flounder	163.3
	pollock	762.2
	white hake	117.3
	cusks	141.0
5Y	Atlantic cod	197.4
5Z	Atlantic cod	263.7
	haddock	795.5

Although no new harvest restrictions are necessarily implied from listing Maritimes cod as a Special Concern population, closure of the directed cod fisheries could result in a loss of up to \$11.6M. Restrictions in the main bycatch fisheries would be very costly, with the value of the haddock fishery being \$11.0M and the value of the pollock fishery being \$5.2M.

As shown in Chapter 4, Tables 4.5b, and 4.5c, there are approximately 1,148 groundfish licence holders who earned revenue from the Maritimes cod population in 2004. 190 of these were Quebec fish harvesters in area 4TVn, while the remainder originate from Nova Scotia, New Brunswick, and Prince Edward Island.

6. COMBINED IMPACTS: HARVESTING, PROCESSING AND ADDITIONAL IMPACTS

Chapter 5 provided a detailed analysis of scenarios for the commercial harvesting and processing sectors. The potential impacts were presented separately, as though the effects would be independent in different NAFO divisions. However, the Atlantic cod populations as defined by COSEWIC are the smallest indivisible units for which a decision to list or not list must be made, and therefore, the overall impacts should be considered at the population level.

This chapter presents population-level impacts for the harvesting and processing sectors, and also provides discussion of the additional benefits and costs that are not included in these quantitative estimates. In order to present impacts by population, it is necessary to choose a plausible subset of illustrative scenarios, shown in Table 6.1. In each case, the chosen scenario is the scenario that is next-most-restrictive and plausible scenario compared to current conservation, from among the set scenarios provided by DFO Science sector and Fisheries and Aquaculture Management. In the case of area 3NO, advice from stakeholders indicated that prioritized rebuilding was not a plausible scenario, as a 50% reduction of bycatch would essentially force a complete closure of the bycatch fisheries. Thus, maximum rebuilding is the plausible alternative.

Table 6.1: Selected Scenarios for Regional Impact Summary

	Current Conservation	Plausible Management Scenario Under SARA listing
Newfoundland and Labrador Population		
2J3KL	Moratorium on directed fishery	Prioritized re-building scenario: Continue moratorium on directed fishery, reduce by-catch of cod by 50% through reductions in winter flounder fishery by 53%
3NO	Moratorium on directed fishery	Maximum re-building scenario: Continue moratorium on directed fishery, reduce by-catch of cod to lowest level through closure of skate, yellowtail, redfish, and Atlantic halibut fisheries.
Laurentian North Population		
3Ps	Total Allowable Catch in 2005 of 15,000 tonnes	Current conservation: Directed fishery at current level of 15,000 tonnes
4RS3Pn	Total Allowable Catch in 2005 of 5,000 tonnes	No directed fishery, bycatch fisheries continue at current rate.

6.1. Harvest and Processing Impacts Summarized by Atlantic Cod Population

Table 6.2 shows the expected impacts for these scenarios if the Newfoundland and Labrador cod population is listed as Endangered. The direct impacts are similar whether the sale of cod is allowed or prohibited. Between 800 and 900 licence holders, and between 1800 and 2200 crew are expected to be affected if this population is listed under SARA. A smaller number would be considered dependent (about 15 licence holders and 270 crew). There are 675 to 685 jobs in fish processing that would be lost, and more if any plants were forced to complete closure. In dollar terms, annual foregone revenue would fall in the range of \$28M.

The long term analysis showed that costs are high and benefits are relatively low from imposing additional restrictions upon the stocks that make up the Newfoundland and Labrador cod population. These stocks are already under moratoria. Under the assumptions of the simple model used (constant growth, no change in other fisheries), 20-year losses would exceed \$300M, while gains in cod biomass would be less than 70,000t at any plausible population growth rate, almost all of which would occur within the inshore sub-population.

Table 6.2: Newfoundland and Labrador Cod Population: Immediate Direct Annual Impacts in Harvest and Processing Sectors

NAFO DIV.	Affected Licenceses (and crew)	Dependent Licenceses (and crew)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
Cod Sales Allowed						
2GH	0	0	0	\$ 0	\$ 0	\$ 0
2J3KL	811 (1,419)	1 (2)	15 jobs (6 FTE)	\$ 0.39 M	\$ 0.63 M	\$ 1.0 M
3NO	30 (425)	13 (263)	660 jobs (269 FTE)	\$ 10.5 M	\$ 16.1 M	\$ 26.6 M
Total	841 (1,844)	14 (265)	675 jobs (275 FTE)	\$ 10.9 M	\$ 16.8 M	\$ 27.7 M
Cod Sales Prohibited						
2GH	0	0	0	\$ 0	\$ 0	\$ 0
2J3KL	838 (1,690)	5 (8)	25 jobs (10 FTE)	\$ 0.72 M	\$ 1.14 M	\$ 1.9 M
3NO	44 (483)	13 (263)	660 jobs (269 FTE)	\$ 10.5 M	\$ 16.2 M	\$ 26.7 M
Total	882 (2,173)	18 (271)	685 jobs (279 FTE)	\$ 11.2 M	\$ 17.3 M	\$ 28.6 M

Table 6.3 shows the potential impacts if the Laurentian North cod population is listed as Threatened. The issue of cod sales has profound implications for this population. If cod sales are permitted under SARA, the additional management restrictions would affect about 865 licence holders and 1830 crew. About 300 of these licence holders (and 600 crew) would be considered dependent upon the revenue they would forego. About 145 processing jobs could be expected to disappear, and more if any plants were forced to close completely. In terms of foregone revenue, the direct impacts in the harvest and processing sectors would be about \$10.5 M.

If the population is listed under SARA and cod sales are prohibited, however, the 3Ps cod fishery would be forced to closure. In that case, almost 2,000 licence holders (and 4,750 crew) would be affected. Of these, 1,000 licence holders (and almost 2,200 crew) would be considered dependent upon the income they would lose. A minimum of approximately 660 processing jobs would be lost, but the closure of this fishery would almost certainly force some groundfish processing plants to close, so that the job losses are potentially much greater. If cod could not be sold, foregone revenue would increase five-fold, to more than \$53M.

The long term impact analysis indicated that positive net benefits from harvest restrictions are possible for this population (specifically for 4RS3Pn), but are quite dependent upon the growth rate. If the growth rate in 4RS3Pn continues at its most recently assessed level or higher, this entire population could be functioning at biomass levels above the LRP. However, the growth in 4RS3Pn has been subject to considerable revision and debate. The 15% currently assessed is much higher than that which was assessed as recently as 2003.

Table 6.3: Laurentian North Cod Population: Immediate Direct Annual Impacts in Harvest and Processing Sectors

NAFO DIV.	Affected Licences (and crew)	Dependent Licences (and crew)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
Cod Sales Allowed						
4RS3Pn	863 (1,829)	303 (606)	143 jobs (59 FTE)	\$ 4.1 M	\$ 6.4 M	\$ 10.5 M
3Ps	0	0	0	\$ 0	\$ 0	\$ 0
Total	863 (1,829)	303 (606)	143 jobs (59 FTE)	\$ 4.1 M	\$ 6.4 M	\$ 10.5 M
Cod Sales Prohibited						
4RS3Pn	899 (2,027)	319 (682)	151 jobs (63 FTE)	\$ 4.4 M	\$ 6.9 M	\$ 11.2 M
3Ps	1,059 (2,724)	690 (1,504)	512 jobs (215 FTE)	\$ 17.1 M	\$ 25.1 M	\$ 42.2 M
Total	1,958 (4,751)	1,009 (2,186)	663 jobs (278 FTE)	\$ 21.5 M	\$ 31.9 M	\$ 53.4 M

The grand totals for the potential effects of listing both populations are shown in Table 6.4.

Table 6.4: Potential Direct Annual Impacts of Listing Both Populations under SARA

	Affected Licences (and crew)	Dependent Licences (and crew)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
Cod Sales Allowed						
Grand Total	1704 (3673 crew)	317 (871 crew)	818 jobs (334 FTE)	\$ 15.0 M	\$ 23.2 M	\$ 38.2 M
Cod Sales Prohibited						
Grand Total	2840 (6924 crew)	1027 (2457 crew)	1348 jobs (557 FTE)	\$ 32.8 M	\$ 49.2 M	\$ 82.0 M

6.2. Harvest and Processing Impacts Summarized by Province

A presentation of the impacts by province (Table 6.5) shows that Newfoundland and Labrador would be most affected, and would also be most vulnerable to the higher impacts of a prohibition on the sale of cod. The already-large impacts would more than double in Newfoundland and Labrador if cod sales were not allowed. Much of this effect is due to the forced closure of the 3Ps fishery that would not necessarily occur if cod could be sold.

Table 6.5: Direct Annual Impact in Harvest and Processing Sectors, by Province

Province	Affected Licences (and crew)	Dependent Licences (and crew)	Foregone Processing Employment	Foregone Harvest Revenue	Foregone Processing Revenue	Total Foregone Revenue
Cod Sales Allowed						
NL	1583 (3346)	266 (757)	755 (305 FTE)	\$ 13.5 M	\$ 21.0 M	\$ 34.5 M
QC	115 (288)	50 (108)	50 (21 FTE)	\$ 0.9 M	\$ 1.7 M	\$ 2.6 M
NS	6 (39)	1 (6)	13 (8 FTE)	\$ 0.6 M	\$ 0.5 M	\$ 1.1 M
Cod Sales Prohibited						
NL	2678 (6363)	976 (2343)	1248 (504 FTE)	\$ 30.2 M	\$ 44.8 M	\$ 75.0 M
QC	142 (381)	50 (108)	51 (22 FTE)	\$ 0.9 M	\$ 1.8 M	\$ 2.7 M
NS	20 (180)	1 (6)	49 (31 FTE)	\$ 1.6 M	\$ 2.7 M	\$ 4.3 M

6.3. Other Impacts

The commercial impacts outlined in the preceding tables and text **are not the only impacts that would be experienced** if Atlantic cod was listed on Schedule 1 of SARA. Many of the other impacts are more difficult to quantify, but a qualitative discussion will still convey, to some extent, the potential contribution of some additional benefits and costs.

6.3.1. Indirect and Threshold Effects

There are indirect and induced regional economic impacts that are not taken into account in this analysis. By analyzing the processing sector specifically, and by counting gross revenue, some spillover effects are accounted for (as previously discussed in Chapter 3). However, the effects of reduced consumer spending in communities resulting from lower personal income has not been taken into account, nor have the potential threshold effects associated with plant closures been quantified. These effects could be devastating if concentrated within particular rural communities, since the basis for the entire local economy could be destroyed.

6.3.2. Effects of Dislocation

Management scenarios that involve further restrictions on harvesting cod may increase out-migration from rural communities (and a corresponding increase in migration to urban regions in other parts of Canada). There are costs associated with this migration, for the communities affected, for the province as a whole, and for the individuals. For communities, population decreases can negatively impact funding allotments for schools, infrastructure and general public and private services. For the province, out migration can mean the province is home to a lower proportion of Canada's population, resulting in lower transfer payments from the federal government when the amounts of those payments are calculated on a per capita basis. For individuals, the cost of moving is not trivial; there are costs associated with buying and selling homes, shipping belongings and hiring moving vans. Downturns in economic fortunes of communities can significantly reduce the market value of homes being sold by people intending to move. Many fishers have significant mortgages on their vessels -- selling the vessels to pay off the mortgage would be difficult, especially when downturns in the fishery reduce their resale value. This may limit their ability to relocate. However without additional economic opportunities in their community, these fishers may be left to rely on social assistance and/or may end up declaring bankruptcy. While estimating these costs is beyond the scope of this analysis, they should be considered in a listing decision.

6.3.3. Effects on Transfer Payments

The impacts of cod listing may impair the ability of affected harvesters and processors to qualify for employment insurance (EI), which is typically a significant source of income for many of these primarily seasonal workers. For instance, in the Lower North Shore region of Quebec, the average payment for EI for fishing-related employment in 2004 was \$8,300. In Newfoundland and Labrador, the average fishers EI payment was \$11,600 in 2004. Self-

employed harvesters may qualify for Fisher's EI if, in the 31 weeks before their claim, they have earned at least \$2,400 to \$4,200 depending on their region. Others, such as a harvester's crew and workers in processing plants may qualify for EI regular benefits if they have worked the required number of hours in the previous year (the exact requirement depends on their region's unemployment rate). Harvesters/crew and processors who work less hours as a result of a potential cod listing may no longer qualify for this income.

6.3.4. Potential Costs to Government

Given the directives of SARA for the responsible Minister to protect a species listed as Extirpated, Endangered or Threatened from killing, harm or harassment, there may be increased costs to government in the form of significant additional enforcement activity. Discussions with stakeholders indicated that there would very likely be a significant protest fishery if cod were to be listed. General estimates were calculated on the basis of historical departmental experience in enforcing the conservation of fisheries. Additional enforcement costs would be expected to range from \$230,000 if non-compliance were to be limited to two days to \$4.6 million for each 60 day period of non-compliance. These costs are additional to the costs from foregone harvesting or processing resulting from implementing the plausible scenarios detailed in this document.

An additional intangible cost for DFO would be the loss of stewardship and co-operation from the industry, previously described in Chapter 4. A listing would also likely drive catch information underground. Also, discussions with stakeholders indicated that there is an expectation that if cod is listed, DFO will implement a significant scientific and research initiative, similar to the recent Northern Cod Science Program (a \$50M program), in order to increase knowledge of the stock's biology and demonstrate a commitment to de-listing cod as soon as possible. The cost of any such potential initiative is not included in this analysis, nor are the costs for developing SARA-compliant recovery strategies and action plans.

6.3.5. Exogenous Economic Factors

The analysis presents the marginal impacts of a potential SARA listing from the reference year (2004), holding other factors constant. However, it should be noted that the Canadian dollar has appreciated significantly in 2005, and fuel costs have risen sharply (for instance, diesel fuel prices have increased by over 50% since September 2004). The uncertain future of the shellfish resources that have provided alternative income to harvesters (discussed in Chapter 4) could also add to the intensity of impacts. These factors have already affected harvesters and processors, and would exacerbate the effects of a potential SARA listing.

6.3.6. Impacts on Aboriginal Groups

The direct commercial impacts upon Aboriginal groups are included within the harvesting and processing impacts assessed in Chapter 5 and summarized in the tables of this chapter. Indirect impacts that may result from critical habitat designation have not been assessed in this report for any fishery or group of harvesters, but these effects are potentially large.

SARA allows for a food, social, and ceremonial (FSC) fishery, if it is included within an approved recovery strategy. The ongoing allowance of FSC fisheries in the case of a listing under SARA would undergo review and negotiations during the course of recovery strategy development. Presumably, the outcome could depend to some extent upon the level of harvest restrictions imposed on the commercial fishery. For example, if commercial bycatch is allowed to continue at some level, then FSC fisheries are far less likely to be restricted. Whatever measures are ultimately undertaken, they must take into consideration a number of standing agreements with Aboriginal peoples regarding allocations and access.

6.3.7. Effects of Potential Restrictions due to Critical Habitat Designation

If cod is listed on Schedule 1 of the SARA, then a process whereby critical habitat is designated would ensue during the development of recovery strategies. If identified, critical habitat and the species' residence would be protected from a great number of anthropogenic activities, which could potentially have serious economic implications for other fisheries (for example, restrictions upon bottom otter trawling and scallop dredging) and for other ocean sector industries (such as oil and gas exploration and development, or seismic surveying)

There is insufficient information at this time to speculate extensively upon the effects of critical habitat protection, but it is an issue that warrants suitable consideration.

6.3.8. Potential Benefits Beyond Future Realized Harvests

In addition to being an important commercial species, Atlantic cod may also have substantial non-market/intangible value to Canadian society, as many individuals who do not use this resource directly may still wish to see it preserved. Citizens may want to preserve the species for future generations to enjoy (bequest value), or the public may derive value from knowing the species exists, even if they will never personally see or 'use' the species (existence value). There is also value derived from retaining the option to observe or even use the species at some future time (option value).

Non-use value is extremely difficult to measure because of its subjectivity, and due to the difficulty in eliciting from individuals their true values for the good in question (and only that good). Non-use values are not expected to be large in the case of Atlantic cod (under the current population status), especially in relation to the commercial values.

Estimating non-market *use* value is less problematic conceptually, but usually requires access to data that are not routinely collected. Non-market values have not been estimated for Atlantic cod at this time, but it is likely that non-market use benefits are fairly high. A prominent species like Atlantic cod carries national significance. Furthermore, the cod fishery is much more than employment for a large number of individuals; it is a tradition embedded in the history and culture of coastal communities in Eastern Canada, and particularly in Newfoundland and Labrador and the lower north shore of Quebec where fishing for cod is regarded by some as a right. In the short run, a decision to list Atlantic cod under SARA is likely to be perceived as a loss of benefits by those who value the act of fishing for cod, independent of the commercial value of the catch. However, to the extent

that this activity could be enjoyed more in the future if SARA contributes to cod recovery (perhaps through an expanded recreational fishery) a decision to list could generate additional non-market use benefits.

There may also be biological spillover effects resulting from harvest restrictions brought about by SARA, should cod be legally listed. Reduced harvests in other fisheries may also provide an opportunity for replenishment of other groundfish stocks; that is, ecosystem benefits may accrue. This is a complex issue that cannot be resolved with verbal logic, but it is a potential source of benefits that may contribute in part towards the offset foregone harvest costs and which may be worthy of further examination.

Finally, there is a value to the stock of cod in the ocean, akin to the capital or “book” value of an asset, beyond the realized income stream that may result from its harvesting and processing within a finite time period. A stock could be valued according to the commercial yield (\$) it is likely to support, minus the costs of harvesting/production. The long term impact analysis presented only biomass values, but a more complete assessment of benefits would assign a dollar value to the additional stock biomass.

6.4. Concluding Notes

This analysis of impacts focused upon the regional incidence of benefits and costs, and did not consider benefits and costs on a national level. However, the vast majority of both the benefits and the costs associated with fisheries management activities considered in this report would be local to the regions in which they are implemented. Furthermore, unlike the dispensing of public funds (the expenditure of which constitutes the typical national benefit cost analysis), the resources employed in the prosecution of these fisheries are not mobile. They are not easily employable in alternative activities even locally, let alone nationally. As a result, a regionally-focused analysis would appear to be the more appropriate approach.

Costs were considered in terms of affected individuals/jobs and foregone income. Benefits were examined through simple models to assess the potential for stock biomass accumulation. All of these methods could be refined and applied to the development of cost-effective recovery strategies under SARA, or to the development of Atlantic cod management plans under the umbrella of the *Fisheries Act*.

BIBLIOGRAPHY

- Atlantic Canada Opportunities Agency. 2002. *The Southern Shore – An Economy in Transition*.
- Audit and Evaluation Directorate. 2002. *Evaluation of the Canadian Fisheries Adjustment and Restructuring Program License Retirement Programs*. Fisheries and Oceans Canada.
- Canadian Council of Professional Fish Harvesters. 2005. *Setting a New Course: Phase II Human Resources Sector Study for the Fish Harvesting Industry in Canada*. Prepared by Praxis Research and Consulting Inc.
- Canning, Patricia and Charlotte Strong. 2002. *Children and Families Adjusting to the Cod Moratorium*. In *The Resilient Outport: ecology, economy, and society in rural Newfoundland*. Edited by R.E. Ommer. Memorial University of Newfoundland, Institute of Social and Economic Research.
- COSEWIC 2003. “COSEWIC assessment and update status report on the Atlantic cod *Gadus morhua* in Canada”. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 76 pp.
- DFO, 2004. Northern (2J+3KL) Cod. Can. Sci. Advis. Sec. Stock Status Report 2004/011. MPO, 2004.
- DFO, 2004. The Northern Gulf of St. Lawrence (3Pn, 4RS) Cod in 2003. DFO Can. Sci. Advis. Sec. Stock Status Report 2004/019. MPO, 2004.
- DFO, 2004. Subdivision 3PS Cod. DFO Can. Sci. Advis. Sec. Stock Status Report 2004/039.
- DFO, 2004. Allowable Harm Assessment for Newfoundland and Labrador Cod. DFO Can. Sci. Advis. Sec. Stock Status Report 2004/042.
- DFO, 2004. Allowable Harm Assessment for Laurentian North Cod Population. DFO Can. Sci. Advis. Sec. Stock Status Report 2004/041.
- DFO 2005. Southern Gulf of St. Lawrence Snow Crab (Areas 12, E and F). DFO Can. Sci. Advis. Sci. Advis. Rep. 2005/022.
- DFO, 2005. Snow Crab of the Estuary and Northern Gulf of St. Lawrence (Areas 13 to 17 and 12A, 12B and 12C) in 2004. DFO Can. Sci. Advis. Sec. Stock Status Rep. 2005/027.
- Dunne, Eric. 2003. *Final Report of the Fish Processing Policy Review Commission*.

Fisheries and Oceans Canada. 1996. Commercial Fisheries Licensing Policy for Atlantic Canada.

Fisheries and Oceans Canada. 1979. From Toward a Policy for the Utilization of Northern Cod: A Discussion Paper.

Fisheries Resource Conservation Council. 2004 / 2005 Conservation Requirements for Groundfish Stocks in the Gulf of St. Lawrence: Report to the Minister of Fisheries and Oceans. Document FRCC.2004.R.3, April 2004.

Government of Newfoundland and Labrador. 2002. Demographic Change, Newfoundland and Labrador: Issues and Implications.

Government of Newfoundland & Labrador, Department of Finance. 2002. Employment Insurance - Trends and Usage in Newfoundland and Labrador.

Hamilton, Lawrence C. and Melissa J. Butler. 2001. Outport Adaptations: Social Indicators through Newfoundland's Cod Crisis. *Human Ecology Review*, Vol. 8, No. 2.

Healey B. P., E. F. Murphy, D. E. Stansbury, and J. Bratley. An Assessment of the Cod Stock in NAFO Divisions 3NO. NAFO SCR Doc. No. 03/59. Serial No. N4878

Human Resources and Skills Development. 2000. 2000 EI Monitoring and Assessment Report.

National Seafood Sector Council. 2004. Meeting the Challenge: Canada's Seafood Processing Industry Labour Market in the 21st Century.

Policy and Economics Branch, Quebec Region. 2004. The Fishing Industry in Quebec – Socio-Economic Profiles 2004. Fisheries and Oceans Canada, Quebec City, Quebec.

Policy and Economics Branch, Quebec Region. 2004. The Fishing Industry in Quebec – Socio-Economic Profiles: Selected Statistics 2004. Fisheries and Oceans Canada, Quebec City, Quebec.

Policy and Economics Branch, Quebec Region. 2004. The Fishing Industry in Quebec – Socio-Economic Profiles: North Shore 2004. Fisheries and Oceans Canada, Quebec City, Quebec.

Policy and Economics Branch, Quebec Region. 2004. The Fishing Industry in Quebec – Socio-Economic Profiles: Magdalen Islands 2004. Fisheries and Oceans Canada, Quebec City, Quebec.

Policy and Economics Branch, Quebec Region. 2004. The Fishing Industry in Quebec – Socio-Economic Profiles: Gaspé Area 2004. Fisheries and Oceans Canada, Quebec City, Quebec.

Sinclair, P. 2002. Leaving and staying: Bonavista residents adjust to the moratorium. *In* The Resilient Outport. Ecology, Economy and Society in Rural Newfoundland. Memorial University of Newfoundland, Institute of Social and Economic Research. Edited by R.E. Ommer.

Special Panel on Corporate Concentration. 2002. Report of the Special Panel on Corporate Concentration in the Newfoundland and Labrador Fishing Industry.

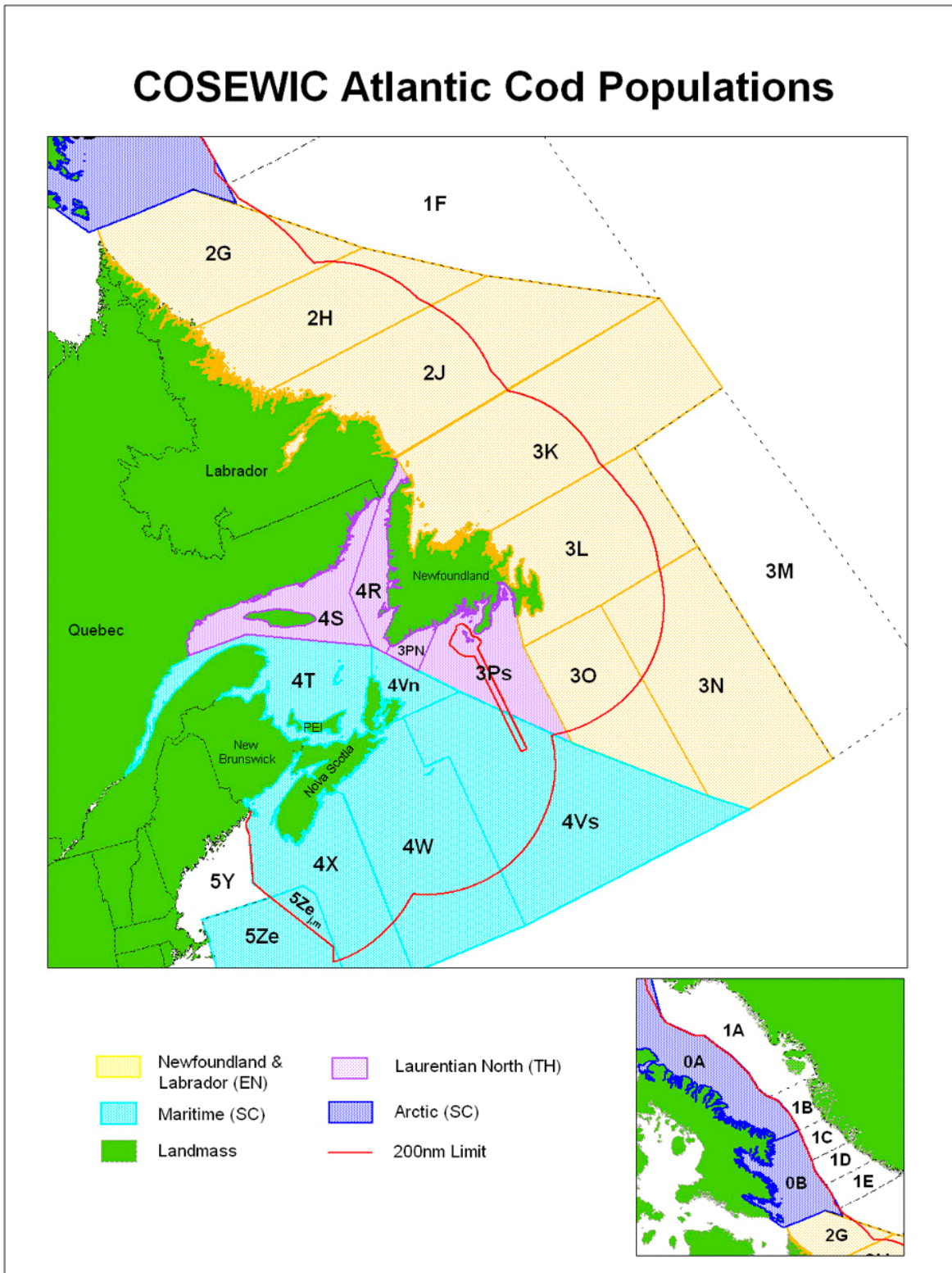
Statistics Canada. "Labour Force Statistics". 2001 Census.

Statistics Canada. Annual Survey of Manufactures: Seafood Product Preparation and Packaging (NAICS 3117).

Statistics Canada. 2001 Census, Custom Tabulations.

Task Force on Incomes and Adjustment in the Atlantic Fishery. Charting a New Course: Towards the Fishery of the Future. Minister of Supply and Services Canada. Ottawa, 1993.

APPENDIX A : Map of Atlantic cod populations



APPENDIX B : Least Cost Implementation of Bycatch Reduction

Many of the scenarios developed by Science and Fisheries Management that are analyzed in Chapter 5 of this report involve restrictions on the bycatch of Atlantic cod. An analysis was conducted for each NAFO fishing area to compare the foregone value of other catches if measures were taken to reduce the bycatch of cod. Harvest data from 2004 are used for these calculations.

In the tables that follow, column A refers to the proportion of the landed weight in a given fishery that is actually cod (in other words, what percentage of the total catch in that fishery is cod, irrespective of the species that was the actual target of the fishery). Column B lists the percentage of the cod bycatch in the NAFO area in question for which a particular fishery is responsible (in other words, of the total number of kilograms of cod that is bycatch in the NAFO area, what percentage comes from fishers targeting a specific other species). Column C calculates average landed value of the fishery per kilogram of fish landed (irrespective of species). Column D calculates the amount of value that would be foregone to protect one kilogram of cod, were the fishery to be restricted.

Area: 2J3KL (LV = landed value)

	A	B	C	D
Main Species	Cod bycatch rate in specific fishery	Proportion of all Cod Bycatch in area 2J3KL	Avg LV per kg (all species)	Foregone LV per kg Cod Protected
Winter Flounder	76.566%	93.93%	\$ 1.13	\$ 1.48
Lumpfish (Roe)	4.180%	3.81%	\$ 5.09	\$ 121.83
Yellowtail Flounder	0.146%	1.18%	\$ 0.76	\$ 519.73
Turbot-Greenland halibut	0.084%	0.74%	\$ 1.41	\$ 1,674.03
American Plaice	88.428%	0.18%	\$ 1.25	\$ 1.41
Redfish	0.518%	0.17%	\$ 0.58	\$ 111.41
Atlantic Halibut	0.488%	0.00%	\$ 4.64	\$ 950.85
Pandalus Borealis Shrimp	0.000%	0.00%	\$ 1.23	\$ 26,897,837.55

In area 2J3KL, the winter flounder fishery is responsible for about 94% of the bycatch of cod. All the remaining fisheries account for 6% of the cod bycatch combined. Note that the cost of reducing bycatch in the Greenland halibut fishery is \$1,674 per kilogram of cod saved, and the cost of reducing bycatch in the shrimp fishery is over \$26 million per kilogram of cod saved – significant foregone value for small gains in cod protected. Therefore, for **prioritized rebuilding** in 2J3KL, the analysis implemented a reduction in winter flounder that would achieve a 50% reduction in the bycatch of cod. For **maximum rebuilding**, the winter flounder fishery was closed. This reduces bycatch almost completely, without imposing the higher marginal costs (per kg bycatch saved) in the other fisheries.

Area: 3NO (LV = landed value)

	A	B	C	D
Main Species	Cod bycatch rate in specific fishery	Proportion of all Cod Bycatch in area 3NO	Avg LV per kg (all species)	Foregone LV per kg Cod Protected
Yellowtail Flounder	3.875%	83.67%	\$ 0.79	\$ 20.37
Redfish	1.168%	6.69%	\$ 0.60	\$ 51.77
Atlantic Halibut	7.849%	4.19%	\$ 2.69	\$ 34.30
Skate	5.954%	2.30%	\$ 0.78	\$ 13.14
Monkfish	1.102%	2.16%	\$ 1.36	\$ 123.57
White Hake	2.119%	0.96%	\$ 1.18	\$ 55.57
Groundfish, Unspecified	1.206%	0.03%	\$ 1.38	\$ 114.37
Turbot-Greenland halibut	0.027%	0.01%	\$ 1.44	\$ 5,342.04

Eliminating cod bycatch in 3NO most economically be achieved by reducing bycatch to zero in four fisheries: Yellowtail flounder, Redfish, Atlantic halibut and Skate. These are the four fisheries with the highest bycatch, which also have the lowest foregone landed value per kg of cod saved. Closure of these fisheries could achieve a 97% reduction in the bycatch of cod for **maximum rebuilding**. To reduce bycatch by 50%, two species are targeted, with the lowest foregone landing value per kg of cod: skate and yellowtail flounder. The **prioritized rebuilding** scenario for 3NO can be achieved by closing the skate fishery (a reduction of 10 mt cod), and reducing the yellowtail fishery by 57% (a bycatch reduction of 223 mt cod).

Area: 4RS3Pn (LV = landed value)

	A	B	C	D
Main Species	Cod bycatch rate in specific fishery	Proportion of all Cod Bycatch in area 4RS3Pn	Avg LV per kg (all species)	Foregone LV per kg Cod Protected
Atlantic Halibut	23.253%	45.70%	\$ 4.52	\$ 19.43
Greyscale-Witch Flounder	8.651%	21.51%	\$ 0.91	\$ 10.47
American Plaice	44.374%	16.36%	\$ 1.06	\$ 2.39
Turbot-Greenland halibut	0.667%	6.94%	\$ 1.95	\$ 291.84
Redfish	0.955%	3.63%	\$ 0.62	\$ 64.75
White Hake	6.620%	2.24%	\$ 0.75	\$ 11.29
Skate	36.001%	1.94%	\$ 0.94	\$ 2.60
Winter Flounder	21.538%	0.77%	\$ 0.90	\$ 4.16
Lumpfish (Roe)	0.866%	0.69%	\$ 4.75	\$ 548.92
Haddock	100.000%	0.10%	\$ 1.32	\$ 1.32
Pandalus Borealis Shrimp	0.001%	0.09%	\$ 1.20	\$ 153,421.02
Rock Cod	21.203%	0.03%	\$ 0.63	\$ 2.97
Queen-Snow Crab	0.000%	0.00%	\$ 5.72	\$ 4,784,102.15

The foregone landed value per kilogram of cod protected for the lumpfish, shrimp and crab fisheries are much higher than for the other species (and in the case of shrimp and crab are prohibitively high), and therefore the analysis of scenarios was based on no bycatch restrictions on those fisheries. The remaining fisheries account for about 99% of the bycatch of cod, and therefore still achieve the objective in the most restrictive scenario.

In order to achieve a 50% reduction in bycatch, an approach that follows the lowest foregone landed value per kg of cod saved reduces bycatch to zero in the following fisheries: witch flounder, American plaice, white hake, skate, winter flounder, and reduces bycatch of cod by 16% in the Atlantic halibut fishery. This is the implementation for **prioritized rebuilding** in 4RS3Pn. **Maximum rebuilding** is implemented by closing all of the fisheries listed for prioritized rebuilding, plus the Greenland halibut and redfish fisheries.

Areas 3PS and 2GH

In area 3PS, all scenarios call for a directed fishery for cod, there are no scenarios that pertain to limiting bycatch. Area 2GH was not analyzed as the reported bycatch is less than 1 metric tonne.

APPENDIX C: Long Term Implementation of Scenarios

C.1. Cod Population Models

A discrete-time model of growth and harvest was obtained from the Science Sector at DFO Headquarters. The particular demographic parameters for modeling each cod stock were obtained directly from DFO-Science personnel, the most recent stock assessments, and DFO allowable harm assessments²⁸.

The biological parameters used in the models are:

- SSB_0 = initial (current) spawning stock biomass,
- G = current growth rate (% of SSB),
- LRP = Limit Reference Point. This is the stock size below which a population's spawning stock biomass should not be allowed to decline when an effective management plan is in place²⁹. *Note: Cod populations in 2J3KL, 3NO, and 4RS3Pn are currently below their LRPs.*
- μ = harvest rate (% of SSB). This is the parameter that is altered to implement the different scenarios.

The *status quo* rate of harvest (μ %) was calculated as the current harvest (in tonnes) divided by the current spawning stock biomass (SSB_0 , tonnes). In the cases where a directed cod fishery is modeled, the current harvest was the total allowable catch (TAC). TACs were assumed to include the volume of cod taken as bycatch in other fisheries. In the cases where cod is modeled as incidental only, the actual landings in the reference year were taken to be the current harvest.

²⁸ Stock status report for 2J3KL cod :

http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_011_e.pdf

3NO cod:

<http://archive.nafo.int/open/sc/2003/scr03-059.pdf>

4RS3Pn cod:

http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_019_e.pdf

3Ps cod:

http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_039_e.pdf

Allowable Harm Assessment for Newfoundland and Labrador Cod population:

http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_041_e.pdf

Allowable Harm Assessment for Laurentian North Cod Population:

http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_042_e.pdf

²⁹ A discussion of reference points can be found in Canadian Science Advisory Secretariat Research Document 2002/084, "Limits to overfishing: reference points in the context of the Canadian perspective on the precautionary approach." Shelton, P.A. and Rice, J.C. (authors).

http://www.dfo-mpo.gc.ca/csas/csas/DocREC/2002/RES2002_084e.pdf

The volume of cod harvested in year t is

$$H_t = \mu * SSB_t \quad \text{for } t = 0, 1, 2, \dots, 19. \quad (\text{Eqn. 1})$$

The spawning stock biomass changes each year as a function of the growth rate and the harvest. As an approximation to concurrent biomass growth and harvest in this discrete-time model, growth is assumed to occur in the middle of the harvest season, with half of the harvest occurring before growth, and half after.

$$SSB_{t+1} = [(SSB_t - \frac{1}{2} * H_t) * (1 + G)] - \frac{1}{2} * H_t \quad (\text{Eqn. 2})$$

The various cod conservation scenarios are implemented by changing μ , whether it is μ from a directed fishery or μ from bycatch. Different μ 's result in different harvests (and different terminal spawning stock biomass). Let μ_0 be the *status quo* harvest rate, and let μ_1 be the new harvest rate for the alternative management scenario. Equations (1) and (2) are iterated up to $t = 20$ for the *status quo* (initially using μ_0) and for the alternative scenario (initially using μ_1). μ_0 and μ_1 are applied as long as the SSB is below the LRP for the population. If the population reaches the LRP, then a third harvest rate, μ_2 , is set at $(G - 5\%)$. Thus, a directed harvest is set so as to allow an ongoing 5% growth in the spawning stock biomass after the LRP biomass is reached. This is one strategy that has been proposed for precautionary management.

It was occasionally necessary to deviate from $(G - 5\%)$ either because the growth rate was already lower than 5%, or because *status quo* management below the LRP was already allocating less than 5% to ongoing growth - a lower harvest rate *after* the LRP was reached did not make sense as a management strategy. These deviations are shown in the tables outlining the scenario implementations in each NAFO division (Section C.4. below).

Economic revenues each year were calculated using the same landed values and processing multipliers that were applied in the short term impact assessments. It is common practice to assume that real prices remain constant over time, and so this assumption is applied in our revenue projections. Harvests were not modeled separately by province, but were assumed to be allocated among provinces in the same proportion as observed in the reference year. The landed value and added production value multipliers were therefore appropriately-weighted when they differed among provinces. For each scenario (*status quo* and alternatives), annual revenues were discounted back to the current time period (5% discount rate) and summed over the 20 years of the projection. The result was the present value of the 20-year revenue stream for each scenario.

Net benefits were identified as the benefits of implementing an alternative scenario minus the costs of implementing that scenario, and were calculated together by taking the *difference* in the present value of revenues, for the alternate scenario minus the *status quo*.

The details of how revenues were calculated differ slightly for scenarios in which a directed cod fishery is altered, versus the case where fisheries targeting other species were restricted in order to decrease cod bycatch. These details are given in the following two sections.

C.2. Modeling Changes to a Directed Cod Fishery

Modeling a TAC reduction or the closure of a directed fishery was straightforward. A new μ was calculated based on the new TAC, or if the directed cod fishery was closed completely, the new μ was based upon the observed bycatch of cod in other fisheries in the reference year.

When changes were made to a directed cod fishery, all the revenues (or foregone revenues) were directly proportional to the quantity of cod harvested. For each tonne of cod harvested, there was a landed value for the cod and added value of production from processing the cod. However, when there is a directed cod fishery, there are additional revenues from the bycatch of other species. These revenues were represented through two aggregate multipliers -- the landed value of bycatch per tonne of directed cod landed, and the added production value of bycatch per tonne of directed cod landed. These values were calculated from the observed bycatch per unit cod in the reference year. These two multipliers were not applied to incidental cod harvests when the directed fishery was closed in a scenario.

C.3. Modeling Changes to Cod Bycatch in Other Fisheries

Scenarios involving bycatch reductions are implemented through discrete TAC changes in the fisheries in which cod is incidental, but the population dynamics of those other species are not modeled. Only cod populations are modeled dynamically in these long term impact assessments. However, it is necessary to account for those fisheries in the economic content of the model, and to account for how cod bycatch in those fisheries changes as the cod biomass changes.

Two "rates" can be identified with respect to bycatch. One rate is relative to the catch of the (non-cod) target species, and the other is relative to the spawning stock biomass of cod itself. The first will be called the "**rate of bycatch**", and the second will be called the "**rate of harvest through bycatch**". Bycatch is a significant modeling issue in and of itself, and a comprehensive analysis was beyond the scope of this study. Instead, the following assumptions were made regarding bycatch rates:

Assumption 1. The **rate of harvest through bycatch** is assumed to be constant, except where specifically altered in a management scenario (see Assumption 2). Therefore, the absolute amount of cod bycatch (in tonnes) is directly proportional to the spawning stock biomass of cod.

Assumption 2. If the TAC of fishery A is cut by X%, then the amount of cod bycatch taken in fishery A is immediately cut by X%. The **rate of bycatch** (cod per unit of species A) is unchanged, unless the spawning stock biomass of cod changes.

Consider the following example calculations:

Let A and B be fisheries directed at species other than cod, and in which cod is taken incidentally. The TAC in each fishery is 10,000 tonnes.

The **rate of bycatch** (of cod) in fishery A is 7.5% in the reference year, and 750 tonnes of cod are

taken that year. The **rate of bycatch** in fishery B is 2.5% in the reference year, so 250 tonnes of cod are taken, for a total of 1,000 tonnes of cod bycatch in these two fisheries.

The initial spawning stock biomass of cod (SSB_0) is 10,000 t, so that the **rate of harvest through bycatch** is 10% in year 0. Assume the growth rate of the cod biomass is 20%.

According to Equation 2, the spawning stock biomass in the following year ($t = 1$) will be:

$$SSB_1 = (10,000 - \frac{1}{2} * 1,000) * (1 + 0.2) - \frac{1}{2} * 1,000 = 10,900 \text{ tonnes}$$

Imagine that no changes are made to the fisheries (*status quo* management). Under assumption 1, if no changes are made in fisheries A and B, then the total cod bycatch in year 1 will be :

$$\begin{aligned} & (\text{rate of harvest through bycatch}) * (SSB_1) \\ & = (0.1) * 10,900 = 1,090 \text{ tonnes} \end{aligned}$$

Thus, cod bycatch is increased by 90t, even though the TACs in fisheries A and B have not changed. This simple approximation for changes in the rate of bycatch is probably adequate at low cod densities, or over small changes in cod biomass. In fact, the application of this approximation is most important for the scenarios in 2J3KL and 3NO, where cod biomass is indeed low and where little change in cod biomass is expected within the 20-year time frame.

Now, imagine a scenario is implemented in which the bycatch of cod must be cut by $\frac{1}{2}$. This can be accomplished by reducing fishery A by $\frac{2}{3}$, since it accounts for 75% of the cod bycatch ($\frac{2}{3} * 75\% = 50\%$).

If the TAC in fishery A is instead cut by $\frac{2}{3}$ in year 0 to ~3,300 tonnes, then the amount of bycatch taken in fishery A will be cut by $\frac{2}{3}$ to 250 tonnes (Assumption 2). The **rate of harvest through bycatch** is now different. With the new restrictions on fishery A, the rate of harvest through bycatch is now $(250 \text{ from fishery A} + 250 \text{ from fishery B}) / 10,000 = 5\%$, and the total cod bycatch in year 1 will be:

$$(0.05) * 10,000 = 500 \text{ tonnes}$$

To calculate revenues associated with the *status quo* and alternative scenarios just described, the value of fishery A (net of the cod bycatch) is treated as a lump sum. The revenue from the cod bycatch is calculated as described in Section C.2. All the rest of the revenue from fishery A (the targeted species and all non-cod bycatch) is added together, using the base year data as reference, and applying the landed values and processing multipliers from the short term impacts.

When no changes are made to fishery A (*status quo* management) this lump sum is added to revenue each year. Thus, it is assumed that *all else remains the same* in fishery A, except for the catch of cod.

When fishery A is reduced by $\frac{2}{3}$, the lump sum revenue for the fishery is multiplied by $\frac{1}{3}$ and then added to revenue each year. The same assumption is applied -- that all else remains the same in fishery A, after the initial cut in the TAC.

IF the cod biomass reaches the LRP in any given scenario, then fishery A would be reinstated to its original TAC, and the lump sum revenue from that fishery would be returned to its full value. If the rate of harvest through bycatch, with the reinstated fishery A, is still less than (G-5%), then a directed cod harvest would also be implemented, as in Section C.2. In none of the scenarios analysed was it necessary to implement a new directed cod fishery when there was none in the reference year. Therefore, it was never necessary to infer what would be the composition and value of bycatch in a directed cod fishery; wherever such a fishery was implemented, revenues could be calculated from the reference year.

C.4. Parameters for Specific Stocks

This section provides details on the parameters used to model each cod stock.

4RS3Pn

SSB₀ = 38,000 tonnes

LRP = 100,000 tonnes

G = 15 %

2004 TAC = 3,500 t (9 % of SSB)

2004 bycatch = 200 t (0.5 % SSB)

2005 TAC = 5,000 t (13 % of SSB)

A range of growth rates were tested to determine sensitivity (5% to 25%). This spans the range of rates observed for this population in recent years.

The following tables shows the harvest rates, μ_i , implemented for each scenario in 4RS3Pn.

Growth	Baseline 2004 TAC		Baseline 2005 TAC		No Directed Fishery	
	< LRP	> LRP	< LRP	> LRP	< LRP	> LRP
15 %	9 %	10 %	13 %	not reached	0.5 %	10 %
5 %	3 % ¹	not reached	3 % ¹	not reached	0.5 %	not reached
20 %	9 %	15 %	13 %	15 %	0.5 %	15 %
25 %	9 %	20 %	13 %	20 %	0.5 %	20 %

Growth	Prioritized Rebuilding		Maximum Rebuilding		TAC = ½ Growth ²	
	< LRP	> LRP	< LRP	> LRP	< LRP	> LRP
15 %	0.25 %	10 %	0 %	10 %	7.5 %	10 %
5 %	0.25 %	not reached	0 %	not reached	2.5 %	not reached
20 %	0.25 %	15 %	0 %	15 %	10 %	15 %
25 %	0.25 %	20 %	0 %	20 %	12.5 %	20 %

¹ Baseline is implemented as 2% less than growth rate, where growth is less than 5%.

² This scenario not provided by Fisheries and Aquaculture Management.

3Ps

Only *status quo* management was presented in the scenarios from Science and Fisheries Management; therefore, no long term analysis was carried out. Parameters are presented here only to characterize the *status quo*, and for comparison with other stocks.

SSB₀ = 110,000 tonnes

LRP ~ 25,000 tonnes (13,000 - 36,000 tonnes)

G = 4% (2005 growth is unusually low; historical norm is 15 - 20 %)

2004 TAC = 15,000 t (14 % of SSB)

2004 actual directed harvest = 10,650 t (9.7% of SSB)

2004 bycatch = 820 t (0.7% SSB)

2J3KL

As described in the text, area 2J3KL was modeled with two sub-component: the inshore population and the offshore population. The parameters for these populations are not well known at this time, and some of the parameters were inferred, as documented below.

Inshore 2J3KL:

SSB₀ Inshore = 22,000 tonnes (inferred from scientific estimates)

The central inshore population is currently estimated at 13,000 tonnes SSB. This part of the inshore population has historically represented about 60% of the entire inshore population. Thus, the inshore population is inferred to be at approximately 22,000 tonnes.

LRP = n.a.

No separate LRP has been defined for the inshore population.

G = 40%.

The inshore population currently exhibits a very high rate of growth. It is unlikely this level of growth would be sustained over 20 years, nor is it likely that the population inshore could/would ever reach the densities implied by 40% growth over 20 years. Therefore, this component of the 2J3KL stock is modeled with logistic growth, so that $40\% = 1/N * dN/dt$.

K = 100,000 tonnes (carrying capacity for the inshore population: **hypothesized value**)

Logistic growth is:

$$1/N * dN/dt = r * (1 - N/K)$$

Solving the logistic equation for the intrinsic rate of increase (r), gives

$$r = 0.51.$$

Offshore 2J3KL:

SSB₀ Offshore = 12,500 tonnes (inferred from scientific estimates)

The biomass index is currently 5,000 tonnes. The index has historically represented about 40% of the actual biomass value (B. Doubleday, *pers. comm.*). Thus a biomass of 12,500 tonnes is inferred.

LRP is undetermined, but is known to be greater than 300,000 tonnes for the inshore and offshore populations combined.

G is currently indistinguishable from 0 %. Results for offshore growth rates of 2% and 5% are also analysed. Growth rates above 5% are highly improbable.

NOTE: Although many of the parameters for this population are inferred or hypothesized, the conclusions drawn from the model are not sensitive to these values. **Results are dominated by the very low initial biomass (and low growth rate) in the offshore population.**

2004 domestic bycatch = 513 tonnes, all inshore (~ 2.5% of inshore SSB)

The following table shows the harvest rates, μ_i , implemented for each scenario in 2J3KL.

Offshore Growth	Baseline			Prioritized Rebuilding		
	< LRP		> LRP	< LRP		> LRP
	Offshore	Inshore		Offshore	Inshore	
0 %	0 %	2.5 %	not reached	0 %	1.25 %	not reached
2 %	0 %	2.5 %	not reached	0 %	1.25 %	not reached
5 %	0 %	2.5 %	not reached	0 %	1.25 %	not reached

Offshore Growth	Maximum Rebuilding		
	< LRP		> LRP
	Offshore	Inshore	
0 %	0 %	0.15 %	not reached
2 %	0 %	0.15 %	not reached
5 %	0 %	0.15 %	not reached

3NO

SSB₀ = 5,000 tonnes

LRP = 60,000 tonnes (provisional value)

G = 20 %

2004 domestic bycatch = 480 t (10 % of SSB)

2004 reported NAFO bycatch = 413 t (9 % SSB). This value represents “NAFO compliance”.

2004 estimated NAFO bycatch = 2,500 t (50 % SSB). This represents non-compliance in NAFO.

Scenarios were also examined with cod biomass growth between 2% and 25%.

The following table shows the harvest rates, μ_i , implemented for each scenario in 3NO.

Growth	Baseline (Domestic <i>Status quo</i> without NAFO compliance)		Prioritized Rebuilding (without NAFO compliance)	
	< LRP	> LRP	< LRP	> LRP
20 %	60 %	not reached	55 %	not reached
2 %	60 %	not reached	55 %	not reached
15 %	60 %	not reached	55 %	not reached
25 %	60 %	not reached	55 %	not reached

Growth	Domestic <i>Status quo</i> with NAFO compliance		Prioritized Rebuilding (with NAFO compliance)		Max Rebuilding (with NAFO compliance)	
	< LRP	> LRP	< LRP	> LRP	< LRP	> LRP
20 %	19 %	not reached	14 %	not reached	9 %	not reached
2 %	19 %	not reached	14 %	not reached	9 %	not reached
20 %	19 %	not reached	14 %	not reached	9 %	not reached
25 %	19 %	not reached	14 %	not reached	9 %	20 %

APPENDIX D: Selected Socio-economic Indicators by Community, Quebec

Location	Total Population 2001 Census	Population Change since 1996 Census (%)	Cod Income as a % of Total Fishing Income	Education – Highest Level Completed Percentage of Local Population 20 Years and Older, 2001 Census			Unemployment Rate (%) 2001 Census
				Less than High School	High School Diploma	Trade Certificate, College or University	
Quebec	7,138,795	1.4		29.9	24.7	45.4	8.2
Blanc Sablon	1,201	-3.8	39.4%	47.0	19.5	33.5	21.7
Fatima	2,686	-9.4	0.0%	55.0	17.6	31.8	18.4
Cote-Nord-du-Golfe-Saint-Laurent ¹	1,183	-2.6	1.2%	59.0	18.0	23.0	34.1
Cloridorme	917	-15.4	12.5%	60.0	24.1	15.9	46.3
Gaspé	14,932	-9.6	7.5%	42.1	20.3	37.6	14.8
Grande-Rivière	3,556	-8.5	1.9%	56.8	16.2	27.0	28.9
Havre-aux-Maisons	2,057	-7.0	0.0%	46.2	18.0	35.7	14.4
L'Etang-du-Nord	2,944	-4.6	0.1%	37.4	18.2	44.4	14.6
Newport	1,808	-10.9	2.4%	58.8	14.9	26.4	10.9
Pabos Mills	1,452	-8.0	2.4%	49.3	18.8	31.9	29.9
Saint-Godefroi	373	-23.6	2.6%	59.4	12.5	28.1	19.0
Sainte-Thérèse-de-Gaspe	1,165	-7.7	2.0%	56.9	21.3	21.8	25.3
St. Germaine-de-L'Anse-aux-Gascons	1,126	-12.1	n/a	57.4	21.6	21.0	19.2

Source: 2001 Census, Statistics Canada, Custom Tabulation; DFO

¹ Includes the communities of Baie-des-moutons and La Tabatiere

APPENDIX D (cont'd): Selected Socio-economic Indicators by Community, Newfoundland and Labrador

Location	Total Population 2001 Census	Population Change since 1996 Census (%)	Cod Income as a % of Total Fishing Income	Education – Highest Level Completed Percentage of Local Population 20 Years and Older, 2001 Census			Unemployment Rate (%) 2001 Census*
				Less Than High School	High School Diploma	Trade Certificate, College or University	
Newfoundland and Labrador	551,792	-7.0		39.6	17.6	42.8	21.8
Arnold's Cove	1,024	-8.2	25.0	51.6	17.4	31.0	4.5
Bonavista	4,021	-11.2	3.0	56.6	17.5	25.9	30.2
Burgeo	1,782	-15.1	44.2	59.5	13.3	27.2	43.6
Burin	2,470	-7.9	16.1	38.4	12.4	49.2	19.6
Burnt Islands	801	-12.8	50.8	69.7	10.9	19.3	43.7
Channel Port aux Basques	4,637	-11.6	61.9	52.7	11.7	35.6	28.1
Fortune	1,615	-18.0	30.5	52.0	15.4	32.7	23.3
Harbour Breton	2,079	-9.2	21.1	60.9	17.2	21.9	51.9
L'Anse au Clair	241	-8.7	21.0	35.0	27.5	37.5	34.6
L'Anse au Loup	635	2.3	2.8	50.6	21.8	27.6	30.4
Marystown	5,908	-12.4	5.1	36.9	13.8	49.3	24.0
Port au Choix	1,010	-11.9	7.1	54.3	15.2	30.5	28.0
Rocky Harbour	1,002	-6.0	11.6	49.0	10.6	40.4	36.0
Rose Blanche	668	-17.9	63.3	69.2	10.3	20.6	68.2

Sources: 2001 Census, Statistics Canada, Custom Tabulation; DFO

APPENDIX E : Community Profiles

Arnold's Cove Community Profile

Population:

- The local population was 1,024, a decline of 8.2% since the 1996 Census.
- Over the period 1996-2001 there has been an increase in the population aged 20-39 years.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 4.5%
 - This represents a decline from the 1996 level of 19.3%.
- Labour force success differed across ages, with the total population 15-24 having an unemployment rate of 20%, compared with 3.2% for those 25 years and older.
- The proportion of employment income has remained stable over the period 1996-2001, with the level of government transfers decreasing from 27.5% to 19.6%.
- The average income based on the total population aged 15 and older was \$23,391.

Sector Activity:

- Job numbers in the primary sector declined from 70 in 1996 to 55 in 2001.
- Secondary sector industries remain the main local employers, with job numbers increasing from 360 jobs in 1996 to 395 in 2001.
- Tertiary industry job numbers fell from 120 in 1996 to 90 by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$17,639 to \$26,058.
- The average number of weeks worked in the primary fishery was 23, compared with 37 and 41 for seafood product and preparation and packaging and all other industries respectively.
- Some 74.5% of workers who were linked to the fishery collected employment insurance benefits.
- There was an estimated range of between 44.4% and 51.9% of all local jobs linked directly to the fishery.

Education:

- 48.1% of local residents, 20 years and older, held at least a high school diploma.
- Some 31% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 3 persons per census family in Arnold's Cove.
- Combined, residents under the age of 18, and 65 years or older, represented 32.2% of the local population.

Bonavista Community Profile

Population:

- Local population was 4,021, a decline of 11.2% since the 1996 Census.
- Since 1996 there has been a major loss to the local labour force, with the population of those aged 20-39 years declining by 24.5%.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 30.2%
 - This represents a decline from 42.2% in the 1996 Census.
- Males 25 years or older recorded the lowest unemployment rate at 27.4%.
- Local income composition has remained stable over the period 1996-2001, with the proportion of income from government transfers remaining high at 38.8%
- The average income based on the total population aged 15 and older was \$16,312.

Sector Activity:

- Primary sector jobs increased over the period, from 95 in 1996 to 175 by 2001.
- Secondary sector industries remain the most significant employer, with jobs numbers increasing from 815 in 1996 to 915 by 2001.
- There were also increases in tertiary sector jobs, from 575 to 675 over the same period.

The Fishery:

- Total income for those in the fishery ranged from \$14,291 to \$22,045.
- The average number of weeks worked in the fishery was 16.
- It is estimated that between 27.8 and 35.4% of local jobs are linked to the fishery.
- As many as 90% of workers who were linked to the fishery collected employment insurance benefits.

Education:

- Only 43.5% of local residents over the age of 20 hold at least a high school diploma.
- Some 25.9% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- There were 2.9 persons per census family
- 35.6% of the local population was under the age of 18, or 65 years and older.

Burgeo Community Profile

Highlights from the 2001 Census are outlined below. Greater detail on each section is provided within the following document.

Population:

- The local population was 1,782, a decline of 15.1% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of 31.9% in the population aged 20-39 years.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 43.6%
 - This represents a decline from the 1996 level of 41.1%.
- The local participation rate was 49.0% for the 2001 Census.
- The proportion of employment income has increased over the period 1996-2001, with the level of government transfers decreasing from 43.6% to 36.7%.
- The average income based on the total population aged 15 and older was \$16,844.

Sector Activity:

- Job numbers in the primary sector increased from 85 in 1996 to 105 in 2001.
- Secondary sector industries remain an important main local employer, with job numbers increasing from 220 jobs in 1996 to 280 in 2001.
- Tertiary industry jobs continue to provide the main source of employment, with job numbers rising from 290 in 1996 to 325 by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$8,257 to \$35,020.
- The average number of weeks worked in the primary fishery was 19, compared with 17 and 33 for seafood product and preparation and packaging and all other industries respectively.
- More than 80% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that 17.6% of all local jobs are linked directly to the fishery.

Education:

- 41% of local residents, 20 years and older, held at least a high school diploma.
- Some 27% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.8 persons per census family in Burgeo.
- Combined, residents under the age of 18, and 65 years or older, represented 30.0% of the local population.

Burin Community Profile

Population:

- Local population was 2,470, a decline of 7.9% from the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 21.8%.

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 19.6%.
 - This represents a decline from the 1996 rate of 29.6%.
- The sources of income have remained relatively stable over the period 1996-2001, with the level of government transfers decreasing from 25.6% to 22.2%.
- The average income based on the total population aged 15 and older was \$21,450.

Sector Activity:

- Job numbers in the primary sector more than tripled over the period 1996-2001, from 30 jobs in 1996 to 100 by 2001.
- Secondary sector employment decreased by some 10.1%, or some 55 jobs, over the same period.
- The tertiary sector experienced more significant decline, with job numbers falling from 565 to 460, over the period 1996-2001.

The Fishery:

- Average total income in the fishery ranged from \$15,799 to \$28,640.
- The average number of weeks worked in the primary fishery was 22, compared with 31 weeks worked for secondary fishery activity.
- Over 80% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that between 20 and 27% of all local employment is in the fishery.

Education:

- 62% of local residents, over the age of 20, held at least a high school diploma.
- Some 49% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 3 persons per census family in Burin.
- Combined, residents under the age of 18, and 65 years or older, represented 33% of the local population.

Burnt Islands Community Profile

Population:

- The population was 801, a decline of 12.8% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 23.3% in the number of 20-39 year olds, representing a major loss of the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 43.7%.
 - This represents an increase from 36.7% in the 1996 Census.
- The lowest participation rate was for males at 14.3%.
- Local income composition has improved over the period 1996-2001, with the proportion of income from government transfers falling from 35.6% to 28.8%.
- The average income based on the total population aged 15 and older was \$17,974.

Sector Activity:

- Primary sector activity was boosted over the period 1996-2001, with an increase from 10 to 60 jobs.
- The secondary sector remains the largest employer even though jobs declined from 235 in 1996 to 205 by 2001.
- The tertiary sector employment increased over the period, from 35 jobs in 1996 to 80 jobs by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$12,929 to \$20,532.
- The average number of weeks worked in the primary fishery was 16, compared to 19 weeks worked on average in secondary sector fishing activity.
- Over 80% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 34.8% and 43.5% of local employment is linked directly to the fishery.

Education:

- 30% of local residents held at least a high school diploma.
- 19% of residents had some form of higher education (trade certificate, college or university).

Households:

- There was an average of 3.0 persons per census family.
- 28.7% of the local population was under the age of 18 or 65 years or older.

Channel-Port aux Basques Community Profile

Population:

- The local population was 4,637, a decline of 11.6% since the 1996 Census
- There have been significant declines in important population brackets, including those aged 15-24 and 30-49 years of age.

Labour Force and Income:

- The unemployment rate for the total labour force 15 years and older was 28.1%.
- Males aged 15-24 recorded the highest unemployment rate, nearing 50%.
- Participation rates were low with males 15-24 years of age recording a rate of 40.3%
- The employment rate for the total population aged 15 years and older was 38.8%.

Sector Activity:

- Employment in the primary sector remained at 65 jobs for the 2001 Census.
- There were declines in the number of jobs in the secondary sector, from 1,210 in 1996 to 945 by 2001.
- Employment gains in the tertiary sector, from 940 in 1996 to 975 in 2001, meant it was now the main source of local employment.

The Fishery:

- Total income in the fishery ranged from \$10,541 to \$25,154.
- The average number of weeks worked in the fishery was 20.
- Some 70% of workers linked to the fishery collected employment insurance benefits during the period, compared with roughly 33% for all other occupations.
- It is estimated that between 8.4 and 9.7% of local jobs are linked to the fishery.

Education:

- 47.4% of local residents 20 years and older held a high school diploma or higher educational qualification.
- 35.6% of the local populations had acquired some form of post-secondary qualification (trade certificate, college or university).

Households:

- The average number of persons per census family was 2.8.
- Combined, the total population either under the age of 18, or 65 years or older, was 1,600, or 34.5% of the local population

Fortune Community Profile

Population:

- Local population was 1,615, a decline of 18% since the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 33.3%

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 23.3%.
 - This represents a decline from the 1996 rate of 58.3%.
- The sources of income changed significantly over the period 1996-2001, with the level of government transfer payments decreasing from 52.7% to 31.8%.
- The average income based on the total population aged 15 and older was \$18,670.

Sector Activity:

- Job numbers in the primary sector increased from 110 in 1996 to 120 in 2001.
- Secondary sector employment decreased, from 480 jobs to 425 by 2001.
- The tertiary sector also posted employment losses, with job numbers declining from 225 in 1996 to 215 in 2001.

The Fishery:

- Total income for those in the fishery ranged from \$15,394 to \$41,192.
- The average number of weeks worked in the primary fishery was 24, compared with 21 weeks worked in the secondary fishery.
- Over 90% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that between 38.2% and 51.3% of local employment is linked to the fishery.

Education:

- 48% of local residents, over the age of 20, held at least a high school diploma.
- 33% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.8 persons per census family in .
- Combined, residents under the age of 18, and 65 years or older, represented 32.8% of the local population.

Harbour Breton Community Profile

It should be noted that in November 2004 Fishery Products International (FPI) closed its Harbour Breton plant, which will cost the local economy some 300 jobs.

Population:

- The population was 2,079, a decline of 9.2% since the 1996 Census.
- Over the period 1996-2001 there has been a 34% decline in the number of 15-29 year olds.

Labour Force and Income:

- The unemployment rate for the total labour force 15 years and older was 51.9%
 - This is an increase from the 1996 rate of 45%.
- Labour force participation was lowest among males 15-24 years of age (34.4%).
- Though the proportion of income in Harbour Breton from government sources remains relatively high (30%) it did decline from a level of 54% over the period 1996-2001.
- The average income based on the total population aged 15 and older was \$19,048.

Sector Activity:

- The number of jobs in the primary sector increased from 45 to 155 by 2001.
- Jobs in the secondary sector declined from 535 in 1996 to 455 in 2001.
- Service sector industries continue to be an important source of local employment and economic activity, increasing from 245 jobs in 1996 to 265 in 2001.

The Fishery:

- Total income for those in the fishery ranged from \$16,690 to \$35,622.
- The average number of weeks worked in the primary fishery was 19, compared to 24 weeks worked, on average, in seafood product preparation and packaging.
- Over 90% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 50% and 56% of all jobs in Harbour Breton are linked to the fishery.

Education:

- 39% of the local population, 20 years and older held at least a high school diploma.
- 22% of local residents held some form of post-secondary qualification (trade certificate, college or university).

Households:

- On average, there were 3.1 persons per census family in 2001.
- 32.5% of the total population were under the age of 18, or 65 years and older

L'Anse au Clair Community Profile

Population:

- Local population was 241, a decline of 8.7% since the 1996 Census.
- During the period 1996-2001 the local population aged 10-29 years of age declined by 26.3%

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 34.6%.
 - This represents an increase from 23.1% in the 1996 Census.
- There were no sources of income data for L'Anse au Clair in the 2001 Census.
- The average income based on the total population aged 15 and older for 1996 Census was \$12,088.

Sector Activity:

- Jobs in the primary sector increased from 15 in 1996 to 50 by 2001
- The secondary sector jobs also increased over the period 1996-2001, from 40 to 55.
- Employment in the tertiary industry was marked by decline over the same period, falling from 50 jobs in 1996 to 30 in 2001.

The Fishery:

- There was no community specific data available on the fishery

Education:

- 65% of local residents had at least a high school diploma.
- 37.5% of residents had some form of higher education (trade certificate, college or university).

Households:

- On average, there were 2.7 persons per census family in L'Anse au Clair.
- Combined, residents under the age of 18 or 65 years and older accounted for 39.4% of the local population.

L'Anse au Loup Community Profile

Population:

- The population was 635, a decline of 2.3% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 9.7% in the number of 20-39 year olds, representing a major loss of the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 30.4%.
 - This represents a decrease from 58% in the 1996 Census.
- The participation rate was %.
- Local income composition has improved over the period 1996-2001, with the proportion of income from government transfers falling from 31.2% to 21.2%.
- The average income based on the total population aged 15 and older was \$21,606.

Sector Activity:

- Primary sector activity remained stable over the period 1996-2001, with no increase of the 45 local jobs in the sector.
- The secondary sector remains the largest local employer, experiencing an increase in job number from 170 in 1996 to 210 by 2001.
- The tertiary sector employment decreased over the period, from 120 jobs in 1996 to 65 jobs by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$12,279 to \$50,050.
- The average number of weeks worked in the primary fishery was 18, compared to 15 weeks worked on average in secondary sector fishing activity.
- Over 95% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 35.9% and 40.6% of local employment is linked directly to the fishery.

Education:

- 49% of local residents held at least a high school diploma.
- 28% of residents had some form of higher education (trade certificate, college or university).

Households:

- There was an average of 3.2 persons per census family.
- 33.9% of the local population was under the age of 18 or 65 years or older.

Marystown Community Profile

Population:

- The population was 5,908, a decline of 12.4% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of 26% in the number of 20-39 year olds, representing a major loss to the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 24%.
 - This represents an improvement from 33.9% in the 1996 Census.
- The lowest participation rates were for males and females aged 15-24 years, at 46.3% and 40.6% respectively.
- Local income composition has remained stable over the period 1996-2001, with the proportion of income from government transfers at 24% for 2001.
- The average income based on the total population aged 15 and older was \$20,294.

Sector Activity:

- Primary sector activity was boosted over the period 1996-2001, with an increase from 95 to 115 jobs.
- The secondary sector remains a large employer even though jobs declined from 1,385 in 1996 to 1,285 by 2001.
- The tertiary sector surpassed the secondary sector as the major employer in the local economy, with jobs numbers increasing from 1,210 in 1996 to 1,295 by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$21,282 to \$41,856.
- The average number of weeks worked in the primary fishery was 21, compared to 25 weeks worked on average in secondary sector fishing activity.
- Roughly 86% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 10% and 12.8% of local employment is linked directly to the fishery.

Education:

- 63.1% of local residents held at least a high school diploma.
- 49.3% of residents held some form of post-secondary qualification (trade certificate, college or university).

Households:

- There was an average of 3.1 persons per census family.
- 32% of the local population was under the age of 18 or 65 years or older.

Port au Choix Community Profile

Population:

- Local population was 1,010, a decline of 11.9% since the 1996 Census.
- Over the period 1996-2001 there has been a 30.6% decline in the number of 20-29 year olds, perhaps because of few employment opportunities.

Labour Force and Income:

- The unemployment rate for the total labour force 15 years and older was 28%.
 - This represents a decrease from the 1996 rate of 36%.
- The unemployment rate is lowest for males 15 year and older, at 24.6%
- Though the proportion of income in Port au Choix, from government sources, remains high (36.1%), it did decline from 43.5% over the period 1996-2001.
- The average income based on total population aged 15 and older was \$19,218.

Sector Activity:

- The number of jobs in the primary sector (145) remained stable over the period 1996-2001.
- The number of secondary sector jobs declined sharply from 275 to 205.
- Service sector industries continue to be an important source of local employment and economic activity with 175 jobs in 2001.

The Fishery:

- Average total income in the fishery ranged from \$20,734 to \$33,465.
- The average number of weeks worked in the primary fishery was 20, compared with 18 weeks worked in secondary fishery activity.
- An estimated 74% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 39% and 49.5% of local employment is directly linked to the fishery.

Education:

- 45.3% of the local population held, at the very least, a high school diploma.
- 30.5% of local residents held some form of higher level qualification (trade certificate, college or university)

Households:

- There were 2.8 persons per census family.
- Combined, residents under the age of 18, and 65 years or older, represented 28.2% of the local population.

Rocky Harbour Community Profile

Population:

- The population was 1,002, a decline of 6% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 21% in the number of 20-39 year olds, representing a major loss of the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 36%.
 - This represents a decrease from 41.3% in the 1996 Census.
- The local participation rate was 51.5%.
- Local income composition has changed over the period 1996-2001, with the proportion of income from government transfers falling from 34.7% to 32.2%.
- The average income based on the total population aged 15 and older was \$18,594.

Sector Activity:

- Primary sector activity declined over the period 1996-2001, with job numbers falling from 60 in 1996 to 55 by 2001.
- The secondary sector was also marked by decline, as employment fell from 135 jobs in 1996 to 90 in 2001.
- Tertiary sector employment increased over the period, from 255 jobs in 1996 to 280 jobs by 2001.

The Fishery:

- There was only income data for Fishing vessel masters, skippers and fishermen/women in 2000. Average total income was \$17,506.
- The average number of weeks worked by fishing vessel masters, skippers and fishermen/women was 16.
- All workers linked to the fishery collected employment insurance benefits in 2000.
- It is estimated that between % and % of local employment is linked directly to the fishery.

Education:

- 51% of local residents held at least a high school diploma.
- 40% of residents had some form of higher education (trade certificate, college or university).

Households:

- There was an average of 2.9 persons per census family.
- 34% of the local population was under the age of 18 or 65 years or older.

Rose Blanche Community Profile

Population:

- The population was 668, a decline of 17.9% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 33.3% in the number of 20-39 year olds, representing a major loss of the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 68.2%.
 - This represents an increase from 23.3% in the 1996 Census.
- The lowest participation rate was for males at 40.0%.
- Local income composition has improved over the period 1996-2001, with the proportion of income from government transfers falling from 53.4% to 41.1%.
- The average income based on the total population aged 15 and older was \$16,057.

Sector Activity:

- Primary sector activity remained stable, with total jobs in the sector unchanged at 55.
- The secondary sector is now the largest employer, with job numbers increasing over the period 1996 to 2001, from 70 to 95.
- Tertiary sector employment decreased over the period, from 80 jobs in 1996 to 60 jobs by 2001.

The Fishery:

- Census data only recorded income for fishing vessel masters, skippers and fishermen/women, with an average total income of \$17,216.
- The average number of weeks worked in the primary fishery was 16, compared to 27 weeks worked on average in all other occupations.
- Over 90% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that % of local employment is linked directly to the fishery.

Education:

- 31% of local residents held at least a high school diploma.
- 21% of residents had some form of higher education (trade certificate, college or university).

Households:

- There was an average of 2.7 persons per census family.
- 35.2% of the local population was under the age of 18 or 65 years or older.

Blanc-Sablon Community Profile

Population:

- Local population was 1,201, a decline of 3.8% from the 1996 Census.
- Over the period 1996-2001, the number of residents aged between 20-39 years decreased by 16.9%.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 21.7%
 - This represents an improvement from the 1996 rate of 31.5%.
- The sources of income have remained relatively stable over the period 1996-2001, with the level of government transfers decreasing from 26.4% to 22.1%.
- The average income based on the total population aged 15 and older was \$23,628.

Sector Activity:

- Job numbers in the primary sector improved, increasing from 45 in 1996 to 75 by 2001.
- Secondary sector employment declined over the same period, from 250 jobs in 1996 to 235 in 2001.
- Tertiary sector jobs also declined, from 290 jobs to 260 in 2001, though this sector still represents the major source of employment for the local economy.

The Fishery:

- Total income for those in the fishery ranged from \$19,358 to \$27,133.
- The average number of weeks worked in the fishery was 16.
- According to the 2001 Census, there was no secondary sector employment in the fisheries in Blanc-Sablon.
- Some 85% of workers who were linked to the fishery collected employment insurance benefits, compared to 34% of workers connected to all other industries.

Education:

- 53% of local residents, over the age of 20, held at least a high school diploma.
- 34% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 3.1 persons per census family in Blanc-Sablon.
- Combined, residents under the age of 18, and 65 years or older, represented 37.1% of the local population.

Côte-Nord-du-Golfe-Saint-Lauren Community Profile

(includes the communities of Aylmer Sound, Baie-des-moutons and La Tabatiere)

Population:

- The local population was 1,183, a decline of 2.6% since the 1996 Census.
- Over the period 1996-2001 the age bracket 20-39 years of age has declined by 9.8%.

Labour Force and Income:

- The unemployment rate for the local population 15 years and older was 34.1%
 - This is an improvement from the 1996 Census rate of 43.3%
- Income composition has remained fairly stable, with the proportion of government transfers declining only slightly to 28.1%.
- The average income based on the total population aged 15 and older was \$21,410.

Sector Activity:

- Since the 1996 Census, primary sector jobs almost tripled, from 40 jobs in 1996 to 115 in 2001.
- Secondary sector jobs actually declined by 16%, from 280 jobs to 235 jobs over the same period.
- With the decline in secondary sector jobs, tertiary industries provide the main source of local employment, with 285 jobs in 2001.

The Fishery:

- It is estimated that between 22.8% and 28.3% of local jobs are linked to the fishery.
- Total income for those in the fishery ranged from \$12,131 to \$34,341.
- The average number of weeks worked in the primary fishery was 17, compared to 18 weeks worked in seafood product preparation and packaging.
- Over 88% of workers linked to the fishery collected employment insurance benefits.

Education:

- Only 41% of the local population held, at the least, a high school diploma.
- As a result, only 23% of the local population held some form of post secondary qualification (trade certificate, college or university).

Households:

- There were 3.1 persons per census family.
- 34.3% of the local population was under the age of 18 or 65 years or older.

Fatima Community Profile

Population:

- The local population was 2,686, a decline of 9.4% since the 1996 Census.
- Over the period 1996-2001 there has been an increase in the population aged 20-39 years.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 18.4%.
 - This represents a decline from the 1996 level of 30.1%.
- Over this period, the local labour force participation rates for the population 15 years and older also declined, from 59.2% to 56.7%.
- The proportion of employment income changed only slightly over the period 1996-2001, with the level of government transfers decreasing from 31.1% to 25%.
- The average income based on the total population aged 15 and older was \$22,330.

Sector Activity:

- Job numbers in the primary sector increased from 120 in 1996 to 165 in 2001.
- The secondary sector experienced significant declines, with job numbers falling from 665 in 1996 to 475 by 2001.
- Tertiary industry job numbers rose from 550 in 1996 to 600 by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$14,859 to \$48,331.
- The average number of weeks worked in the primary fishery was 21, compared with 18 and 34 for seafood product and preparation and packaging and all other industries respectively.
- Over 80% of workers who were linked to the fishery collected employment insurance benefits.

Education:

- 49% of local residents, 20 years and older, held at least a high school diploma.
- Some 32% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.8 persons per census family in Fatima.
- Combined, residents under the age of 18, and 65 years or older, represented 33.3% of the local population.

Cloridorme Community Profile

Population:

- The population was 917, which represents a decline of 15.4% since the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 30.2%.

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 46.3%.
 - This represents an increase from the 1996 rate of 25.4%.
- The sources of income have remained relatively stable over the period 1996-2001, with the level of government transfers decreasing from 42.8% to 37.8%.
- The average income based on the total population aged 15 and older was \$16,788.

Sector Activity:

- Job numbers in the primary sector increased from 50 in 1996 to 60 by 2001.
- Secondary sector employment declined by 70 jobs, from 180 in 1996 to 110 in 2001.
- Tertiary sector employment improved from 45 jobs in 1996 to 135 by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$22,269 to \$30,441.
- It is estimated that 14.8% of local employment is linked to the fishery.
- The average number of weeks worked in the primary fishery was 18, compared to 22 weeks worked in the secondary fishery.
- Some 60% of workers linked to the fishery collected employment insurance benefits.

Education:

- 40% of local residents, over the age of 20, held at least a high school diploma.
- 16 % of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.8 persons per census family in Cloridorme.
- Combined, residents under the age of 18, and 65 years or older, represented 37% of the local population.

St. Germaine-de-L'Anse-aux-Gascons Community Profile

Population:

- Local population was 1,126, a decline of 12.1% from the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 32.9%.

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 19.2%.
 - This represents an improvement from the 1996 rate of 50.9%.
- The sources of income have changed slightly, with income from employment decreasing and the level of government transfers increasing from 34.7% to 40.2%.
- The average income based on the total population aged 15 and older was \$21,032.

Sector Activity:

- Job numbers in the primary sector increased from 45 in 1996 to 125 by 2001.
- Secondary sector employment declined slightly, from 295 jobs to 290 in 2001.
- The tertiary sector posted losses, with job numbers declining from 175 to 75.

The Fishery:

- Total income for those in the fishery ranged from \$16,161 to \$41,052.
- The average number of weeks worked in the primary fishery was 17, compared with 15 weeks worked in the secondary fishery.
- Some 86% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that between 46.9% and 48.9% of local employment is linked to the fishery.

Education:

- 73% of local residents, over the age of 20, held at least a high school diploma.
- 21% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.8 persons per census family in Gascons.
- Combined, residents under the age of 18, and 65 years or older, represented 36.4% of the local population.

Gaspé Community Profile

Population:

- Local population was 14,932, a decline of 9.6% since the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 29.1%.

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 14.8%.
 - This represents improvement from the 1996 rate of 21%.
- The sources of income have changed slightly, with income from employment increasing and the level of government transfers decreasing from 25.4% to 21.7%.
- The average income based on the total population aged 15 and older was \$22,779.

Sector Activity:

- Job numbers in the primary sector have decreased over the period. From 480 in 1996 to 395 by 2001.
- Secondary sector employment also declined from 2,480 in 1996 to 2,260 in 2001.
- The tertiary sector remains the major local employer, with 4,000 jobs in 2001, a decline of roughly 5%, or 220 jobs from 4,220, since 1996.

The Fishery:

- Average total income in the fishery ranged from \$16,284 to \$37,165.
- The average number of weeks worked in the primary fishery was 20, compared to 25 weeks worked in the secondary fishery.
- Some 88.4% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that between 7% and 8.6% of local employment is linked directly to the fishery.

Education:

- 58% of local residents, 20 years of age and or, held at least a high school diploma.
- 38% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.9 persons per census family in Gaspé.
- Combined, residents under the age of 18, and 65 years or older, represented 35% of the local population.

Grande-Riviere Community Profile

Population:

- Local population was 3,556, a decline of 8.5% since the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 28%.

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 28.9%.
 - This represents an improvement from the 1996 rate of 34.7%.
- The sources of income have remained stable, with income from employment decreasing by 0.4% and the level of government transfers decreasing by 1%.
- The average income based on the total population aged 15 and older was \$17,611.

Sector Activity:

- Job numbers in the primary sector fell from 155 to 125 over the period 1996-2001
- Secondary sector employment also declined from 785 jobs in 1996 to 580 in 2001.
- The tertiary sector remains the major local employer, with job numbers increasing from 615 in 1996 to 675 by 2001.

The Fishery:

- Average total income in the fishery ranged from \$17,121 to \$29,928.
- The average number of weeks worked in the primary fishery was 16, compared to 15 weeks worked in the secondary fishery.
- Some 84% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that between 18.5% and 25% of local employment is directly linked to the fishery.

Education:

- 43% of local residents, 20 years of age or older, held at least a high school diploma.
- Roughly 27% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.7 persons per census family in Grande-Riviere.
- Combined, residents under the age of 18, and 65 years or older, represented 33.6% of the local population.

Havre-aux-Maisons Community Profile

Population:

- Local population was 2,057, a decline of 7.0% since the 1996 Census.
- Over the period 1996-2001, the number of local residents aged 20-39 years declined by 30.1%.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 14.4%.
 - This represents an improvement from the 1996 rate of 24.4%.
- The sources of income have changed slightly, with the proportion of employment income rising, while the level of government transfers declined from 29.3% to 24.7%.
- Average income based on the total population 15 years and older was \$23,646.

Sector Activity:

- Job numbers in the primary sector increased from 170 in 1996 to 260 in 2001.
- Secondary sector employment declined over the period 1996-2001, from 395 to 340 jobs, or 14.1%.
- The tertiary sector also experienced some decline, though more modest, with jobs falling from 460 in 1996 to 450 jobs by 2001.

The Fishery:

- Average total income in the fishery ranged from \$14,706 to \$36,030.
- The average number of weeks worked in the primary fishery was 17 and 16 for the secondary fishery sector.
- Over 90% of those linked to the fishery collected employment insurance benefits.
- It is estimated that between 25.7% and 30% of local employment is directly linked to the fishery.

Education:

- 54% of local residents, 20 years of age and older, held at least a high school diploma.
- 36% of the local population held some form of post-secondary qualification (trade certificate, college diploma or university degree).

Household:

- On average, there were 2.9 persons per census family in Havre-aux-Maisons.
- Combined, residents under the age of 18 and 65 years or older represented 33.5% of the local population.

L'Étang-du-Nord Community Profile

Population:

- Local population was 2,944, a decline of 4.6% since the 1996 Census.
- Over the period 1996-2001, the number of local residents aged 20-39 years declined by 23.4%.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 14.6%
 - This represents an improvement from the 1996 rate of 26.4%
- The sources of income have changed slightly, with the proportion of employment income falling, and government transfers also falling from 22% to 17.9%.
- The average income based on the total population 15 years and older was \$27,147.

Sector Activity:

- Job numbers in the primary sector declined from 180 in 1996 to 150 in 2001.
- Secondary sector employment declined over the period 1996-2001, from 705 to 650.
- The tertiary sector experienced employment growth, from 800 jobs in 1996 to 815 jobs by 2001.

The Fishery:

- Average total income in the fishery ranged between \$18,498 and \$36,796.
- The average number of weeks worked in the primary fishery was 23, and 26 for the secondary fishery sector.
- Over 75% of those linked to the fishery collected employment insurance benefits.
- It is estimated that between 7.4% and 12.4% of local employment is linked directly to the fishery.

Education:

- 63% of local residents, 20 years of age and older, held at least a high school diploma.
- 44% of the local population held some form of higher level qualification (trade certificate, college diploma or university degree).

Household:

- On average, there were 2.8 persons per census family in L'Étang-du-Nord.
- Combined, residents under the age of 18 and 65 years or older represented 32.8% of the local population.

Magdalen Islands Region Profile

Population:

- 12,824, which represents a decline of 7.1% from the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 26% in the number of 20-39 years olds.

Labour Force and Income:

- The unemployment rate for the local population 15 years and older was 17.5%
 - This represents an increase from the 1996 rate of 27.9%.
- The proportion of income from government transfers declined from 30.5% in 1996 to 25.2% by 2001.
- The average income based on the total population aged 15 and older was \$23,693.

Sector Activity:

- Since 1996 primary sector jobs increased from 875 to 1,185 by 2001.
- Secondary sector employment declined, from 2,900 jobs in 1996 to 2,355 in 2001.
- Tertiary sector industries now account for the most employment, with increases from 2,885 jobs in 1996 to 2,945 jobs by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$ to \$.
- The average number of weeks worked in the primary fishery was , compared with and for seafood product and preparation and packaging and all other industries respectively.
- Some % of workers who were linked to the fishery collected employment insurance benefits.

Education:

- 51.7% of the local population held at least a high school diploma.
- 33% of the local population held some form of higher education (trade certificate, college or university)

Households:

- There were 2.9 persons per census family.
- 34% of the local population was under the age of 18 or 65 years or older.

Newport Community Profile

Population:

- Local population was 1,808, a decline of 10.9% since the 1996 Census.
- Over the period 1996-2001, the number of residents aged 20-39 years has declined by 37.2%.

Labour Force and Income

- The unemployment rate for the total population 15 years and older was 34%.
 - This represents an improvement from the 1996 rate of 37.7%.
- The sources of income have changed slightly, with employment income increasing and the level of government transfers decreasing from 40.6% to 34%.
- The average income based on the total population aged 15 and older was \$19,644.

Sector Activity:

- Job numbers in the primary sector more than doubled, from 80 to 175 by 2001.
- Secondary sector employment declined over the period 1996-2001, by some 45 jobs, from 280 in 1996 to 235 in 2001.
- The tertiary sector was stable at 290 jobs, and remains the main source of local employment.

The Fishery:

- Average total income in the fishery ranged from \$12,647 to \$34,237.
- The average number of weeks worked in both the primary and secondary fishery was 17.
- Over 80% of workers who were linked to the fishery collected employment insurance benefits.
- It is estimated that between 21% and 26% of local employment is linked directly to the fishery.

Education:

- 41% of local residents, 20 years of age and older, held at least a high school diploma.
- 26% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.7 persons per census family in Newport.
- Combined, residents under the age of 18, and 65 years or older, represented 36.2% of the local population.

Pabos Mills Community Profile

Population:

- The population was 1,452, a decline of 8% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 25.8% in the number of 20-39 year olds, representing a major loss of the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 29.9%.
 - This represents a decrease from 35% in the 1996 Census.
- The local participation rate was 47.4%.
- Local income composition has changed over the period 1996-2001, with the proportion of income from government transfers falling from 67.3% to 62.5%.
- The average income based on the total population aged 15 and older was \$20,529.

Sector Activity:

- Primary sector activity decreased over the period 1996-2001, with job numbers falling from 55 jobs in 1996 to 45 by 2001.
- The secondary sector was also marked by decline, as employment decreased from 265 in 1996 to 155 in 2001.
- The tertiary sector, on the other hand, experienced strong gains, with job numbers increasing from 245 in 1996 to 360 by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$12,002 to \$27,884.
- The average number of weeks worked in the primary fishery was 17, compared to 16 weeks worked on average in secondary sector fishing activity.
- Over 90% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 8.0% and 8.9% of local employment is linked directly to the fishery.

Education:

- 51% of local residents held at least a high school diploma.
- 32% of residents had some form of higher education (trade certificate, college or university).

Households:

- There was an average of 2.1 persons per census family.
- 33.1% of the local population was under the age of 18 or 65 years or older.

Saint-Godefroi Community Profile

Population:

- The local population was 373, a decline of 23.6% since the 1996 Census.
- Over the period 1996-2001 there has been an increase in the population aged 20-39 years.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 19%
 - This represents a decline from the 1996 level of 40%.
- During this period, the participation rates for the total labour population 15 years and older also declined, from 43.8% in 1996 to 30.4% in 2001.
- The proportion of employment income has increased over the period 1996-2001, with the level of government transfers decreasing from 51% to 41.2%.
- The average income based on the total population aged 15 and older was \$15,808.

Sector Activity:

- Job numbers in the primary sector declined from 35 in 1996 to 20 in 2001.
- Secondary sector industries remain the main local employers, though job numbers declined from 60 jobs in 1996 to 45 in 2001.
- Tertiary industry job numbers rose over the period from 10 in 1996 to 35 by 2001.

The Fishery:

- Labour income data for 2000 was limited. Those in the fishery averaged a total income of \$20,374.
- The average number of weeks worked in the primary fishery was 23. There was no data for secondary fishery activity, while the average weeks worked in all other industries was 33.
- Some 80% of workers who were linked to the fishery collected employment insurance benefits.

Education:

- 41% of local residents, 20 years and older, held at least a high school diploma.
- Some 28% of local residents held some form of post-secondary qualification (trade certificate, college or university)

Households:

- On average, there were 2.5 persons per census family in Saint-Godefroi.
- Combined, residents under the age of 18, and 65 years or older, represented 34.9% of the local population.

Sainte-Thérèse-de-Gaspé Community Profile

Population:

- The population was 1,165, a decline of 7.7% since the 1996 Census.
- Over the period 1996-2001 there has been a decline of some 29.1% in the number of 20-39 year olds, representing a major loss of the working age population.

Labour Force and Income:

- The unemployment rate for the total population 15 years and older was 25.3%.
 - This represents a decrease from 34.0% in the 1996 Census.
- The local participation rate was 49.3%.
- Local income composition has changed over the period 1996-2001, with the proportion of income from government transfers falling from 36.7% to 25%.
- The average income based on the total population aged 15 and older was \$23,938.

Sector Activity:

- Primary sector activity increased over the period 1996-2001, with job numbers rising from 70 jobs in 1996 to 105 by 2001.
- The secondary sector also experienced employment improvements, with jobs numbers increasing from 215 in 1996 to 250 in 2001.
- The tertiary sector, however, was marked by decline, as jobs fell from 135 1996 to 110 jobs by 2001.

The Fishery:

- Total income for those in the fishery ranged from \$12,666 to \$61,480.
- The average number of weeks worked in the primary fishery was 22, compared to 15 weeks worked on average in secondary sector fishing activity.
- Over 85% of workers linked to the fishery collected employment insurance benefits.
- It is estimated that between 33.3% and 41.9% of local employment is linked directly to the fishery.

Education:

- 43% of local residents held at least a high school diploma.
- 22% of residents had some form of higher education (trade certificate, college or university).

Households:

- There was an average of 2.8 persons per census family.
- 31.8% of the local population was under the age of 18 or 65 years or older.

APPENDIX F : Atlantic Cod Dependence in 2004

Newfoundland and Labrador, Atlantic Cod Population. Each cell shows the number of licence holders falling into a given revenue/cod-dependence category. Licencees include all those from Quebec or Newfoundland and Labrador who earned at least \$1 from the Newfoundland and Labrador cod population in 2004.

Gross Fishing Revenue (All Species, \$)	Proportion of Licensee's Fishing Revenue from Cod						Total by Province	Licence Holders (%) earning > 25% from cod
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%		
<1,000	0	0	5	3	20	22	50	100 %
1,000 - 2,999	2	4	6	8	33	8	61	90 %
3,000 - 4,999	4	2	4	0	0	0	10	40 %
5,000 - 9,999	3	10	0	0	0	0	13	0 %
10,000 - 19,999	9	2	0	0	0	0	11	0 %
20,000 - 29,999	65	0	0	0	0	0	65	0 %
30,000 - 39,999	342	1	0	0	0	0	343	0 %
40,000 - 49,999	119	0	0	0	0	0	119	0 %
50,000 - 99,999	123	0	1	0	0	0	124	0.8 %
100,000 - 199,999	12	0	0	0	0	0	12	0 %
200,000 +	57	0	0	0	0	0	57	0 %
Total	736	19	16	11	53	30	865	13 %

Laurentian North, Atlantic Cod Population. Each cell shows the number of licence holders falling into a given revenue/cod-dependence category. Licencees include all those from Quebec or Newfoundland and Labrador who earned at least \$1 from the Laurentian North cod population in 2004.

Gross Fishing Revenue (All Species, \$)	Proportion of Licensee's Fishing Revenue from Cod						Total by Province	Licence Holders (%) earning > 25% from cod
	<10%	10 % to 24.9 %	25 % to 49.9 %	50 % to 74.9 %	75 % to 99.9 %	100%		
<1,000	0	3	2	3	6	19	33	91 %
1,000 - 2,999	3	4	2	3	32	26	70	90 %
3,000 - 4,999	4	3	9	15	37	13	81	91 %
5,000 - 9,999	9	18	37	24	75	15	178	85 %
10,000 - 19,999	31	83	106	75	69	16	380	70 %
20,000 - 29,999	46	67	104	66	4	0	287	61 %
30,000 - 39,999	51	69	165	11	1	0	297	60 %
40,000 - 49,999	29	42	124	5	1	0	201	65 %
50,000 - 99,999	76	93	67	4	3	0	243	30 %
100,000 - 199,999	55	15	5	0	0	0	75	7 %
200,000 +	77	31	3	2	0	0	113	4 %
Total	381	428	624	208	228	89	1958	59 %