

# **Socio-Economic Implications of SARA**

Interior Fraser Coho  
Bocaccio

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## Discussion Document

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# Preface

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This report was prepared under contract for Canada Fisheries & Oceans to assess the socio-economic implications of the Species at Risk Act (SARA)-listing of Interior Fraser coho and bocaccio.

The consultants have benefited from discussions with industry, government, and others. Notwithstanding this assistance, the authors have final responsibility for the analyses and conclusions of this study.

This report outlines preliminary information on potential socio-economic impacts of SARA on First Nations. DFO plans further consultations with First Nations on background data, scenario development and potential impacts, and plans to summarize the results.

# Summary: Socio-Economic Implications of SARA

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## 1. Background

- COSEWIC has designated Interior Fraser coho salmon as “endangered” and bocaccio, a marine rockfish, as “threatened” – these species may become listed as such under the federal Species at Risk Act or SARA.
- Socio-economic analysis of impacts comprises one information input to the listing decision.

## 2. Study Objectives

- Develop socio-economic framework for impacts of SARA-listing.
- Apply the framework to Interior Fraser coho and bocaccio.

## 3. The Multiple Account Evaluation (MAE) Framework

- Compares base case and alternative scenarios of socio-economic and environmental activity/well-being.
- MAE framework has 8 accounts under two major headings – Environmental (Biological, Ecosystem, Science) and Socio-Economic (First Nation, Business, Government, Regional Development and Social/Community).
- DFO plans further consultations with First Nations on background data, scenario development and potential impacts, and plans to summarize the results.

## 4. Impacts from SARA-listing

- SARA impacts are summarized in the two following panels.
- Interior Fraser coho.
  - Impacts depend critically on future marine survival (MS).
  - No escapement benefits or business costs if present ~2 to 3% MS persists/some escapement benefits and foregone catch and costs to business, mainly felt in recreational sector, if MS increases.
  - No change in FSC catches under all MS due to allocative priority.
  - Increased salmon populations would increase existence or intrinsic values to Canadians from knowing the resource is healthy.
  - The delisting process under SARA is unclear.
- Bocaccio
  - Little known about productivity or sustained yield potential.
  - Existing fishing mortalities do not jeopardize the survival or recovery of the species but it is advisable to enhance recovery through catch reductions.
  - Trawl fleet in 2004/05 has demonstrated ability to avoid bocaccio and reduce catch on voluntary basis.
  - More severe catch reductions than in 2004/05 would impose undue hardship on commercial trawl and hook & line fleets and processors and compromise viability.

## 5. Conclusions

- The MAE approach allows the consistent and fair treatment of the impacts of SARA on people, businesses, communities, First Nations and governments.
- Substantial uncertainties exist as to impacts, in part due to the nature of fisheries and in part due to the projection of impacts before Recovery Strategies, Action Plans, and Allowable Harm Assessments have been formulated.

## SUMMARY – INTERIOR FRASER COHO SARA IMPACTS

<b>Current Situation &amp; Potential SARA Actions</b>	
Current Situation	<ul style="list-style-type: none"> <li>- significant decline in 5 main populations since 1980s (Fraser Canyon, Upper Fraser, North Thompson, South Thompson and Lower Thompson/Nicola)</li> <li>- high fishing exploitation rates (ERs), decline in marine survivals (MS) &amp; habitat loss contributed to decline</li> <li>- DFO implemented significant fishing restrictions in late 1990s</li> <li>- species appears to be rebounding at current low 12% ER (3% Canadian ER is all non-directed fisheries, remainder is US fishery ER entitled under Pacific Salmon Treaty)</li> <li>- late run Fraser sockeye fisheries currently curtailed for conservation reasons (late run sockeye and Interior coho co-mingle)</li> </ul>
Fisheries Actions	<ul style="list-style-type: none"> <li>- analyzed under three views of future MS: Current ~2 to 3% (75% probability), Improved ~5% (20% probability), Superior ~8% (5% probability)</li> <li>- under current MS, fisheries would be managed the same as without SARA</li> <li>- under better MS, not all potential catch benefits can be captured due to: 1) “burden of proof” justifying catch increase would be greater, 2) legal challenges could occur i.e., DFO would have to manage the fishery more conservatively</li> <li>- assumed listing occurs in 2005, delisting in 2017 if Recovery Target met (10 year COSEWIC review plus 2 years consultations)</li> </ul>
Habitat Actions	<ul style="list-style-type: none"> <li>- could affect forestry, agriculture (mainly water extraction), mining, urban &amp; linear developments (e.g., roads and culverts)</li> <li>- difficult to identify since entails part of Action Plan</li> </ul>
<b>Potential Impacts of SARA</b>	
<b>Environmental Impacts</b>	
1. Biological	<ul style="list-style-type: none"> <li>- under current MS Interior Fraser coho is rebuilding slowly and should surpass on a consistent basis recovery target of 25,000 wild spawners in a few years</li> <li>- zero impact on escapement in short term 2005 to 2008</li> <li>- with SARA, improvements in escapement 2009 + under better MS conditions</li> </ul>
2. Ecosystem	<ul style="list-style-type: none"> <li>- habitat measures will increase water quality and water flows</li> <li>- preserve genetic diversity</li> <li>- increased coho populations lead to increased nutrients which contribute to fish growth, nutrients to bears, eagles &amp; other animals, and forest growth</li> </ul>
3. Science/Other	<ul style="list-style-type: none"> <li>- additional research spurred</li> <li>- foster environmental partnerships and awareness</li> </ul>
<b>Socio-Economic Impacts</b>	
4. First Nations	<ul style="list-style-type: none"> <li>- salmon has significant food, social &amp; ceremonial (FSC) values</li> <li>- salmon also contribute to distribution, cultural expression and socialization roles in First Nation communities</li> <li>- no impact on FSC catch during listing period due to allocative priority after conservation/after delisting, FSC harvests could increase</li> <li>- 25% of Southern BC commercial salmon licences operated by First Nations</li> </ul>

*continued*

## SUMMARY – INTERIOR FRASER COHO SARA IMPACTS (continued)

### Potential Impacts of SARA

#### Socio-Economic Impacts cont'd

- |                         |   |
|-------------------------|---|
| 5. Business             | <ul style="list-style-type: none"> <li>- present health of salmon fleet &amp; processors without SARA is precarious</li> <li>- zero business impacts in short term 2005 to 2008</li> <li>- reduced commercial (landed value &amp; processor) gross revenues and angler expenditures in medium term 2009 to 2016 under higher MS</li> <li>- zero business impacts in long term 2017 + after delisting</li> <li>- angler expenditure losses much larger than commercial sector losses due to greater recreational dependence on coho (also commercial opportunities constrained by late run sockeye concerns)</li> <li>- other industry impacts (e.g., forestry, agriculture) could be significant</li> <li>- listing could reduce market demand for BC Salmon</li> </ul> |
| 6. Government           | <ul style="list-style-type: none"> <li>- listing may enhance Canada's international image in environmental conservation</li> <li>- loss of personal, corporate &amp; commodity (e.g., fuel, GST) taxes</li> </ul>   |
| 7. Regional Development | <ul style="list-style-type: none"> <li>- loss in GDP, wages and employment</li> </ul>   |
| 8. Social & Community   | <ul style="list-style-type: none"> <li>- salmon are special to residents and visitors to province</li> <li>- significant "existence" value enhanced under SARA</li> <li>- several communities, including First Nation communities, on or near Vancouver Island depend on salmon</li> </ul>  |

### Key Assumptions, Uncertainties and Risks

1. improved Marine survival (MS) is key to long term recovery of species
2. it is assumed that MS will not change in short term 2005 to 2008 period
3. delisting is assumed for 2017 – if delisting is delayed or can not occur then negative business impacts would be larger
4. after delisting, it is unknown how increased returns will be split between escapement and harvest interests
5. future salmon returns, escapement and harvests subject to significant uncertainty (in large part tied to marine survival uncertainty)
6. it is unclear how the Wild Salmon Policy, McRae – Pearse consultations, the First Nation Panel Report, and other policies or initiatives will affect the fishery of the future
7. Canada can not influence US catches of Interior Fraser coho under Pacific Salmon Treaty
8. the SARA commercial and recreational sector catch scenarios under Minimal, Moderate and Severe SARA restrictions (of 75%, 50% and 25% catch benefit capture) is arbitrary
9. the analysis does not address potential policy options and adjustment mechanisms that could mitigate adverse impacts e.g., new opportunities could emerge if transfers between commercial salmon areas/interests were feasible, opportunities could exist for new in-river fisheries (DFO is unable to quantify such opportunities at the present time).
10. it is unknown what habitat-related measures might be implemented and what their impacts on the resource and on affected industry might be

## SUMMARY – BOCACCIO SARA IMPACTS

<b>Current Situation &amp; Potential SARA Actions</b>	
Current Situation	<ul style="list-style-type: none"> <li>- decline in bocaccio abundance since 1980s</li> <li>- stable commercial catches ~300 t in last several years</li> <li>- commercial trawl about 85% of catch, 15% commercial hook &amp; line, trace other</li> <li>- no TAC set for bocaccio since little is known about the species</li> </ul>
Fisheries Actions	<ul style="list-style-type: none"> <li>- set a TAC arbitrarily at say 300 t, 150 t or 75 t, or</li> <li>- have fleet implement voluntary measures to reduce catch to 150 t (the trawl fleet implemented such a program in 2004/05)</li> </ul>
Habitat Actions	<ul style="list-style-type: none"> <li>- not relevant/effective since bocaccio is a demersal marine species</li> </ul>
<b>Potential Impacts of SARA</b>	
<b>Environmental Impacts</b>	
1. Biological	<ul style="list-style-type: none"> <li>- little known about productivity &amp; sustained yield potential</li> <li>- Allowable Harm Assessment (AHA) concluded:               <ul style="list-style-type: none"> <li>- 300 t mortalities do not jeopardize the survival or recovery of the species</li> <li>- but advisable to enhance recovery through catch reductions</li> <li>- trawl fleet in 2004/05 has demonstrated ability to avoid bocaccio</li> </ul> </li> </ul>
2. Ecosystem	<ul style="list-style-type: none"> <li>- return to traditional predator-prey role</li> </ul>
3. Science	<ul style="list-style-type: none"> <li>- spur additional research</li> </ul>
<b>Socio-Economic Impacts</b>	
4. First Nations	<ul style="list-style-type: none"> <li>- no impact on FSC catch since has allocative priority after conservation</li> <li>- 5 of 142 trawl licence holders are aboriginal</li> </ul>
5. Business	<ul style="list-style-type: none"> <li>- trawl and hook &amp; line fleets, plus processors affected</li> <li>- manageable impacts under 300 t TAC or 150 t voluntary “target” (with no TAC)</li> <li>- significant impacts under 150 t TAC scenario and very serious impacts under 75 t TAC scenario (latter results in loss of 40% of quota groundfish catch)</li> <li>- fleet and processor viability, benefits of IVQ system compromised under 75 t scenario</li> </ul>
6. Government	<ul style="list-style-type: none"> <li>- loss of personal, corporate &amp; commodity (e.g., fuel) taxes</li> </ul>
7. Regional Development	<ul style="list-style-type: none"> <li>- loss in GDP, wages and employment</li> </ul>
8. Social & Community	<ul style="list-style-type: none"> <li>- species existence or intrinsic value enhanced with recovery</li> <li>- significant crew employment, trucking, processing in communities affected</li> </ul>
<b>Key Assumptions, Uncertainties and Risks</b>	
1.	lack of scientific basis for setting a TAC at present
2.	research programs should result in science-based TAC in a few years
3.	in meantime, it may be difficult to adjust TAC even if indices indicate significant recovery
4.	projected catch declines somewhat subjective, particularly for hook & line fleet (their avoidance potential is unknown)
5.	100% monitoring of landings (trawl plus hook & line) and of releases (trawl in place now, hook & line in place for 2006/07) mean that effectiveness of implemented strategy can be assessed
6.	DFO needs to consult with hook & line fleet to reduce management uncertainties
7.	delisting process for a species is unknown

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## 1.0 INTRODUCTION

- 1.1 The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated some species as "threatened" or "endangered". These species may become listed under the federal Department of Environment Species-At-Risk-Act (SARA) or Bill C-5. "Endangered" species are those at significant risk of biological extinction. "Threatened" species are those likely to become endangered if limiting factors are not reversed.
- 1.2 For species legally listed, there is an automatic prohibition on harming individuals or their residences, unless a permit has been authorized, and mandatory development of Recovery Strategies and Action Plans. Permits are contingent on a scientific assessment of the amount of harm allowable without jeopardizing survival or recovery (commonly called an "Allowable Harm Assessment").
- 1.3 Socio-economic information can aid in the listing decision and in the development of Recovery Strategies and Action Plans. There is a need to ensure that the analysis of socio-economic impacts occurs in a consistent and transparent manner.
- 1.4 In 2004, GSGislason & Associates Ltd., under contract with Canada Department of Fisheries and Oceans (DFO), developed a socio-economic impact framework for the analysis of SARA – listing and associated Recovery Strategies, and illustrated the framework through worked examples for Cultus Lake sockeye and Sakinaw Lake sockeye.

### ***1-1 Overall Study Objective***

- 1.5 The objective of this study is to analyze the socio-economic impacts of SARA-listing of two species:
- Interior Fraser coho (designated as "endangered" by COSEWIC)
  - Bocaccio (designated as "threatened" by COSEWIC)
- 1.6 Comments and feedback received on the original Sakinaw - Cultus report has helped to refine the socio-economic framework and analysis for this new assignment.

### ***1-2 Workplan and Consultations***

- 1.7 The consultant reviewed the COSEWIC assessment reports and draft Recovery Strategies, Allowable Harm Assessments, and Action Plans if available. The consultant also reviewed and assembled a variety of publications and reports by the federal and provincial governments, academics, consultants and others (see Bibliography).

- 1.8 The consultant interviewed approximately fifty (50) individuals from Canada Department of Fisheries and Oceans (DFO) and the Province of British Columbia – scientists, fisheries managers, and enforcement and policy personnel – as well as individuals from commercial fishing organizations and industry.
- 1.9 The intent of these discussions was to identify a range of fisheries management, habitat and other measures in response to SARA-listing, and the likely impacts on the environment, people, businesses and communities affected. That is, the discussions were not broad-based consultations but rather targeted interviews with individuals with specific information. This study can serve to focus more broad-based industry and public consultations in the future.
- 1.10 This report is informed by broad-based DFO consultations to date:
- DFO has held more than 20 First Nations consultation sessions dealing with legal listing of Interior Fraser coho and bocaccio and with the draft Interior Fraser Coho Recovery Strategy (February – November 2004).
  - DFO has held more than 20 general public consultation sessions dealing with legal listing of Interior Fraser coho and bocaccio and with the draft Interior Fraser Coho Recovery Strategy (February – November 2004).
- 1.11 This report also reflects input and advice received from the:
- DFO/Province of BC working group
  - Interior Fraser Coho Recovery Team (IFCRT)
  - Participants at the January 17/05 technical review meeting (including First Nations, Marine Conservation Council, recreational fishing and commercial fishing industry representatives), and
  - Methodological review conducted by an academic

***More First Nations Consultations***

- 1.12 DFO plans further consultations with First Nations on background data, scenario development and potential impacts, and plans to summarize the results.

### **Report Outline**

I.13 The next section presents the socio-economic framework. The remaining sections of the report are:

<b>Section</b>	<b>Type</b>
2	Impact Framework
3	Socio-economic Impacts - Interior Fraser Coho
4	Socio-economic Impacts - Bocaccio

I.14 Several appendices provide additional data and analysis.

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## 2.0 SOCIO-ECONOMIC ASSESSMENT FRAMEWORK

2.1 This section presents a Multiple Account Evaluation framework for assessing the socio-economic impacts of SARA. The framework is revised from that presented in the Sakinaw-Cultus SARA study earlier this year (GSGislason & Associates Ltd. 2004).

### **2-1 A Brief Description of the SARA Process**

2.2 For species designated as "endangered" or "threatened" by COSEWIC, the federal Minister of Environment makes a recommendation to the Governor in Council whether to list or not to list (or to refer the matter back to COSEWIC for further information). For aquatic species, the Minister of Fisheries and Oceans makes a decision and provides the Minister of Environment with a recommendation.

2.3 Legal listing triggers two events:

- mandatory and immediate prohibitions against killing, harming, taking, possessing, capturing, collecting, buying, selling and trading legally-listed species and against damaging or destroying their residences,
- the development of a Recovery Strategy and an Action Plan for each listed species, and identification and protection of critical habitat

The Recovery Strategy for an "endangered" species must be completed within 1 year of legal listing. The Recovery Strategy for a "threatened" species must be completed within 2 years of legal listing. The Recovery Strategy typically runs for 5 years. Exhibit 1 displays the process.

2.4 There is a provision under the Act that allows the Recovery Strategy to permit fishing or another activity that directly or indirectly affects a species-at-risk without the mandatory prohibitions to apply. However, scientific research must show that the "harm" would not jeopardize survival or recovery of the species (under a so-called Allowable Harm Assessment or AHA). A permit may also be issued to allow an activity indirectly affecting the species at risk, e.g. bycatch fisheries, but again the permit must be based on a scientific assessment of allowable harm.

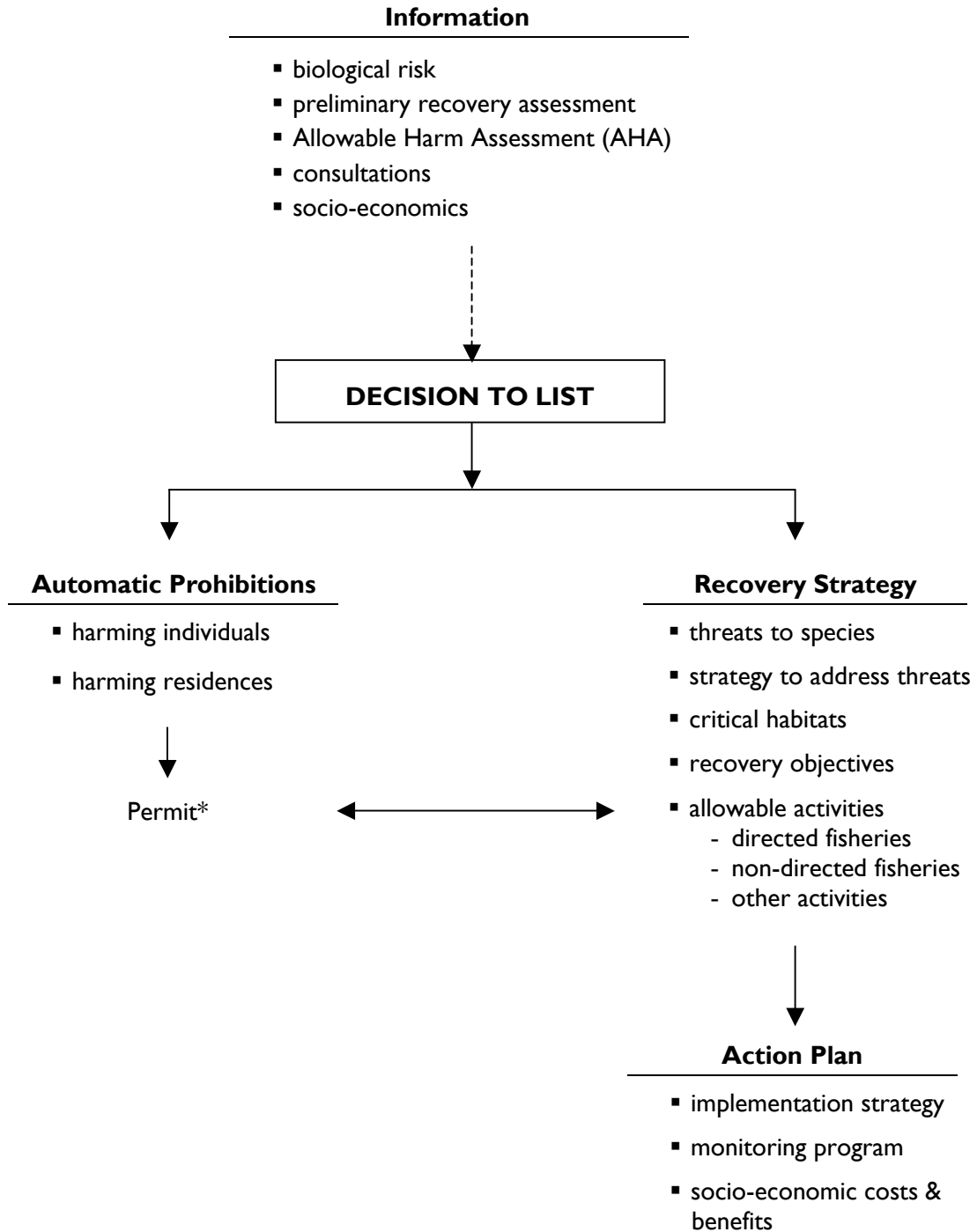
### **2-2 Evaluation Framework**

2.5 Multiple Account Evaluation (MAE) is a method for systematically displaying a broad spectrum of impacts associated with development projects or policy initiatives. An MAE framework organizes project information and anticipated impacts under different objectives or "accounts".

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## Exhibit 1: The SARA Listing Process

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\* A permit may be issued for non-directed fisheries.

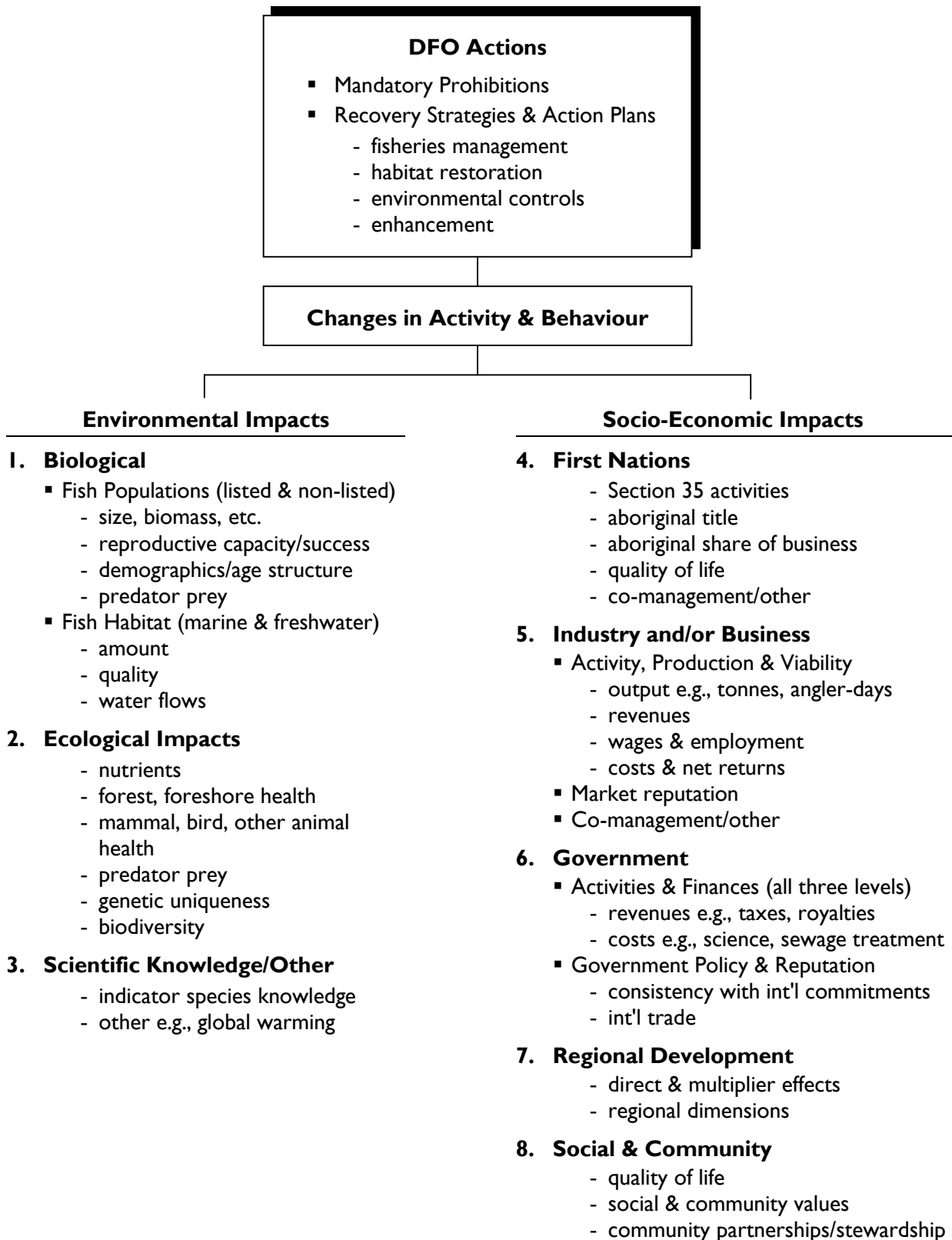
MAE makes the trade-offs between accounts/objectives transparent. But, MAE says nothing about how to arrive at a decision. MAE does not offer a process to choose from competing proposals since MAE does not have any explicit weighting and rating scheme for the various accounts. This is both an advantage and disadvantage.

- 2.6 In impact assessment one develops a base case scenario or assessment of economic, social, and environmental activity/well-being in the absence of the environmental program, regulations or policy, in this case SARA, and then develops the alternative scenario with the initiative. The impacts then are the differences between the "with" and "without" scenarios i.e., impact analysis focuses on incremental effects.
- 2.7 Typically a set of quantitative and qualitative impact indicators are identified for each account or category of impact. The indicators should focus on the key changes in activity and behaviour as a result of the regulatory action.
- 2.8 If one cannot designate in some detail the differences in activity and behaviour attributable to regulation, it is very difficult if not impossible to assess impacts of the regulations.
- 2.9 The impact framework can be used to assess the impacts of a single regulation. It can also be used to assess the impacts of a variety of potential regulations or measures. In the latter situation, it is unlikely that any one proposed measure will be uniformly superior to all interests for all indicators. However, the value of a formal impact framework is that it makes tradeoffs between interests or indicators transparent.
- 2.10 The MAE framework for analyzing the impact of SARA has eight accounts (see Exhibit 2):
- Biological
  - Ecosystem
  - Science & other Environmental
  - First Nations
  - Industry and/or Business
  - Government
  - Regional Development
  - Social & Community
- 2.11 Four broad types of DFO actions are possible – fisheries management changes, habitat restoration activities, imposition of environmental controls, and enhancement activities – to assist aquatic species at risk to recover.
- 2.12 These DFO actions, as well as affecting the natural environment, can also affect activity and behaviour of business, people, communities, First Nations, and governments. These changes are summarized under each of the accounts.

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## Exhibit 2: SARA Impact Framework

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2.13 Although the focus of the impact framework and the analysis is socio-economic impacts, the framework also contains three environmental accounts – Biological, Ecosystem and Science. The rationale for their inclusion is that it is important to discuss in one document all the relevant impacts, and inherent tradeoffs, associated with SARA-listing.

2.14 Preliminary impact indicators have been identified for the First Nation account. However, DFO plans further consultations in this area as noted in Section 1-3.

### **2-3 Some Issues**

2.15 Action Plans detailing activities and initiatives to be carried out to promote species recovery do not exist at present for the two species addressed in this report. In a real sense, it is difficult to conduct socio-economic impact analysis (SEIA) of SARA-listing. On the other hand, the federal Governor in Council (GIC) requires SEIA information as input into its listing decision. In this context SEIA information, albeit preliminary and somewhat speculative, is useful.

2.16 Ideally the MAE analysis should be forward looking and address likely and potential impacts 10 to 20 years into the future. This is especially important for the environmental account where it likely will take several years for species at risk to recover. As well, stocks such as salmon can be cyclical. It is also important for the business account where economic activity (e.g., commercial fish catches) may need to be curtailed in the short run to rebuild stocks of concern over time i.e., greater business opportunities may exist in the long term.

2.17 The mere possibility of SARA-listing of certain species may cause DFO and industry actions and improvements to the natural environment even if the species are never listed. It is problematic to isolate the impacts of SARA-listing from the broader impacts of the SARA review and assessment process. For example, as discussed later, groundfish trawl commercial fishermen voluntarily implemented some bocaccio "avoidance" measures in 2004/05 to reduce bocaccio catch – but at this time bocaccio has not been listed under SARA.

2.18 DFO's management of fish and fish habitat is guided by a variety of policies and legislation including the 1867 Fisheries Act, the 1982 Constitution Act and subsequent Supreme Court of Canada rulings, the 1986 policy for the Management of Fish Habitat, the Canadian Environmental Assessment Act of 1992, the 1997 Oceans Act, the 1998 New Direction Paper, and the 1999 Salmon Allocation Policy. The Wild Salmon Policy has just been released. The Department since 1997 has had an increased conservation focus. The Department has obligations and initiatives to protect weak stocks even in the absence of SARA. The result is that, in some cases, it is very difficult to isolate the impacts of SARA initiatives from broad environmental protection measures.



- 2.19 Fisheries management of British Columbia's commercial salmon, groundfish and other species has undergone significant change over the past 10 years and more change is imminent. For example, active discussions on changes in salmon fisheries management are underway as a result of the McRae-Pearse Report (McRae and Pearce, 2004), the Wild Salmon Policy and other initiatives (e.g. First Nation Panel Report, 2004). And Groundfish Integrated Fisheries Management is being proposed. Such future management changes can not be incorporated into our analysis and projections.
- 2.20 The business account often is more amenable to numerical measurement than are the social, First Nation, environmental accounts. One should strive to quantify as much as possible impacts and effects under all our accounts. However, if impacts under one account cannot be quantified, this does not mean that such impacts necessarily are less significant or important than impacts that can be quantified. (There are examples where non-monetized benefits of environmental improvements have outweighed monetized costs to business in regulatory decisions – see Gowan et-al, 2005.)
- 2.21 SARA is silent as to whether or not a species, after being listed under the Act, can be delisted at a later date i.e., whether SARA-listing is reversible. The Act does indicate that
- ...COSEWIC must review the classification of each species at risk at least once every 10 years, or at any time if it has reason to believe that the status of the species has changed significantly (Section 24).*

The process and timeliness for delisting are unclear.

#### **2-4 Economic Value Concepts**

- 2.22 The economic benefits of improvements to the natural environment include the value that members of society place on living in a cleaner, more productive and aesthetically pleasing environment. Society's collective choices for acquiring particular goods, services or amenities are expressed through individuals' willingness to pay (WTP). WTP is not restricted to the amount individuals would pay in a market, where one exists, but also includes any further payment that would be willingly made if necessary i.e., the WTP measure provides a means to value non-market goods such as the environment.
- 2.23 The economic benefits or value of improvements to the environment, such as protection of species at risk, has several components differentiated by whether the environment is "used" or not, now or in the future (Turner and Pearce, 1990). Economic costs are the mirror image of economic benefits in that a cost is just a benefit foregone. Three components of value can be identified:

Economic value = use value + option value + existence value

**Use value** – market and non-market benefits from the actual (consumptive or non-consumptive) use of the environment. For example, commercial fishermen, anglers, wildlife photographers and viewers, and many others will use the natural environment and secure benefit. SARA-induced measures may alter the use and/or harvest of the species of concern as well as other species.

**Option value** – is the non-market value the current generation places on the option to use the environment in the future in contrast to the value to present users e.g. the value a non-angler places on the option or opportunity to go angling in the future. For our purposes, this value also includes the value of protecting the environment for the use of future generations (this is sometimes called bequest value). SARA-induced measures can affect the option value of natural resources.

**Existence value** –is the non-market value people place on the satisfaction in knowing that a species continues to exist, thus maintaining a species' diversity and the ecosystem. This value is unrelated to use values, either in the present or the future. For example, many people feel a "stewardship" or obligation to protect the natural environment, and accordingly value the continued existence and preservation of the Amazon Rain Forest, endangered species, and many other natural environments even though they will never use the resources.

- 2.24 While recognizing the importance of all these components of value, we restrict the socio-economic impact analysis of the SARA-listing of the three candidate species to use impacts. This reflects severe information constraints – there are no empirical studies of option or existence values for any species in British Columbia (there is some illustrative analysis for the value of natural capital in the Lower Fraser Valley – see Olewiler, 2004). The environmental impact analysis, however, does include information on ecological and other environmental impacts of SARA-listing.

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## 3.0 SOCIO-ECONOMIC IMPACTS – INTERIOR FRASER COHO

3.1 This section applies the Multiple Account Evaluation framework of Exhibit 2, Section 2 to the case of SARA-listing Interior Fraser coho.

### 3-1 Background

#### Species Description and Status

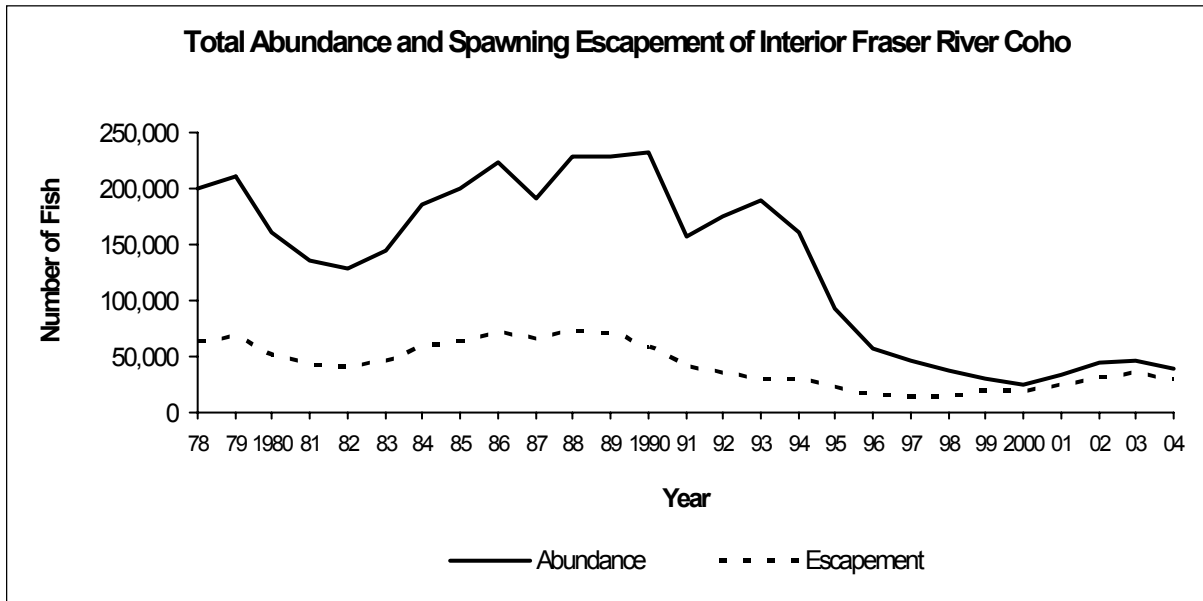
3.2 Within North America, coho salmon (*Oncorhynchus kisutch*) spawn in streams from California to Alaska. Coho salmon are anadromous – they are born and spend their first year in freshwater, then migrate to the ocean for 18 months before returning to freshwater to spawn and die. Almost all coho have a 3 year life cycle.

3.3 The Fraser River is the largest river in BC – the Interior Fraser (i.e., upstream of the Fraser Canyon) constitutes most of the 220,000 km<sup>2</sup> drainage basin of the Fraser. The Interior Fraser River watershed includes the Thompson River. Interior Fraser coho comprise about one quarter of the range of coho salmon in Canada.

3.4 There are 5 distinct coho populations – Fraser Canyon, Upper Fraser, North Thompson, South Thompson and Lower Thompson/Nicola – within the Interior Fraser that are geographically separated (and eleven subpopulations). The Interior Fraser watershed includes more than 100 coho spawning streams. Coho salmon return to the watershed during fall and spawn during fall and early winter.

3.5 Climate – related changes have reduced coho marine survivals to less than 3%, a level much lower than during the 1980s. Canadian fisheries exploitation rates for Interior Fraser coho averaged 68% until 1996, were reduced to ~40% in 1997, were reduced again due to conservation concerns to ~7% over the next 3 years, and presently are at about 3%. These figures exclude US fishing mortality on Fraser stocks (presently US fishing mortality is ~9%, giving a total fishing mortality of ~12%).

3.6 Declines over the 10 year 1990-2000 period in the size of Interior coho runs averaged 60%. Spawning numbers in the late 1990s were less than 25,000, the lower benchmark suggested by Interior Fraser Coho Recovery Team (IFCRT 2004). For escapements below this level there is a high risk of populations going extinct. Spawning escapements have improved substantially since then but it is too soon to determine whether the rebound will be long lived.



Source: DFO (figures are 3 year geometric means).

- 3.7 Reductions in ocean productivity and low marine survivals were an important factor in the decline. Excessive fishing in the 1990s, since reduced, and freshwater habitat degradation also played a role in the coho escapement declines. Much of the Interior Fraser watershed where coho are found has been logged and has been used for a variety of agricultural activities. The COSEWIC Status Report on Interior Fraser coho observes:

*...overfishing, changing marine conditions, and habitat perturbations all contributed to declines. Excessive fishing resulted when harvest rates were not reduced quickly in response to climate-driven declines in marine productivity. In addition, coho declines were often related to the intensity of human disturbance in freshwater.*

*...the outlook for Interior Fraser coho is highly uncertain and will depend on impacts due to fishing, habitat perturbations, and climate-related change in survival. An extremely cautious approach to managing both fisheries and habitat is required to ensure the viability of populations of coho salmon within the interior Fraser River watershed.*

- 3.8 In 2002, COSEWIC identified Interior Fraser coho as "endangered" (COSEWIC, 2002).
- 3.9 An Interior Fraser Coho Recovery Team (IFCRT) was struck and produced a Draft Recovery Strategy in 2004 (Interior Fraser Coho Recovery Team, 2004). An Allowable Harm Assessment is under development.

### **Conservation Measures to Date**

3.10 DFO has taken substantial measures since the early 1980s to conserve Interior Fraser River coho. These changes reflect the conservation mandate of the 1867 Fisheries Act as well as more recent legislation and policy initiatives. In particular, the 1998 New Directions Policy and its reinforcement of the Department's conservation mandate and precautionary approach to fisheries management resulted in substantial changes. There has been a zero retention policy for Fraser River coho since 1998. Changes over the past 20 years include:

- no directed net fisheries for Fraser River coho
- non-retention of coho salmon in southern troll fisheries since 1998
- reduced in-river aboriginal food, social, and ceremonial (FSC) fisheries when coho are in the river
- reduced coho bag limits for anglers in both saltwater and freshwater (mark-only recreational fisheries since the late 1990s)
- red "no fishing" and yellow "selective fishing only" zones implemented for commercial and recreational fisheries in 1998
- "brail and sort" –only seine fisheries, the adoption of revival boxes on gillnet vessels, the mandatory use of barbless hooks in troll and recreational fisheries, since 1998

3.11 These regulatory changes have been profound. As the COSEWIC Status Report states,  
*...Recent regulatory changes made to conserve Interior Fraser coho salmon were probably the most significant fishery changes ever implemented within the Pacific Region of Canada.*

3.12 It may be that the 2002 COSEWIC designation of Interior Fraser coho as "endangered" influenced DFO's continuation through 2004 of the severe regulatory measures on the fishery first introduced in 1998.

3.13 Appendix 5 of the September 2004 Draft Recovery Strategy provides a chronology of management actions taken by DFO to conserve Interior Fraser River coho.

### **The Fraser River Mixed Stock Fishery Situation and Coho**

3.14 There are many salmon stocks that after hatching in the Fraser River and its tributaries, spending a period of time in freshwater and one or more years in the North Pacific, return as adults through Johnstone Strait and Juan de Fuca Strait to their natal streams in the Fraser River to spawn. Sockeye salmon over their four year life cycle usually exhibit cyclic dominance with one dominant (strong) cycle and three sub-dominant off-cycles. Coho, chinook, and chum salmon usually exhibit less cyclic dominance.

- 3.15 The various populations co-mingle on their return in the Johnstone Strait and Juan de Fuca Strait approach paths and many are caught by a variety of First Nations, commercial, and recreational interests. Weak stocks may be harvested at exploitation rates more suitable for strong stocks.
- 3.16 The sockeye fishery is the major management focus for Fraser River salmon stocks. DFO manages Fraser River sockeye stocks under four broad run timing groups (based on timing to entering the Strait of Georgia).
- early – late June to mid July
  - early summer – early July to late July
  - summer – late July to mid August
  - late – mid August to early October
- 3.17 In recent years since 1997, due to conservation concerns and the 1998 DFO New Directions Policy, DFO fisheries managers have tried to cut down fishing rates on early and late run stock groupings of concern, and target fishing on more abundant early summer and summer stock groupings. The result has been a drop of overall Fraser River sockeye exploitation rates, and a curtailment of the Fraser River sockeye fishery to the narrow July 20 to mid August period.
- 3.18 The migration timing for Interior Fraser coho overlaps with that of late run sockeye stocks, a major management concern. Reductions in fishing pressure on these late run sockeye stocks – in the recent past and the foreseeable future – also help to reduce fishing pressure on Interior Fraser coho. In addition, severe fishing restrictions targeted at coho concerns since 1998 have helped reduce the Canadian exploitation rate (ER) to the ~3% today.

### **3-2 Marine Survival, Fisheries Management & SARA**

- 3.19 There has been a regime shift in ocean productivity since the early to mid 1990s resulting in decreased marine survival for many salmon species (DFO State of the Ocean Report 2004, GSGislason SWOT Report 2004). Low marine survival currently is the major limiting factor to Interior coho recovery (COSEWIC 2002, IFCRT 2004). But DFO has little capability to assess marine survival in-season and very limited capability to access marine survival in the short term i.e. 1 to 3 years.
- 3.20 With the current low marine survival, it is likely that fisheries management under the "with SARA" scenario would be identical to the current situation i.e., there is very little room to ratchet coho exploitation rates down further.
- 3.21 If marine survival were to improve then, in the absence of SARA, it is likely that DFO could increase coho exploitation rates (ERs) and expand fishing opportunities. However, if Interior coho were listed under SARA the ability to increase ERs, under evidence of improving marine survival, could be limited. Impediments to increasing ERs under SARA include: 1) the "burden of proof" that the stock was not at risk would be higher, and 2) legal challenges could be launched. The existing Draft Recovery Strategy does allow increased fisheries ERs under improved marine survival.

3.22 Sockeye is critical to the FSC salmon fishery and to the fortunes of the BC commercial salmon fishing fleet and salmon processing sector (in most years, sockeye contributes two thirds or more of salmon fleet landed value). Consequently, any changes in sockeye catches will be the main "driver" of changes to FSC harvests and commercial revenues attributable to SARA.

3.23 However, the DFO Allocation Policy for Pacific Salmon states under Principle #2 that,  
*...After conservation needs are met, First Nations' food, social and ceremonial requirements and treaty obligations to First Nations have first priority in salmon allocation (DFO 1999).*

Therefore, SARA is unlikely to affect FSC salmon catch.

3.24 The analysis of commercial fisheries impacts of SARA-listing of Interior Fraser coho is complex as listing will have impacts on sockeye and chinook fisheries and stocks as well as coho fisheries and stocks e.g., San Juan seine fishery and Fraser gillnet fishery for sockeye, WCVI troll fishery for chinook. It is also important to note:

- the base case management and catch scenarios reflect concerns over non-Interior coho stocks i.e., concerns for sockeye stocks limit harvest opportunities
- the analysis focuses on the years 2005 to 2008, a period when projections of catch are available
- the analysis does not address potential policy options and adjustment mechanisms that could mitigate adverse impacts e.g., new opportunities could emerge if transfers between commercial salmon areas/interests were feasible, opportunities could exist for new in-river fisheries (DFO is unable to quantify such opportunities at the present time)
- the distribution of the commercial catch among areas is identical under the base case and all scenarios presented, a simplification

3.25 The commercial salmon fleet is a competitive fishery managed with limited entry, area licencing, and gear restrictions. There are about 2,220 commercial licences in total for 8 fishing area/gear combinations – 3 in the north (1 for each of seine, gillnet and troll gear), and 5 in the south (1 seine, 2 gillnet, 2 troll). The fish allocation targets amongst the gears on a coastwide basis are: 40% seine, 38% gillnet, and 22% troll. The catch distribution by species and gear for southern licences in recent years has been approximately:

	Seine	Gillnet		Troll		Total South
	Area B	Area D	Area E	Area G	Area H	
Chinook	0%	5%	10%	85%	0%	100%
Chum	50%	30%	15%	0%	5%	100%
Coho	0%	10%	0%	90%	0%	100%
Pink	90%	5%	0%	0%	5%	100%
Sockeye	40%	15%	30%	0%	15%	100%

To the extent SARA impacts commercial catch of each species differently, fleet segments will be affected differently as well.

### Exhibit 3: Fisheries Management and Harvest Scenarios – Interior Coho

	Base Case Scenarios*											
	#1 Current Marine Survival ~2 to 3%				#2 Improved Marine Survival ~5%				#3 Superior Marine Survival ~8%			
<b>Assumptions</b>												
Objective - prevent extinction	> 25,000 wild spawners				> 25,000 wild spawners				> 25,000 wild spawners			
Coho Exploitation Rate - CDN	3%				10%				20-25%			
- Total	12%				22%				40%			
<b>Management Regime</b>												
First Nations FSC - Marine	3-4 week fishery				3-4 week fishery				3-4 week fishery			
- In-River	Normal sockeye fishery				Normal sockeye fishery + increased access to coho				Normal sockeye & coho fishery			
Commercial - San Juan	2 week seine fishery/ 30-50 boats				2 week seine fishery/ 50 + boats				2 week seine fishery/ full fleet + gillnet fishery			
- Fraser Gillnet	2-3 week fishery				2-3 week fishery				2-3 week fishery			
- WCVI Troll	Closed areas/coho bycatch cap				Fewer closed areas/ increased bycatch/cap				No closed areas for coho reasons/ limited coho retention with cap			
Recreational - Marine	Marked coho retention only				Marked coho retention only				Coho retention			
- In-River	Marked coho retention only/ Fraser closed early Sept to mid Oct to all salmon fishing				Marked coho retention only/ no Fraser closure				Coho retention			
<b>Coho Harvest '000 fish</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
First Nations FSC - Marine	1	1	1	1	NA	NA	NA	NA	NA	NA	NA	NA
- In-River	4	4	4	4	NA	NA	NA	NA	NA	NA	NA	NA
- Total	5	5	5	5	NA	NA	NA	NA	NA	NA	NA	NA
Commercial - Marine	5	5	5	5	35	35	35	35	200	200	200	200
Recreational - Marine	54	54	54	54	340	340	340	340	560	560	560	560
- In-River	16	16	16	16	80	80	80	80	100	100	100	100
- Total	70	70	70	70	420	420	420	420	660	660	660	660
<b>Sockeye Harvest '000 fish</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
First Nations FSC - Marine	160	160	160	80	NA	NA	NA	NA	NA	NA	NA	NA
- In-River	790	790	790	395	NA	NA	NA	NA	NA	NA	NA	NA
- Total	950	950	950	475	NA	NA	NA	NA	NA	NA	NA	NA
Commercial - Marine	1650	3400	940	0	1650	4000	1000	0	1650	5100	1060	0
Recreational - Marine	5	5	2	0	6	6	3	0	6	6	3	0
- In-River	95	95	48	0	144	144	72	0	144	144	72	0
- Total	100	100	50	0	150	150	75	0	150	150	75	0



### Exhibit 3: Fisheries Management and Harvest Scenarios – Interior Coho (cont'd)

	Base Case Scenarios*											
	#1 Current Marine Survival ~2 to 3%				#2 Improved Marine Survival ~5%				#3 Superior Marine Survival ~8%			
	2005	2006	2007	2008	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
<b>Chinook Harvest '000 fish</b>												
First Nations FSC - Marine	5	5	5	5	NA	NA	NA	NA	NA	NA	NA	NA
- In-River	30	30	30	30	NA	NA	NA	NA	NA	NA	NA	NA
- Total	35	35	35	35	NA	NA	NA	NA	NA	NA	NA	NA
Commercial - Marine	150	150	150	150	150	150	150	150	180	180	180	180
Recreational - Marine	88	88	88	88	88	88	88	88	130	130	130	130
- In-River	12	12	12	12	12	12	12	12	20	20	20	20
- Total	100	100	100	100	100	100	100	100	150	150	150	150

\* The catch projections under Current Marine Survival conditions reflect anticipated catches for years 2005 to 2008 respectively. The catch projections under the two better survival conditions reflect anticipated catches in 2005 to 2008 if the better conditions occurred immediately and if fisheries management reflected these better conditions. But in actual practice, the current poor conditions are expected to persist for several years. Improved and Superior Marine Survival conditions therefore are not reasonable in the short term – they are presented to illustrate the “upside” to catch under better oceanographic conditions.

- Notes:
1. The DFO Allocation Policy for Pacific Salmon states under Principle #2 that “After conservation needs are met, First Nations’ food, social and ceremonial requirements and treaty obligations to First Nations have first priority in salmon allocation” (DFO 1999).
  2. In all years and all scenarios the commercial catches of pinks and chum are assumed to be 1 million and 1.4 million fish respectively (these are the average catches in southern BC over the past 4 years).
  3. The 2008 commercial and recreational catches of sockeye are projected to be zero due to very low escapements in 2004.
  4. There are annual negotiations regarding the amount of FSC catch. Generally 950,000 sockeye has been the targeted amount for the last 4 years.
  5. Marine commercial catch of chinook is driven by allocations under the Pacific Salmon Treaty (PST).
  6. Coho catches include catches of both wild and enhanced/hatchery coho.
  7. Approximate probabilities for the three marine survivals are 75% Current, 20% Improved and 5% Superior (Ian Perry, DFO pers. comm.).
  8. Commercial catch projections for 2005 to 2007 under Current Marine Survival came from the 2004 Pacific Salmon Commission pre season planning model run sizes, escapement goals, and available catch for 5 sockeye stock groupings – early Stuart, early summer, mid summer, Brokenhead, and late-lates-provided by Les Jantz of DFO (the 2008 sockeye catch projection is zero).
    - 2005 – 11.62 million run size, 4.57 million escapement goal
    - 2006 – 15.79 million run size, 8.47 million escapement goal
    - 2007 – 5.96 million run size, 3.15 million escapement goal
 A 60% diversion rate through Johnstone Strait was assumed.

Source: Discussions with DFO (FSC requirements under better marine survival conditions would be determined through discussions with First Nations).

## Base Case

3.26 We identify three different Base Cases with each corresponding to a different exploitation rate (reflecting different marine survival). The Base Case is a projection of catch, without SARA-listing of Interior coho, if DFO knew with high probability that they were in the marine survival situation specified.

Base Case #1 - Current Marine Survival ~2% to 3% (12% total exploitation rate)

Base Case #2 - Improved Marine Survival ~5% (22% total exploitation rate)

Base Case #3 - Superior Marine Survival ~8% (40% total exploitation rate)

The Superior Marine Survival scenario is much less likely than the other two. Approximate probabilities for the three marine survivals are 75% Current, 20% Improved and 5% Superior (Ian Perry, DFO pers. comm.). Exhibit 3 gives the Base Case scenarios for the aboriginal FSC, commercial, and recreational fisheries.

## SARA Scenarios

3.27 The impact of SARA-listing of Interior Fraser coho depends critically upon: 1) the marine survival scenario, 2) the extent to which catches can be increased under better marine survival and, in the case of sockeye, 3) the year (sockeye returns and catches are highly cyclical). Appendix B contains the SARA scenarios for the commercial fishery, Appendix C contains the SARA scenarios for the recreational fishery.

The SARA scenarios for commercial and recreational sectors are based upon the following procedures or assumptions:

Scenarios	
No SARA "Base Case"	- based on discussions with DFO
SARA "Minimal"	- fishery is not managed conservatively under all marine survivals i.e. 75% of the catch benefits of higher marine survival are captured
SARA "Moderate"	- fishery is managed conservatively or "halfway" under all marine survivals i.e. 50% of the potential catch benefits of higher marine survival are captured
SARA "Severe"	- fishery is managed very conservatively under all marine survivals i.e., only 25% of the catch benefits of higher marine survival are captured

The three SARA scenarios should be viewed as illustrative of the range of impacts.

- 3.28 There are several limitations to the scenario specifications and resulting analysis:
- the analysis assumes instantaneous recognition and reactions from higher marine survivals whereas, in actual practice, DFO has limited ability to analyze marine survival especially in-season.
  - the higher marine survival scenarios and DFO management response to higher survivals are not realistic in the foreseeable future of the next 3 to 4 years i.e., DFO will be managing under the Current Marine Survival scenario for the next 3 to 4 years and the immediate short term impact on catch levels likely will be close to zero.

In response to the above, one should consider the 2005 to 2008 period of analysis to be representative of longer term impacts of SARA (this period contains one very good sockeye year 2006 and one very poor sockeye year 2008).

**Delisting Assumption**

- 3.29 Although SARA does not specify a delisting process and timeline, it is reasonable to assume that a listed species could be delisted if biological targets specified in the Recovery Strategy and Action Plan are met i.e., the probability of extinction is not appreciable.

For this analysis, we assume that Interior Fraser coho would be recommended for delisting by COSEWIC, if Recovery Strategy objectives are met, after 10 years and actually delisted after 12 years (this allows 2 years for consultations). Under the Act, COSEWIC is obligated to review the status of any listed species within 10 years of listing.

	Listing Period		Delisting
	2005 to 2008	2009 to 2016	2017 +
<b>Marine Survival</b>			
Current MS	~2 to 3%	~2 to 3%	~2 to 3%
Improved MS	~2 to 3%	~5%	~5%
Superior MS	~2 to 3%	~8%	~8%
<b>Catch Scenario</b>			
Current MS	Current Base	Current Base	Current Base
Improved MS	Current Base	SARA	Improved Base
Superior MS	Current Base	SARA	Superior Base

- 3.30 As denoted by the highlighted box above, SARA can have an impact in the 2009 to 2016 period under higher marine survival conditions. In other periods or with Current Marine Survival of ~2 to 3%, SARA is unlikely to affect FSC, commercial and recreational catch.

## Exhibit 4: FSC Fraser River Coho Catch 1951 to Date

	Region				Region		
	Lower <sup>a</sup> Fraser	Upper Fraser	Total		Lower <sup>a</sup> Fraser	Upper Fraser	Total
1951	2,368	1,612	3,980	1980	28,002	1,425	29,427
52	2,652	2,539	5,191	81	11,830	1,089	10,741
53	2,299	3,812	6,111	82	45,483	4,162	49,645
54	3,276	3,930	7,206	83	6,341	1,207	7,548
55	4,146	6,453	10,599	84	54,599	2,698	57,297
56	2,720	3,657	6,377	85	16,204	1,977	18,181
57	3,000	3,200	6,200	86	31,398	3,760	35,158
58	3,387	2,588	5,975	87	21,314	2,423	23,737
59	5,115	3,220	8,335	88	36,404	2,120	38,524
1960	4,920	3,185	8,105	89	8,902	1,343	10,245
61	9,095	4,087	13,182	1990	13,489	144	13,633
62	10,860	4,820	15,680	91	9,207	179	9,386
63	9,945	4,615	14,560	92	5,960	609	6,569
64	11,060	5,157	16,217	93	2,029	132	2,161
65	15,985	5,150	21,135	94	11,857	-	11,857
66	17,964	3,563	21,527	95	2,370	69	2,439
67	3,095	1,750	4,845	96	1,126	-	1,126
68	15,425	2,197	17,622	97	190	90	280
69	12,613	1,336	13,949	98	191	-	191
1970	16,090	3,300	19,390	99	891	-	891
71	13,816	4,184	17,999	2000	2,002	-	2,002
72	17,522	2,125	19,647	01	2,453	64	2,517
73	14,994	1,440	16,434	02	3,902	330	4,232
74	25,654	2,270	27,924	03	1,258	224	1,482
75	14,117	3,965	18,082	04	1,505	130	1,635
76	22,567	2,357	24,924				
77	14,383	2,160	16,543				
78	19,329	3,410	22,739				
79	10,958	4,095	15,053				

<sup>a</sup> below Sawmill Creek (includes Fraser estuary where approximately 28 First Nations fish).

Source: DFO (figures for recent years are preliminary)

### **Aboriginal FSC Fishery Catch Impacts**

- 3.31 The FSC catch for coho sockeye, and chinook does not change under each of the three SARA-scenarios during the listing period i.e., SARA has no impact on FSC catch. The insensitivity of FSC catch to SARA reflects the priority of FSC salmon allocation, second only to conservation, under DFO's New Direction Policy (DFO 1998).
- 3.32 It is possible that, if Interior Fraser Coho are listed and then rebuilt and delisted under SARA, FSC catches of coho could be higher in the long term than if the species had not been listed at all. FSC catches of coho have declined dramatically over the past 15 years from an annual average of 28,000 in the 1980s to under 5,000 today – see Exhibit 4.

### **Commercial Fishery Catch Impacts**

- 3.33 Commercial fishery catch projections are given in Appendix B. The example below displays the impacts of SARA for sockeye catch in 2006, a high run year, under the SARA assumptions of point 3.24.

	2006 Commercial Sockeye Catch '000 pieces		
	Current Survival	Improved Survival	Superior Survival
<b>Base Case</b>	3,400	4,000	5,100
<b>SARA - Minimal</b>	3,400	3,850	4,675
- Moderate	3,400	3,700	4,250
- Severe	3,400	3,550	3,825

There is a 1.7 million fish catch differential between the base case Superior Survival and the base case Current Survival (5.1 million vs. 3.4 million fish). Under “Minimal” SARA restrictions, 75% of this can be captured – the expected catch is 4.675 million fish (3.4 million + 75% of 1.7 million fish), the short term “cost” of SARA is a foregone catch of 0.425 million fish.

- 3.34 Note also the following:
- under the Current Marine Survival Scenario, SARA has zero impact i.e., the 3% Canadian ER is about as low as feasible
  - under Improved and Superior Marine Survival scenarios, the Base Case catch improves from 3.4 million to 5.1 million fish i.e., without SARA, the fleet can catch significantly more fish. But with "Severe" SARA restrictions, the fleet could be constrained to 3.825 million fish and much of the benefits of better marine survival could be foregone.
  - SARA has no impact on commercial sockeye catch in 2008 which is projected to be zero under all scenarios (the 2004 sockeye escapement was very poor)

### **Recreational Fishery Catch Impacts**

3.35 Recreational fishery catch projections are given in Appendix C. SARA will have a significant impact on the recreational catch, as illustrated below, under better marine survival conditions (Strait of Georgia recreational catches of coho approached 1 million fish in the late 1980s). These higher recreational catches result from some combination of a relaxation in the mark-only retention regulation and/or higher daily possession limits for coho.

	Recreational Coho Catch '000 pieces		
	Current Survival	Improved Survival	Superior Survival
<b>Base Case</b>	70	420	660
<b>SARA - Minimal</b>	70	333	513
- Moderate	70	245	365
- Severe	70	158	218

### **3-3 Habitat Measures and SARA**

3.36 If Interior coho is listed, there may be initiatives regarding habitat protection and environmental controls. In particular, forestry, urbanization and agricultural/water use issues could be affected. There are no hydroelectric dams on the Fraser mainstem. However, some hydroelectric dams presently exist on Fraser tributaries and several other dams are proposed. All existing coho enhancement is linked to "assessment" programs, and therefore enhancement is unlikely to be affected by listing.

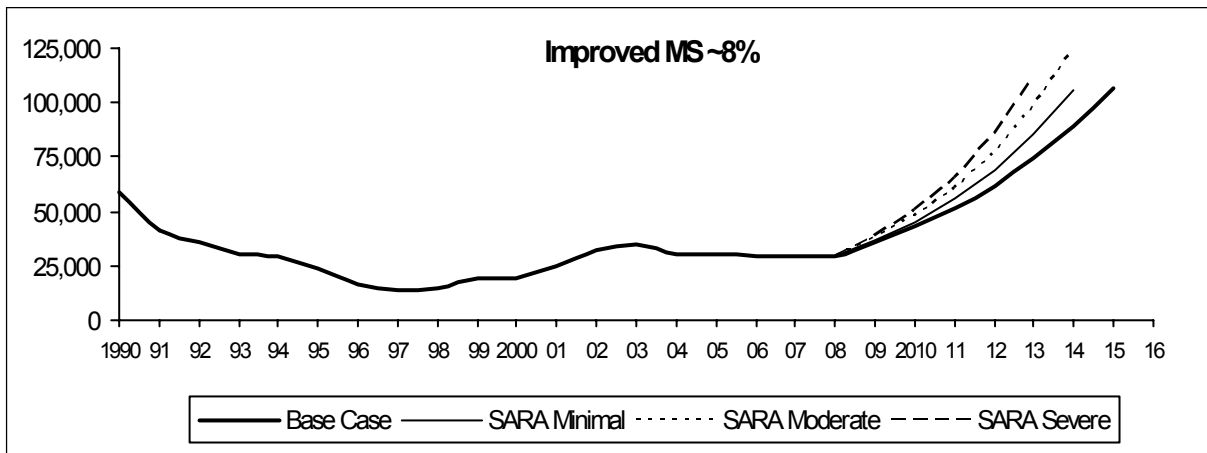
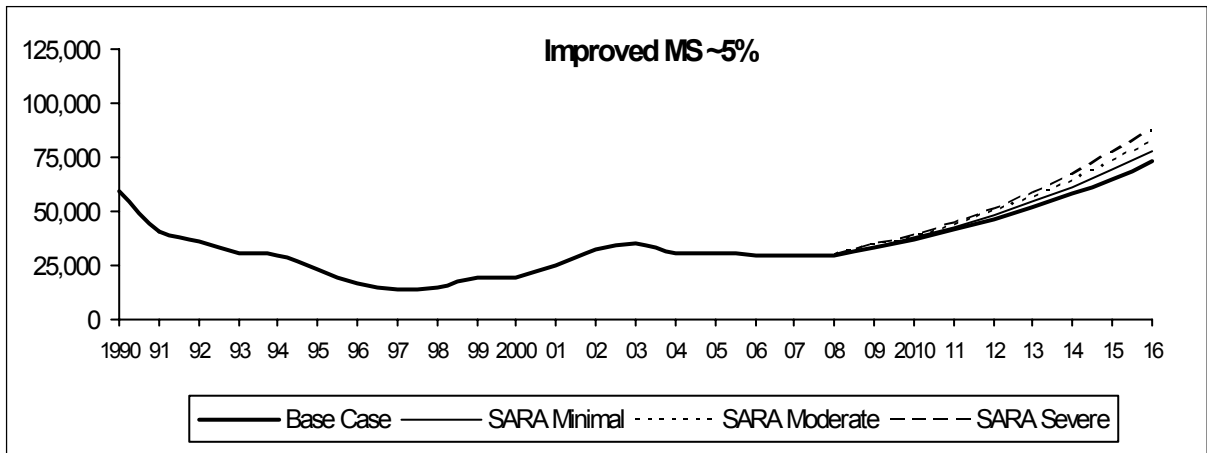
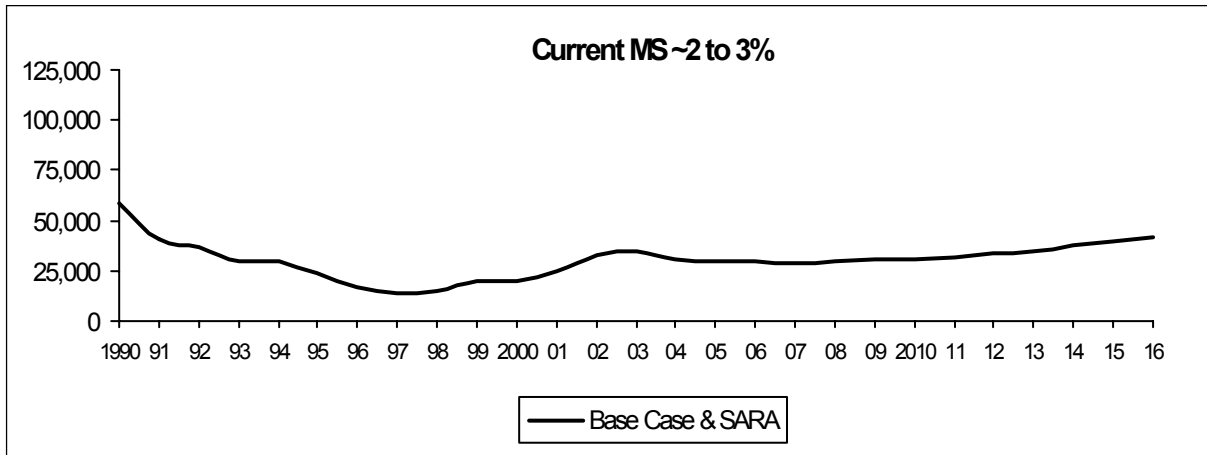
It is likely that different habitat measures would be implemented in each of the five coho areas – Fraser Canyon, Upper Fraser, North Thompson, South Thompson and Lower Thompson/Nicola.

3.37 Three areas have been proposed as "critical habitat" for Interior Fraser River coho – the portion of the Nahatlach above the lakes, the Fraser canyon in the vicinity of Hell's Gate fishways, and the North Thompson River in the vicinity of Little Hell's Gate (Interior Fraser Coho Recovery Team, 2004). DFO is planning to continue, launch or investigate a variety of habitat improvements and enhancement activities. These include:

- Improvements to the quality and quantity of riparian vegetation
- Reductions in water withdrawals from key areas
- Restoration of nursery watersheds including changes to practices in existing forestry and urban expansion
- Ensuring access to key freshwater habitats

3.38 However these habitat-related other DFO actions do not vary under each of the SARA scenarios identified above and, as a result, their impacts on returns and escapement are not addressed in this study. In addition the beneficial results of such initiatives would mainly be felt in the long term. The specification of habitat measures and their impact on coho stock rebuilding is a key component of the Action Plan process.

**Exhibit 5: Illustrative Impact of SARA on Coho Escapement Under Different Marine Survivals and Fisheries Management Regimes\***



\* Probabilities of 75% current MS, 20% Improved MS, 5% Superior MS (escapement is the 3 year geometric mean).

Source: Fisheries exploitation rates applied to a simple population model (see text, Jim Irvine DFO pers. comm.)

### **3-4 MAE – Biological Impacts**

- 3.39 The Interior Fraser Coho Recovery Team (IFCRT) has set the recovery threshold "the 3-year average escapement in at least half of the sub-populations within each of the five populations is to exceed 1,000 naturally spawning coho salmon". They suggest that this avoidance of a high risk of extinction can be achieved with a total of 25,000 wild coho spawners in the watershed (IFCRT, 2004).
- 3.40 Coho escapements have exceeded this 25,000 threshold in 3 of the last 4 years. Coho appears to be making a recovery without SARA. However, the stock has not shown a rebound for all three brood years. Although promising, the current rebound in escapement does not meet the scientific criteria for a "recovery".
- 3.41 Exhibit 5 presents escapement simulations based on a simple coho population model (Jim Irvine DFO pers. comm.):
- 45% of spawners are female
  - 80 smolts per female spawner
  - returns equal smolts 3 years previous x marine survival
  - catch equals total ER x returns
  - escapement equals returns less catch

The exploitation rates or ERs in the simulation vary with the Marine Survival (MS) and SARA scenarios:

- Base Case total ERs of 12% (3% CDN), 22% (10% CDN), and 40% (25% CDN) under Current, Improved and Superior MS respectively
- US ERs do not change with SARA
- CDN ERs under SARA Minimal, Moderate and Severe capture 75%, 50%, and 25% respectively of the potential catch benefits of higher MS

The evidence suggests that we are in a period of poor marine survival in the short term (Jim Irvine DFO and Richard Bailey DFO, pers. comm.) – but there still exist some possibility that survivals in the short term could increase if El Nino warm water events do not occur (Ian Perry, DFO pers. comm.). The assumption is made that any better marine survivals do not occur until 4 years from now in 2009. And in the SARA scenario it is assumed that, under better marine survivals Interior Fraser coho after being listed in 2005 will be delisted in 2017 after 12 years – a COSEWIC review for any listed species is mandated within 10 years of listing (the extra two years allows time for analysis, consultation, etc.).

- 3.42 The results of Exhibit 5 show that under Current Marine Survival of ~2 to 3% SARA-listing will not have any impact on coho escapements i.e., the fishery will be managed the same with or without SARA listing. Under Improved or Superior Marine Survival, coho escapements and abundance will increase under SARA.



	Average Annual Increase in Escapement*		
	2005 to 2008	2009 to 2016	2017 +
Current MS	0	0	0
Improved MS	0	2,100-6,100	positive
Superior MS	0	7,900-17,500	positive

*Source: Derived from projections in Exhibit 5 (escapement trajectories truncated at 125,000 fish)*

\* Probabilities of 75% Current MS, 20% Improved MS, 5% Superior MS

- 3.43 The results also show that, under current exploitations and marine survivals of the 2 to 3% level, Interior Fraser coho is rebuilding slowly.
- 3.44 If marine survival declines from the current 2 to 3%, then Interior Fraser coho populations also will decline and slip below the 25,000 escapement benchmark, even if Canadian fisheries exploitation rates fall to zero.
- 3.45 Under "Improved" or "Superior" marine survival, SARA initiatives launched in 2005 would result in higher escapements. This could result in more healthy long run coho populations and higher long run catches by First Nation, commercial, and recreational interest – but the distribution of this higher abundance between escapement and harvesting interests is a public policy decision.
- One can not assess the impacts of SARA on the probability of extinction of Interior Fraser coho since the original 2002 COSEWIC report and the September 2004 draft Recovery Strategy do not provide extinction probabilities at different escapement levels.
- 3.46 Habitat-related measures under SARA will strive to increase water quality and water flows. Developments affected – both existing and proposed – include forestry, agriculture (mainly water extraction), mining, urban, and linear (e.g., roads & culverts, railways). The thrust of measures will be to increase the quality of the existing 3,682 km of suitable habitat in the watershed, rather than to increase the quantity of habitat.
- 3.47 The impacts of SARA on coho habitat are very difficult to ascertain at this stage – the IFCRT has not identified specific habitat-related measures to date. It properly entails part of the Action Plan process.

### **3-5 MAE – Ecosystem Impacts**

- 3.48 Interior Fraser Coho play an integral part in the Pacific aquatic ecosystems as a delivery system for nutrients and carbon from ocean to lakes/streams. These nutrients contribute to: 1) salmon and other fish growth (Wipfli et al, 2003; Heintz et al, 2004), 2) sustenance for bears (Hildebrand et al, 1999), eagles and other animals which feed on salmon, and 3) forest growth and water quality e.g. grizzly bears carry salmon carcasses to the forest floor.

- 3.49 Interior Fraser coho are a genetically unique and locally adopted coho population. Interior Fraser coho are the last remaining coho derived from mid-Columbia River coho (extirpated), and as such represent an important genetic line. These lineages cannot be replaced once lost – the more numerous they are, the greater the biodiversity and the greater the chances for Interior Fraser coho to adjust to future environmental changes.
- 3.50 Protection and recovery measures targeted at Interior Fraser coho will promote abundance of other species within its surrounding areas. For example, the Interior Fraser Recovery Strategy has identified critical habitat and water flow measures as key protective and recovery measures necessary for each of the five Interior coho populations. These measures will provide additional benefit to spring chinook, steelhead, rainbow trout in Southern Interior streams and to forest species, such as the spotted owl, through changes in forestry practices in the Fraser Canyon (Nahatlach) system. Furthermore, protection and restoration of critical habitat will promote riparian stabilization which will benefit other aquatic dependent species such as river otters, beavers, muskrats, etc.

### **3-6 MAE – Science & Other Impacts**

- 3.51 If Interior Fraser coho are listed under SARA, there undoubtedly will be additional research on the biology of the species, their distribution and their marine and freshwater environments. However, any such funding for coho science may be not incremental as research could be foregone in other areas i.e., there is only so much research money in total available.
- 3.52 The IFCRT reports that the recovery planning process to date has resulted in many meaningful partnerships being developed with First Nations, environmental interests, businesses, and individuals. If Interior Fraser coho is listed, one would expect these partnerships and associated stewardship programs to strengthen. Environmental awareness among the general population likely would increase.

### **3-7 MAE – First Nations Impacts**

- 3.53 Salmon is important to First Nations for food, social and ceremonial (FSC) use. First Nations have locally-adapted technologies for capture and processing of salmon and economic-trade relations (Dave Moore, BCAFC pers. comm.).

*"British Columbia's First Nations have a special relationship with the wild Pacific salmon forged over nearly 10,000 years... cultures, languages and values are intimately linked to the continued existence of salmon and other marine resources" (Narcisse, 2003).*

Salmon are a focal point of stories that are passed from one generation to the next and as such, comprise an important component of First Nations culture (Roche & McHutchison, 1998).

Salmon... formed an integral part of Indian cultural life... The first fish was treated as an honoured guest of the rank of a visiting Chief [First Salmon Ceremony]. They believed that the salmon permitted itself to be harpooned or clubbed, or captured in certain definite ways consistent with the practice of the local tribe and family unit.

The fish fed these people of the coast. They fed their relatives who settled far inland along the banks of the Nass, the Skeena, the Fraser and their tributaries.

The fish determined where people lived... people lived close to the rivers because they were highways through the forests as well as conveyers upon which their protein arrived.

Hugh W. McKewill, "The Salmon People," Gray's Publishing, 1967.

- 3.54 Several First Nations have a direct interest in Fraser salmon and have had targeted FSC fisheries for these stocks. These fisheries have been curtailed over the past decade. For example, Secwepemc First Nation communities in the Fraser Interior have foregone coho fishing opportunities, a vital component of the fall food fishery, in an effort to conserve the stock.

*Interior Fraser coho return to spawn primarily within the traditional territories of the Secwepemc people (North and South Thompson and Clearwater rivers) and of the Nlaka'pmux, Sce'exmx and Okanagan people of the upper Fraser canyon and Nicola valley. Some coho spawning also takes place within the traditional territories of the St'at'imc, (Lillooet/Bridge River areas) and Tsilhqot'in (Chilcotin river system). The Secwepemc Fisheries Commission (SFC) and the Nicola Valley Stewardship and Fisheries Authority (NWFSa) represent bands with knowledge of traditional fisheries (COSEWIC 2002).*

- 3.55 In addition, a number of other First Nations harvest Fraser stocks in areas where Interior coho are taken as part of a mixed stock fishery. The Kwakwiltl Territorial Fisheries Commission representing an amalgm of Bands harvests sockeye in Johnstone Strait. The Musqueam, Matsqui, and other Lower Mainland Bands harvests Fraser salmon in the Fraser estuary and downstream of the Vedder River on the Fraser mainstem.

- 3.56 These harvests provide an important source of food to aboriginal people. Such subsistence harvesting also provides very important social and cultural benefits to aboriginal people.

- Distribution – sharing of food among an extended family and the community
- Cultural expression and continuity – providing linkages to traditional lifestyles and ancestors
- Socialization – integrating young people into work roles and the community

- 3.57 As noted previously, SARA will not reduce FSC catch. However, recovery efforts for Interior Fraser coho, if successful, would enhance long term benefits accruing to First Nations from the marine resources of British Columbia.

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**Exhibit 6: Projected Commercial Salmon Sector Economics – Southern BC 2005**

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**2005 Commercial Salmon Catches – Southern BC**

chinook	—	150,000	pieces
chum	—	1,400,000	"
coho	—	5,000	"
pink	—	1,000,000	"
sockeye	—	1,650,000	"

**Salmon Fleet\*\*\***

Revenues	\$35 million
Crew Wages	\$12 million
Earnings/EBITDA*	zero
Person Weeks Employment	14,500

**Salmon Processors**

Revenues	\$65 million**
Plant Wages	\$10 million
Earnings/EBITDA*	\$2 million
Person Weeks Employment	15,500

\* Earnings Before Interest, Taxes, Depreciation and Amortization.

\*\* Processing margin is \$30 million (\$65 product sales less \$35 million fish purchases).

\*\*\* Fleets from Areas B, D, E, G & H.

Source: GSGislason & Associates Ltd. estimates derived from DFO catch projections.

3.58 A substantial 25% share of southern commercial salmon licences are operated by First Nations. And there are many First Nations employed in fish processing plants, especially in Northern Vancouver Island.

	Seine Area B	Gillnet		Troll		Total
		Area D	Area E	Area G	Area H	
<b>Native Participation</b>						
% Native Owned	29%	38%	17%	13%	14%	22%
% Native Operated	46%	38%	17%	13%	15%	25%

Source: Michelle James "Native Participation in British Columbia Commercial Fisheries 2003".

As a result, reductions in commercial catch will result in reductions in aboriginal revenue, wages, net returns, and employment.

### 3-8 MAE – Business Impacts

3.59 Even without SARA-imposed restrictions, the financial health of the fleet and processor sectors is precarious as a result of the very large fleet of 1,100 vessels with high fixed costs assumed to be in operation – see Exhibit 5. The salmon fleet would have to be substantially smaller, with the departing vessels having fixed costs serviced from another income stream, for the remaining vessels to earn essentially zero return on investments. Processing earnings although positive do not represent an adequate return on investment. SARA restrictions magnify what is already a very difficult situation.

### Commercial Fishing

3.60 Commercial sector revenues are reduced by wages, other operating costs (e.g., fuel, food) and fixed costs (e.g., insurance, moorage, gear, repairs) to arrive at estimates of net return to capital to cover interest, depreciation, and before tax profit (often called EBITDA or Earnings Before Interest, Taxes, Depreciation and Amortization). The cost calculations are based on simple ratios which in turn are based on the consultant's experience with the salmon fishery, fleet costs & earnings surveys, and processor financials over the past 25 years. (The information is used in Exhibit 6 and the Regional Development Impact section to follow).

3.61 Exhibits B.6 and B.7 in Appendix B presents fishing (landed) plus processing (processed) values for the Base Case and the SARA scenarios. The results are derived from the catch scenarios and prices in Appendix B. The prices approximate those received in 2004. The results of Exhibit B.7 can be summarized as:

	Cumulative Commercial Losses \$ million NPV*		
	2005 to 2008	2009 to 2016	2017 +
<b>Landed Value</b>			
Current MS	0	0	0
Improved MS	0	3.4 to 10.0	0
Superior MS	0	12.1 to 36.1	0
<b>Processed Value</b>			
Current MS	0	0	0
Improved MS	0	4.9 to 15.0	0
Superior MS	0	17.5 to 52.9	0

Source: Exhibit B.7, Appendix B.

\* Probabilities of 75% Current, 20% Improved and 5% Superior Marine Survival (MS).

The losses are the cumulative Net Present Value (NPV) of gross revenue losses over the 2005 to 2016 period using a 6% real discount rate. The gross revenue losses are mainly felt in Seine Area "B" and Gillnet Area "E", the areas catching the most sockeye.

3.62 Under Low Marine Survival, the impact of SARA on commercial revenues is zero as the Canadian commercial exploitation rate (ER) is already at a very low 3% level, and can not really be reduced further. The low end of the ranges above refers to "Minimal" SARA restrictions, the high end to "Severe" SARA restrictions (the impact of "Moderate" restrictions is about halfway between the two). The cycle year 2006, a high run sockeye year is the year when most of the commercial losses occur.

Most of the losses in commercial revenues results from reduced catch of sockeye, rather than reduced catches of coho or chinook, under SARA. Sockeye business impacts are zero in every fourth year since no commercial catch of sockeye is anticipated in 2008 under any scenario considered (see Exhibit B.6, Appendix B).

3.63 The listing of Interior Fraser coho as an endangered species may have some ramifications in the marketplace e.g., it could reduce consumer demand for all BC salmon.

3.64 With SARA commercial catches and revenues will be lower in the mid term, as discussed here, under better marine survival conditions. However, in the long run commercial catch could be higher, depending on the management regime, than without SARA. The analysis assumes the commercial catch from 2017, the year of delisting, onwards is the same with vs. without SARA. If delisting is not possible or occurs at a later date, business losses would be higher than projected.

## Recreational Fishing

- 3.65 Recreational sector revenues in the Base Case are based on expenditures of \$240 per angler-day or \$600 per salmon caught. Changes in catches from the Base Case are valued at \$90 per fish i.e., 85% of any change in angling effort represents effort redirected to/from other fisheries. The daily expenditures are based on the SWOT Assessment by GSGislason & Associates Ltd. (2004) and the DFO 2000 Survey of Recreational Fishing (2003) respectively. The effort response function is based on Gislason et al (1996).
- 3.66 Exhibits C.2 and C.3 in Appendix C present angler expenditures for the Base Case and the SARA scenarios (these are gross expenditures). The recreational sector results of Exhibit C.3 can be summarized as:

	Cumulative Angler Expenditures Losses \$ million NPV*		
	2005 to 2008	2009 to 2016*	2017 +
Current MS	0	0	0
Improved MS	0	41.9 to 126.7	0
Superior MS	0	73.9 to 222.7	0

Source: Exhibit C.3, Appendix C.

\* Probabilities of 75% Current, 20% Improved and 5% Superior Marine Survival (MS).

Under Current Marine Survival, the impact of SARA is zero as the Canadian ER can not really be reduced further from the very low 3% level. The low end of the ranges above refer to "Minimal" SARA restrictions, the high end to "Severe" SARA restrictions (the impact of "Moderate" restrictions is about halfway in between).

Most of the losses in recreational expenditures result from reduced angling opportunities for coho, rather than sockeye or chinook, under SARA.

- 3.67 The recreational sector impacts of SARA will not be distributed evenly throughout southern BC waters. Rather impacts are expected to be isolated to certain terminal and marine areas such as the Fraser mainstem and Georgia Strait respectively.
- 3.68 The analysis indicates that the commercial sector exhibits greater annual variability in revenues under the various scenarios than does the recreational sector. This reflects the importance of sockeye to the commercial sector, and the substantial cyclical nature of sockeye returns and catches.

## Other Sectors

3.69 Five activities – forestry, mining, agriculture, urbanization and linear development – were identified previously as potentially affected by SARA-listing of Interior Fraser coho. Impacts could be most pronounced for agricultural water extraction (irrigation) activities in the Thompson and South Thompson regions and for forestry activities in the Nahatlach in the Fraser Canyon area. Increased costs associated with all industry could be several million dollars annually.

However, compliance costs to SARA-induced habitat measures can not be estimated until the Action Plan is formulated.

### 3-9 MAE – Government Impacts

3.70 DFO has incurred significant costs related to SARA and its associated recovery planning process for Interior Fraser sockeye. These costs include the value of DFO personnel time and associated personnel expenses e.g., travel. DFO has spent significant monies on contractors that have worked on hatchery programs, habitat improvement contracts, science investigations, and the like. The provincial government also has spent professional time and incurred expenditures related to the SARA process. An approximation to the magnitude of these costs is:

		<b>Federal &amp; Provincial SARA Costs 2004/05</b>
Person-Years		2.5
Costs	- Labour*	\$275,000
	- Other	<u>\$175,000</u>
	- Total	<u>\$450,000</u>

\* Includes benefits plus O&M imputed e.g., rent, supplies etc.

These 2004/05 costs are independent of any listing decisions.

3.71 The cumulative personal, corporate, and commodity (PST, GST, fuel, etc.) tax implications of SARA options are (\$ 2004 NPV):

	<b>Cumulative Government Tax Losses \$ million*</b>		
	<b>Personal**</b>	<b>Corporate***</b>	<b>Commodity</b>
Current Marine Survival	0	0	0
Improved Marine Survival	2.3-6.9	0.4-1.3	5.4-16.3
Superior Marine Survival	4.7-14.2	0.7-2.2	9.7-29.2

\* Probabilities of 75% Current MS, 20% Improved MS, 5% Superior MS.

\*\* Assumed to be 20% of the wage loss.

\*\*\* Assumed to be 1% of the expenditure loss for angling.

The lower end of the range corresponds to Minimal SARA, the upper end to Severe SARA (and the mid point to Moderate SARA).



The federal-provincial split of personal income taxes depends on the taxable income level but likely is about 70:30 overall in British Columbia. The federal-provincial split of corporate income taxes is approximately 75:25 (although the actual rate/split depends on whether the corporation qualifies for the small business rate). The federal:provincial split of commodity taxes is approximately 60:40.

- 3.72 There are no impacts on DFO commercial licence fee revenue since it is assumed the fleet size stays the same under all scenarios. There would be some negative impacts on both federal and provincial angling licence fee revenues arising from SARA.

SARA could also impact local government revenues and costs through, for example, property tax and sewage treatment. Again no information on these potential outcomes and associated local government revenues/costs are available.

- 3.73 There could be some broad-based government benefits from SARA-listing. Canada was the first industrialized nation to ratify the UN convention on Biological Diversity signed by over 150 countries at the 1992 Earth Summit in Rio de Janeiro. Providing protection to stabilize and recover species demonstrates Canada's commitment to the convention. In addition:

- actions to protect and recover species will contribute to Canada's image as an international leader in environmental conservation
- actions to protect and recover species supports Canada's role in international trade discussions

It is also possible that without legislation and consequent compliance that the US could suggest Canada has an unfair trade advantage over US firms.

### 3-10 MAE – Regional Development

- 3.74 The cumulative impacts of SARA on provincial measures of Gross Domestic Product or GDP (\$millions), wages, (\$ millions), and employment (person-years) under the SARA scenarios are (\$ 2004 NPV):

	Cumulative Direct Losses*			Cumulative Total Losses*		
	GDP	Wages	Employment	GDP	Wages	Employment
Current Marine Survival	0	0	0	0	0	0
Improved Marine Survival	19-55	12-35	350-1,030	28-83	18-53	560-1,650
Superior Marine Survival	36-107	24-71	730-2,160	54-161	36-107	1,170-3,460

\* Probabilities of 75% Current MS, 20% Improved MS, 5% Superior MS.

The above impacts include both commercial and recreational sector impacts. The estimates are derived from the fisheries SWOT study (GSGislason & Associates Ltd. 2004), from estimates based on available financial data for the commercial sector, and from provincial multiplier analysis (Horne 2004). Total impacts include indirect supplier plus induced consumer responding impacts as well as direct impacts.

## Exhibit 7: Commercial Salmon Licences and Salmon Processing Activity by Region

Region <sup>1</sup>	2004 <sup>2</sup> FRCs	2004 Commercial Salmon Licences <sup>3</sup>								2002 Wild Salmon Processing <sup>4</sup> Person-Years	
		Seine		Gillnet			Troll				Total
		A	B	C	D	E	F	G	H		
Queen Charlotte Islands	141	1	-	10	1	-	13	-	-	25	13
North Coast	1,057	9	3	287	47	12	24	2	1	385	289
Central Coast	141	2	1	56	12	3	2	-	-	76	*
Van Island - North	491	8	13	53	49	-	5	12	5	145	24
- Mid	1,524	9	30	38	65	8	33	51	67	301	70
- South	873	1	4	16	17	17	21	44	32	152	98
- West Coast	420	-	-	1	6	3	3	48	2	63	*
- Victoria	526	-	1	6	4	3	23	40	13	90	24
Sunshine Coast	539	2	-	39	17	14	8	1	7	88	*
Lower Mainland	2,168	76	114	197	65	334	25	29	19	859	1,092
Other BC	151	1	1	4	1	6	1	4	1	19	0
Outside BC	48	-	-	3	2	-	-	3	-	7	0
Unknown	0	-	-	7	2	1	-	-	-	10	0
Total	8,079	109	167	717	288	401	158	233	147	2,220	1,635

Notes: 1. Licences are allocated to each region based on location of principal contact/owner e.g., processing company – owned licences are allocated to head office location, the 254 NNFC gillnet licences are allocated to the North Coast. The 2,220 licences are on about 1,800 vessels i.e., about 420 licences are "stacked" on vessels having more than one licence.

2. Fisher Registration Card (a requirement for skippers & crew members on commercial fishing vessels).

3. Total employment – skippers plus deckhands – on salmon vessels would be about 4,000 jobs or half the total individuals with an FRC (each salmon crew job would last at most 8 weeks).

4. Person-years employment Includes activity from processing raw fish imported from Alaska.

Source: Derived from December 2004 data provided by DFO Licencing and GSGislason & Associates Ltd. "British Columbia Seafood Sector and Tidal Water Recreational Fishing: A Strengths, Weakness, Opportunities and Threats (SWOT) Assessment", Final Report Prepared for BC Ministry of Agriculture, Food & Fisheries, February 2004.

### **3-11 MAE – Social & Community Impacts**

- 3.75 Salmon are special to the people of British Columbia. Beyond their economic importance, salmon are part of the intrinsic identity of the province, to both those who live here and those who visit from afar. The salmon and the people, businesses, and communities that depend on them are a rich part of our cultural heritage and psyche. Losing this rich endowment seems unthinkable (GSGislason & Associates Ltd. 1998).
- 3.76 Salmon also are important in their own right to the people of British Columbia and Canada, the so-called "existence value" discussed in Section 2-4, Chapter 2. A wide variety of people value the continued existence of salmon regardless of whether or not they or their ancestors "use" the resource.
- 3.77 For example, a household survey in the US Pacific Northwest estimated the existence value of doubling Columbia River salmon runs to be \$27 US per household and \$12 US per fish annually in 1990 (equivalent to about \$20 Canadian per fish today). While this study addresses all species of salmon, and not one species or one subspecies such as Interior Fraser coho, it does illustrate the value that society at large places on healthy salmon populations (Olsen et al, "Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs", 1991).
- 3.78 Analysis of the recreational fishery in British Columbia has indicated that anglers are willing to pay (WTP) more than the amount they actually spend in order to continue to fish. For example, Gislason et al (1996) estimated such WTP benefits for BC chinook and coho angling to be 21 cents on top of every dollar of actual angler expenditure. The non-market benefits to society of angling for salmon are substantial.
- 3.79 Exhibit 7 gives the regional distribution of commercial salmon licences and salmon processing employment. There are several communities such as Alert Bay, Sointula, Port Hardy and Quadra Island that depend heavily on Fraser salmon and the economic benefits generated. Significant reductions in salmon runs and harvest from historical levels will have negative repercussions for a wide variety of people and communities in Southern BC.

### **3-12 SARA Impact Summary**

- 3.80 The following panel summarizes the potential SARA measures and associated impacts.

## SUMMARY – INTERIOR FRASER COHO SARA IMPACTS

<b>Current Situation &amp; Potential SARA Actions</b>	
Current Situation	<ul style="list-style-type: none"> <li>- significant decline in 5 main populations since 1980s (Fraser Canyon, Upper Fraser, North Thompson, South Thompson and Lower Thompson/Nicola)</li> <li>- high fishing exploitation rates (ERs), decline in marine survivals (MS) &amp; habitat loss contributed to decline</li> <li>- DFO implemented significant fishing restrictions in late 1990s</li> <li>- species appears to be rebounding at current low 12% ER (3% Canadian ER is all non-directed fisheries, remainder is US fishery ER entitled under Pacific Salmon Treaty)</li> <li>- late run Fraser sockeye fisheries currently curtailed for conservation reasons (late run sockeye and Interior coho co-mingle)</li> </ul>
Fisheries Actions	<ul style="list-style-type: none"> <li>- analyzed under three views of future MS: Current ~2 to 3% (75% probability), Improved ~5% (20% probability), Superior ~8% (5% probability)</li> <li>- under current MS, fisheries would be managed the same as without SARA</li> <li>- under better MS, not all potential catch benefits can be captured due to: 1) “burden of proof” justifying catch increase would be greater, 2) legal challenges could occur i.e., DFO would have to manage the fishery more conservatively</li> <li>- assumed listing occurs in 2005, delisting in 2017 if Recovery Target met (10 year COSEWIC review plus 2 years consultations)</li> </ul>
Habitat Actions	<ul style="list-style-type: none"> <li>- could affect forestry, agriculture (mainly water extraction), mining, urban &amp; linear developments (e.g., roads and culverts)</li> <li>- difficult to identify since entails part of Action Plan</li> </ul>
<b>Potential Impacts of SARA</b>	
<b>Environmental Impacts</b>	
1. Biological	<ul style="list-style-type: none"> <li>- under current MS Interior Fraser coho is rebuilding slowly and should surpass on a consistent basis recovery target of 25,000 wild spawners in a few years</li> <li>- zero impact on escapement in short term 2005 to 2008</li> <li>- with SARA, improvements in escapement 2009 + under better MS conditions</li> </ul>
2. Ecosystem	<ul style="list-style-type: none"> <li>- habitat measures will increase water quality and water flows</li> <li>- preserve genetic diversity</li> <li>- increased coho populations lead to increased nutrients which contribute to fish growth, nutrients to bears, eagles &amp; other animals, and forest growth</li> </ul>
3. Science/Other	<ul style="list-style-type: none"> <li>- additional research spurred</li> <li>- foster environmental partnerships and awareness</li> </ul>
<b>Socio-Economic Impacts</b>	
4. First Nations	<ul style="list-style-type: none"> <li>- salmon has significant food, social &amp; ceremonial (FSC) values</li> <li>- salmon also contribute to distribution, cultural expression and socialization roles in First Nation communities</li> <li>- no impact on FSC catch during listing period due to allocative priority after conservation/after delisting, FSC harvests could increase</li> <li>- 25% of Southern BC commercial salmon licences operated by First Nations</li> </ul>

*continued*

## SUMMARY – INTERIOR FRASER COHO SARA IMPACTS (continued)

<b>Potential Impacts of SARA</b>	
<b>Socio-Economic Impacts cont'd</b>	
5. Business	<ul style="list-style-type: none"> <li>- present health of salmon fleet &amp; processors without SARA is precarious</li> <li>- zero business impacts in short term 2005 to 2008</li> <li>- reduced commercial (landed value &amp; processor) gross revenues and angler expenditures in medium term 2009 to 2016 under higher MS</li> <li>- zero business impacts in long term 2017 + after delisting</li> <li>- angler expenditure losses much larger than commercial sector losses due to greater recreational dependence on coho (also commercial opportunities constrained by late run sockeye concerns)</li> <li>- other industry impacts (e.g., forestry, agriculture) could be significant</li> <li>- listing could reduce market demand for BC Salmon</li> </ul>
6. Government	<ul style="list-style-type: none"> <li>- listing may enhance Canada's international image in environmental conservation</li> <li>- loss of personal, corporate &amp; commodity (e.g., fuel, GST) taxes</li> </ul>
7. Regional Development	<ul style="list-style-type: none"> <li>- loss in GDP, wages and employment</li> </ul>
8. Social & Community	<ul style="list-style-type: none"> <li>- salmon are special to residents and visitors to province</li> <li>- significant "existence" value enhanced under SARA</li> <li>- several communities, including First Nation communities, on or near Vancouver Island depend on salmon</li> </ul>
<b>Key Assumptions, Uncertainties and Risks</b>	
1.	improved Marine survival (MS) is key to long term recovery of species
2.	it is assumed that MS will not change in short term 2005 to 2008 period
3.	delisting is assumed for 2017 – if delisting is delayed or can not occur then negative business impacts would be larger
4.	after delisting, it is unknown how increased returns will be split between escapement and harvest interests
5.	future salmon returns, escapement and harvests subject to significant uncertainty (in large part tied to marine survival uncertainty)
6.	it is unclear how the Wild Salmon Policy, McRae – Pearse consultations, the First Nation Panel Report, and other policies or initiatives will affect the fishery of the future
7.	Canada can not influence US catches of Interior Fraser coho under Pacific Salmon Treaty
8.	the SARA commercial and recreational sector catch scenarios under Minimal, Moderate and Severe SARA restrictions (of 75%, 50% and 25% catch benefit capture) is arbitrary
9.	the analysis does not address potential policy options and adjustment mechanisms that could mitigate adverse impacts e.g., new opportunities could emerge if transfers between commercial salmon areas/interests were feasible, opportunities could exist for new in-river fisheries (DFO is unable to quantify such opportunities at the present time).
10.	it is unknown what habitat-related measures might be implemented and what their impacts on the resource and on affected industry might be

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## 4.0 SOCIO-ECONOMIC IMPACTS – BOCACCIO

4.1 This section applies the Multiple Account Evaluation Framework of Exhibit 2, Section 2 to the case of SARA-listing of bocaccio.

### 4-1 Background

#### *Species Description and Status*

4.2 Bocaccio (*Sebastes paucispinis*), commonly called “longjaw” by fishermen, is one of over 35 species of rockfish in the marine waters off British Columbia. Bocaccio are found in eastern Pacific Ocean waters from northern Mexico to the Gulf of Alaska. Within British Columbia the distribution is widespread over the continental shelf and also includes enclosed waters and inlets. Bocaccio are larger than most other rockfish with an adult weight averaging 4 kg.

4.3 Adult bocaccio are found over a variety of bottom types, most commonly over 60-340 m in depth. Bocaccio are sometimes scattered, and sometimes are found in schools. Bocaccio are primarily piscivorous.

4.4 In the commercial fishery, most bocaccio catches occur through bottom trawling by "T" licensed trawlers for rockfish (including Pacific ocean perch), soles, Pacific cod and other groundfish species. Very few bocaccio are caught in the mid water trawl fishery for hake. The commercial hook & line fleet for groundfish also encounters bocaccio although it is not a targeted species. Bocaccio have physoclastic swim bladders that cannot accommodate the sudden change in pressure when brought to the water surface, the resulting barotrauma causes death for almost all fish caught i.e., at-sea releases are not an option.

4.5 Little is known about the productivity and sustained yield potential of the species. There are no biomass estimates and no exploitation rates. This lack of information prevents the setting of analytically-based TAC (Total Allowable Catch) or exploitation rate targets for the species i.e., there is no groundfish trawl or hook & line TACs for bocaccio. Bocaccio is one of a number of general rockfish "other" species such as darkblotch, redbanded and sharpchin without a specific TAC – catches of these auxiliary species are managed in the aggregate through a 15,000 lb (6,800kg) limit per groundfish trawl trip.

4.6 The available evidence from limited surveys in BC waters suggests a significant decline in abundance in Southern waters from the early 1980s to the present. Other data suggest that the 1980s may have seen a period of peak abundance and the evidence of decline from the earlier 1970s period is less clear (Stanley and Starr 2004). Available indices indicate that population abundance has been stable over the past decade. It is thought that a combination of low recruitment and possibly harvest impacts resulted in the decline. The abundance trends for other coastal BC waters is less certain.

- 4.7 Since the late 1990s commercial catches have stabilized at about 300 tonnes per year (the sum of landings plus at-sea releases) – about 260 tonnes groundfish trawl commercial fleet, 40 tonnes other commercial fleet and trace amount other (recreational and aboriginal).
- 4.8 COSEWIC identified bocaccio as "threatened" in 2002 (although the data were interpreted to reflect a decline of greater than 50% which would qualify for "endangered" status, the listing was reduced to "threatened" because of the limited area represented by the abundance indices – Stanley and Starr, 2004).
- 4.9 Neither a Recovery Strategy nor an Action Plan has been developed for bocaccio. However, recently an Allowable Harm Assessment has been completed (Stanley & Starr 2004).

### ***Conservation Measures to Date***

- 4.10 Although significant conservation measures have previously been adopted for a variety of trawl and hook & line rockfish, prior to 2003 no bocaccio-specific conservation measures were initiated. General rockfish conservation measures have been adopted by commercial fleets since the mid 1990s.
- 4.11 The groundfish trawl fleet has adopted several measures that have enhanced conservation and sustainable fishing practices for all species – namely a 100% dockside monitoring program (1994), a 100% at-sea observer coverage (1996), and an Individual Vessel Quota or IVQ program (1997). The fleet, through voluntary and regulatory closures, avoids sensitive habitat areas e.g., sponge reefs in Queen Charlotte Sound.
- 4.12 The hook & line fleets also have adopted conservation and monitoring measures. For example, the halibut fleet went to an IVQ program in 1991 which entailed 100% dockside monitoring. Presently there is partial 10 to 20% at-sea observer coverage of hook & line fleets – but at-sea monitoring of the hook & line sector is expected to reach 100% by the 2006/07 fishing year.
- 4.13 In 2001, research on bocaccio status was commenced by COSEWIC and by DFO through its PSARC process (in fact the resultant reports are closely related as the main researchers were the same individuals). The initial 2001 PSARC document subsequently was updated and revised in 2004 (Stanley et al 2004).
- 4.14 For the 2004/05 fishing year the groundfish trawl "T"-licensed fleet adopted more selective harvesting practices and a voluntary program to avoid fishing known bocaccio areas at certain times of the year, and to direct the proceeds of all landed bocaccio rockfish to research and management purposes. The action is intended to eliminate directed fishing at bocaccio by the trawl fleet and to reduce bocaccio catches.

## Exhibit 8: Fisheries Management and Harvest Scenarios Under SARA – Bocaccio

	Base Case	Options			
		#1 Minimal Cap Catches with TAC	#2A Moderate 50% Reduction no TAC	#2B Moderate 50% Reduction with TAC	#3 Severe 75% Reduction with TAC
<b>Bocaccio Assumptions</b>					
Objective	Maintain Status Quo	Maintain Status Quo	Rebuild	Rebuild	Accelerated Recovery
Biomass Level	Unknown	Unknown	Unknown	Unknown	Unknown
Exploitation Rate	Unknown	Unknown	Unknown	Unknown	Unknown
<b>Management Regime</b>					
Commercial - GF Trawl "T"	Status Quo	TAC & IVQ	Avoidance	TAC & IVQ	TAC & IVQ
- Hook & Line	Status Quo	TAC	Avoidance	TAC	TAC
Recreational	Status Quo	Status Quo	Status Quo	Status Quo	Zero Retention
Aboriginal	Status Quo	Status Quo	Status Quo	Status Quo	Status Quo
<b>Commercial GF Landings tonnes</b>					
Groundfish Trawl "T" - Bocaccio	~260	~260	~130	~130	~65
- "Other RF"	~1,000	~900	~700	~600	~500
- Hake	~145,000	~145,000	~145,000	~145,000	~145,000
- Other	<u>~39,000</u>	<u>~38,220</u>	<u>~38,220</u>	<u>~35,100</u>	<u>~23,400</u>
- Total	~185,260	~184,380	~184,050	~180,830	~168,965
Hook & Line - Bocaccio	~40	~40	~20	~20	10
- Other	<u>~15,000</u>	<u>~14,700</u>	<u>~14,700</u>	<u>~13,500</u>	<u>~9,000</u>
- Total	~15,040	~14,740	~14,720	~13,520	~9,010
All Commercial - Bocaccio	~300	~300	~150	~150	75
- "Other RF"	~1,000	~900	~700	~600	~500
- Hake	~145,000	~145,000	~145,000	~145,000	~145,000
- Other	<u>~54,000</u>	<u>~52,920</u>	<u>~52,920</u>	<u>~48,600</u>	<u>~32,400</u>
- Total	~200,300	~199,120	~198,770	~194,350	~177,975

- Notes: 1. First Nations food, social, and ceremonial (FSC) requirements and treaty obligations to First Nations are second only to conservation in fisheries allocation.
2. Very little is known about bocaccio – no biomass or exploitation rates exist. Bocaccio is not a targeted species in the commercial fishery.
3. The options are consistent with the precautionary approach whereby fisheries can continue, in the absence of concrete biomass data, if fisheries management includes defined objectives, assessment and monitoring.
4. "Other RF" is other rockfish not under GF trawl TAC but subject to 15,000 lb (6,800 kg) trip limit.
5. The commercial hook & line fleet does not catch hake.

Source: DFO and discussions with groundfish trawl industry and the groundfish hook & line industry.



## 4-2 Fisheries Management and SARA

- 4.15 It can be argued that the 2004/05 voluntary response by the groundfish trawl fleet was spurred by the COSEWIC designation of bocaccio as "threatened" (DFO recently projected that the 2004/05 bocaccio catch from all fisheries will be in the order of 150 tonnes, down from the 300 tonnes in recent years). We consider this recent voluntary conservation initiative to be a response to the SARA process.
- 4.16 The Base Case commercial catch scenario is therefore deemed to be the recent past prior to the 2004/05 fishing year i.e. a 300 tonne catch (with no Total Allowable Catch or TAC).

### SARA Scenarios

- 4.17 We designate SARA scenarios corresponding to 100% ("Minimal"), 50% ("Moderate"), and 25% ("Severe") of the Base Case 300 tonne catch respectively – see Exhibit 8. There are two "Moderate" 50% reduction scenarios since the 150 tonne catch will have different impacts depending on whether the 150 tonne figure is a TAC or a voluntary "target". Similarly the Minimal scenario differs from the Base Case in that it involves a TAC.
- 4.18 Each of the scenarios is consistent with the precautionary approach to fisheries management and with the DFO PSARC Allowable Harm Assessment for Bocaccio (2004) which recommends permitting the continued operation of commercial fisheries.
- ...current [300 tonne] mortalities do not appear to jeopardize the survival or recovery of bocaccio in BC waters over the short term.*
- ...it is advisable to increase the likelihood and potential rate of recovery by reducing catches from the levels observed in the late 1990s and the early 2000s.*
- ...it has already been demonstrated that catches can be reduced in the commercial trawl fleet by removing incentives or implementing catch disincentives. Furthermore, current catch monitoring in this fleet is sufficiently accurate to determine the effectiveness of such management actions.*
- 4.19 A bocaccio TAC most likely means an IVQ for the species which in turn means (Stu Nelson, Deep Sea Trawlers Association or DSTA pers. comm.):
- fishing defensively to minimize chances of random, unwanted and unavoidable 'hits' of bocaccio (bocaccio are pervasive along the coast)
  - increasing avoidance of TAC and non-TAC species that most commonly co-mingle with bocaccio
  - trawl fishermen becoming less likely to pursue their 15,000 lb "other rockfish" trip limit
  - an increased amount of fish – both TAC and non-TAC – "left in the water"

- 4.20 Our projected declines in harvests by the groundfish trawl “T” fleet and by the groundfish hook & line fleets – mainly halibut “L”, rockfish “ZN” and Schedule II “C” – under each scenario are:

Catch Declines*	Scenario			
	Minimal 300t TAC	Moderate A 150t no TAC**	Moderate B 150t TAC**	Severe 75t TAC**
<b>GF Trawl Fleet</b>				
Bocaccio	-	50%	50%	75%
“Other Rockfish”	10%	30%	40%	50%
Hake	-	-	-	-
Other Groundfish	2%	2%	10%	40%
<b>GF Hook &amp; Line Fleets</b>				
Bocaccio	-	50%	50%	75%
Other	2%	2%	10%	40%

\* relative to “300 tonne (t) target with no TAC” scenario.

\*\* assumes fleet relinquishes any bocaccio caught.

The declines are based in part on discussions with industry associations and on analysis of trawl catch to date for the 2004/05 fishing year. The declines postulated for the hook & line fleet are speculative as DFO has not held any discussions with the hook & line fleet on possible fisheries management responses to SARA-listing of bocaccio. As the hook & line fleet does not have any targeted fisheries on bocaccio, the ability of the fleet to avoid bocaccio is unknown i.e., hook & line impacts may be underestimated.

- 4.21 SARA Minimal is essentially the Status Quo but with a cap – this will prevent catches from escalating. SARA Moderate A represents a substantial 50% decline in catch which, by coincidence, appears that it will be achieved with the voluntary avoidance program by the GF trawl fleet in 2004/05 (this would need to be extended to the hook & line fleets as well). The third SARA Moderate B scenario also comprise a 50% decline in catch but is enforced with a regulatory TAC. The fourth SARA Severe scenario involves much greater sacrifices by the trawl fleet plus non-trawl fleets. The designated 75% catch reduction target is arbitrary – admitted with no analytical basis to support it. Its inclusion is meant to illustrate a more severe option.
- 4.22 In the "Severe" case, the groundfish trawl catch of other/quota groundfish falls by 40% - the fleet can not avoid bocaccio completely as they appear coastwide and co-mingle with a large variety of other bottom dwelling species including silver gray, canary, lingcod, Pacific cod, redbanded, darkblotch, and rock sole. The fleet would have to cut back on catch of quota species in order to adhere to the bocaccio TAC.

There are no catch ramifications for hake under any of the scenarios as the hake fishery is prosecuted with midwater trawl gear and very rarely encounters bocaccio.

## Delisting

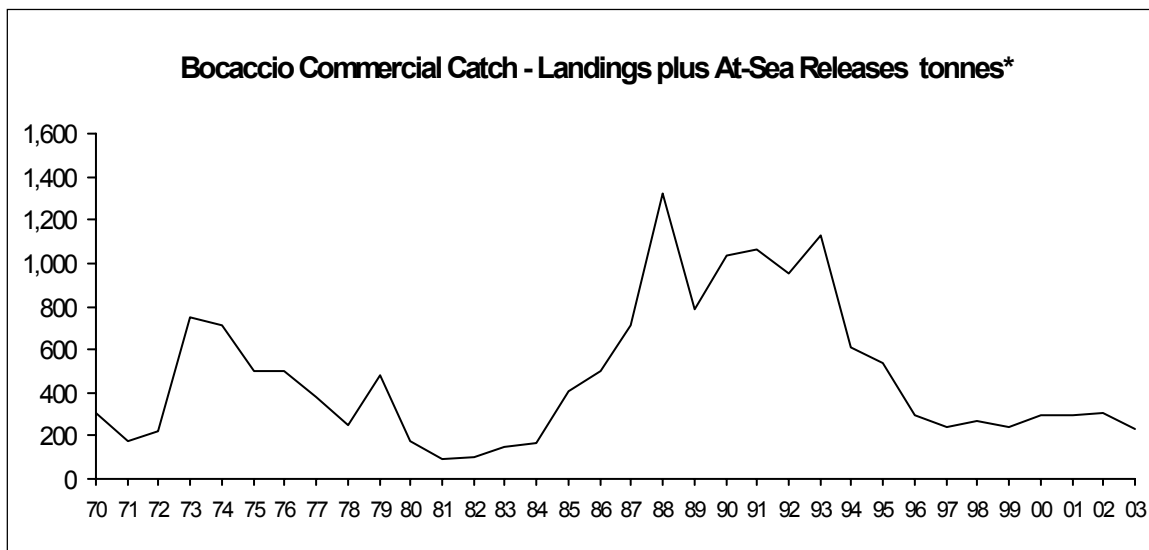
4.23 SARA does not specify a delisting process and timeline. COSEWIC could recommend a listed species be delisted if recovery objectives are met. But no Recovery Strategy with recovery objectives for bocaccio has been formulated to date. Given the long life of the species and the lack of knowledge of its abundance and sustained yield potential, it may be difficult to remove bocaccio from the list of “threatened” species if it was listed as such. Accordingly, we make no judgement or projection for delisting.

### 4-3 Habitat Measures and SARA

4.24 Currently there are no enhancement, habitat protection, or environmental control measures that specifically address bocaccio. None of these initiatives are planned to address bocaccio concerns. As the 2004 PSARC paper states "...controlling fishing mortality is the only current means of remedial action" (Stanley et al 2004).

### 4-4 MAE – Biological Impacts

4.25 The impact of SARA and SARA-induced conservation measures is unknown. Little is known about the productivity and sustained yield of the species. It is only since 1994 with the advent of the Dockside Monitoring Program (DMP) for the trawl fleet that landing statistics became reliable. It is only since 1996 with the introduction of 100% at-sea observer coverage for the trawl fleet that at-sea release figures, and hence total catch, became available for this fleet segment. SARA measures would help recovery but the recovery period could be long – the fish recruit gradually.



\* Data prior to the mid 1990s are less reliable than data for recent years

Source: COSEWIC

#### **4-5 MAE – Ecosystem Impacts**

- 4.26 Bocaccio is one of over thirty-five species of rockfish found throughout British Columbia marine waters. Reducing catch of bocaccio will help promote recovery and abundance, allowing them to occupy their traditional role within the marine ecosystem (i.e. through predator prey relationships).
- 4.27 Bocaccio range from northern Mexico to Alaska and are ubiquitous in BC, occurring as juveniles and adults from coastal inlets to outer continental shelf. BC represents a significant proportion of the North American range – and the more numerous they can become, the greater chances bocaccio have to increase their genetic diversity and adjust to future environmental changes.
- 4.28 Actions taken to limit catch of this species will also reduce catches of other rockfish species within its surrounding areas as a result of fishing restrictions.

#### **4-6 MAE – Science Impacts**

- 4.29 The COSEWIC Assessment process has spurred research on bocaccio. SARA-listing undoubtedly would spur additional research. However, any such funding for bocaccio science may not be incremental as research could be foregone in other areas i.e., there is only so much research money to go around.

#### **4-7 MAE – First Nations Impacts**

- 4.30 First Nations indicate some food consumption of bocaccio (COSEWIC Assessment of Bocaccio 2002) but data as to FSC catch of bocaccio are not available. The importance of bocaccio to First Nations will be discussed during DFO consultations.

SARA will not reduce FSC catch of bocaccio due to the allocation priority of FSC catch. However, recovery efforts for bocaccio, if successful, would enhance long term benefits accruing to First Nations from the marine resources of British Columbia.

- 4.31 There are 5 First Nations owners of Groundfish Trawl commercial licences of the total 142 (James, 2003). They will be affected as are other GF trawl operations by SARA-restrictions.

## Exhibit 9: Financial Impacts on Commercial Groundfish Industry from SARA-Listing of Bocaccio

	Impacts of SARA Options \$ millions			
	#1 Minimal Cap Catches with TAC	#2A Moderate 50% Reduction no TAC	#2B Moderate 50% Reduction with TAC	#3 Severe 75% Reduction with TAC
<b>Gross Value Declines</b>				
<b>Groundfish Trawl</b>				
Landed Value	1.0	1.6	5.3	18.9
Processing Margin	<u>1.0</u>	<u>1.6</u>	<u>5.3</u>	<u>18.9</u>
Processed Value	2.0	3.2	10.6	37.8
<b>Groundfish Hook &amp; Line*</b>				
Landed Value	1.2	1.3	6.1	24.1
Processing Margin	<u>0.4</u>	<u>0.4</u>	<u>2.0</u>	<u>8.0</u>
Processed Value	1.6	1.7	8.1	32.1
<b>Total Groundfish</b>				
Landed Value	2.2	2.9	11.4	43.0
Processing Margin	<u>1.4</u>	<u>2.0</u>	<u>7.3</u>	<u>26.9</u>
Processed Value	3.6	4.9	18.7	69.9

<sup>a</sup> over 80% of hook & line impacts are halibut fleet impacts.

Source: Derived from harvest scenarios in Exhibit 8 and data and assumptions in Appendix D.

#### 4-8 MAE – Business Impacts

4.32 The bocaccio catch restrictions under SARA result in decreased gross revenues to both groundfish fleets and groundfish processors as analyzed in Exhibit 9 and summarized below:

	Annual Commercial Revenue Losses \$millions	
	Fishing	Processing
"Minimal"	2.2	3.6
"Moderate A"	2.9	4.9
"Moderate B"	11.4	18.7
"Severe"	43.0	69.9

Processing gross revenues include fishing revenues e.g. the \$3.6 million revenue figure above includes the \$2.2 million fish cost plus \$1.4 million in processing margin.

Both groundfish trawl and groundfish hook & line fleets are impacted. The much more dramatic losses under the "Severe" case reflect the 40% loss in quota fish catch.

The above are annual losses. Discounting these annual losses over say the 12 years 2005 to 2016 at a 6% real discount rate results in a Net Present Value (NPV) loss greater than 8 times the annual loss e.g., the cumulative loss in processed value over 12 years under the "Severe" option would exceed \$550 million (\$ 2004) in gross value.

4.33 The fleet would also incur extra trips and increased fishing costs to avoid bocaccio e.g., from moving away from productive grounds for lingcod, for example, if they encountered too many bocaccio. Our discussions with industry suggest increased costs under the Moderate B scenario – a 150 tonne TAC – could approach \$2 million annually i.e., 100 extra trips at \$20,000 per trip operating costs.

4.34 We also note that complete avoidance of bocaccio is impossible without shutting down many commercial fleets in their entirety – groundfish trawl, rockfish hook & line, halibut, salmon troll, etc. – and the recreational fishery in tidal waters. So doing would cause a loss in annual revenues approaching \$1 billion. Fortunately, the Allowable Harm Assessment for bocaccio does not suggest this (DFO PSARC 2004).

4.35 The commercial groundfish trawl fleet presently is viable and the groundfish processing sector presently is viable. SARA could cause both sectors to become non-viable as each is a high volume, low value and margin industry. Moreover, if groundfish processing operations such as JS McMillan or Oceans became non-viable they may be unable or unlikely to continue to support unprofitable or marginal operations such as salmon.

4.36 Our discussions with industry also highlighted the following:

- In the short term, without biomass estimates and exploitation rates for bocaccio, it may be difficult to adjust the TAC even if indices start to indicate significant recovery (industry believes that bocaccio abundance is rising)

- but industry is confident that scientific surveys will be able to provide a science-based approach for setting a bocaccio TAC in a few years. In the meantime they would prefer that a voluntary avoidance program be maintained.
- the evidence is strong from the 2004/05 fishery that bocaccio catches are being reduced without a formal TAC and steps are being taken to enhance recovery.
- the 50% reduction scenario on a voluntary basis is the greatest reduction that can be accommodated without major changes in fishery practices and major economic loss
- the 75% reduction scenario would "leave fish in the water", reduce the season, and jeopardize relationships with year-round buyers of BC groundfish i.e. it would eliminate many of the benefits resulting from the IVQ program.
- DFO should engage in discussions with hook & line fleet sectors as to potential fisheries management response to SARA-listing of bocaccio.

#### 4-9 MAE – Government Impacts

4.37 DFO has incurred costs related to SARA and its associated recovery planning process for bocaccio. These costs include the value of DFO personnel time and associated personnel expenses e.g., travel. The provincial government also has some professional time and incurred expenditures related to the SARA process.

		<b>Federal &amp; Provincial SARA Costs 2004/05</b>
Person-Years		1.25
Costs	- Labour*	\$240,000
	- Other	<u>\$100,000</u>
	- Total	\$340,000

These 2004/05 costs are independent of any listing decisions.

4.38 The personal, corporate, and commodity (PST, GST, fuel, etc.) tax implications of SARA options are:

	<b>Annual Government Tax Losses \$ million</b>		
	<b>Personal*</b>	<b>Corporate**</b>	<b>Commodity</b>
"Minimal"	0.2	0.1	.1
"Moderate A"	0.3	0.1	.1
"Moderate B"	1.1	0.4	.6
"Severe"	4.0	1.4	2.1

\* Assumed to be 20% of wages.

\*\* Assumed to be 2% of revenues.

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## Exhibit 10: Regional Distribution of Groundfish Trawl Licences 2004

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Region <sup>1</sup>	2004 <sup>1</sup> FRCs	2004 Commercial Trawl Licences <sup>2</sup>	2002 Groundfish Processing <sup>3</sup> Person-Years
Queen Charlotte Islands	141	1	*
North Coast	1,057	8	93
Central Coast	141	1	0
Van Island - North	491	2	58
- Mid	1,524	16	*
- South	873	8	39
- West Coast	420	4	207
- Victoria	526	19	72
Sunshine Coast	539	3	0
Lower Mainland	2,168	78	527
Other BC	151	1	0
Outside BC	48	0	0
Unknown	0	1	0
Total	8,079	142	1,015

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- Notes: 1. Fisher Registration Card (a requirement for skippers & crew on commercial fishing vessels).
2. Licences are allocated to each region based on location of principal contact/owner e.g., processing company-owned licences are allocated to head office location. Trawl licenced boats have an average of 4 crew members including the skipper. It is likely that groundfish commercial hook & line licences such as halibut would be less concentrated in the Vancouver (Lower Mainland) area.
3. Person-years employment includes activity from processing all groundfish i.e., includes the processing of halibut, rockfish and other groundfish caught by fleets other than the trawl fleet.

Source: Derived from December 2004 data provided by DFO Licencing and GSGislason & Associates Ltd. "British Columbia Seafood Sector and Tidal Water Recreational Fishing: A Strengths, Weakness, Opportunities and Threats (SWOT) Assessment", Final Report Prepared for BC Ministry of Agriculture, Food & Fisheries, February 2004.



The federal-provincial split of personal income taxes depends on the taxable income level but likely is about 70:30 overall in British Columbia. The federal-provincial split of corporate income taxes is approximately 75:25 (although the actual rate/split depends on whether the corporation qualifies for the small business rate). The federal:provincial split of commodity taxes is approximately 60:40.

#### **4-10 MAE – Regional Development Impacts**

4.39 The annual impacts of the three SARA scenarios on provincial measures of Gross Domestic Product or GDP (\$ million), wages (\$ million), and employment (person-years) under the SARA scenarios are:

	Annual Direct Loss			Annual Total Loss		
	GDP	Wages	Employment	GDP	Wages	Employment
"Minimal"	1.7	1.0	20	2.6	1.5	30
"Moderate A"	2.2	1.4	30	3.3	2.1	50
"Moderate B"	8.7	5.3	120	13.1	8.0	190
"Severe"	32.8	19.8	440	49.2	29.7	700

\* Less likely than the other two scenarios.

The estimates are derived from the commercial sector SWOT study (GSGislason & Associates Ltd. 2004), material provided by the Deep Sea Trawlers Association (Stu Nelson, pers. comm.), a financial profile of the trawl fleet (GSGislason & Associates Ltd. 1999) and provincial multiplier analysis (Horne 2004). Total impacts include indirect supplier plus induced consumer responding impacts as well as direct impacts.

#### **4-11 MAE – Social & Community Impacts**

4.40 Bocaccio have an "existence value" as discussed in Section 2-4, Chapter 2 – but the fact they live their whole life cycle in the marine environment suggests that this existence value would not be as great as for coho salmon i.e., they are much less well-known than salmon.

4.41 Decreases in revenue and activity of the groundfish trawl fleet affect a variety of coastal communities from Prince Rupert to Port Hardy to Ucluelet and many others. The fleet takes on fuel and provisions at a variety of ports and unloads fish at a variety of ports as well. Many of the crew come from Vancouver Island. Exhibit 10 displays the regional distribution of the trawl fleet and processing employment.

#### **4-12 SARA Impact Summary**

4.42 The following panel summarizes the potential SARA measures and associated impacts.

## SUMMARY – BOCACCIO SARA IMPACTS

<b>Current Situation &amp; Potential SARA Actions</b>	
Current Situation	<ul style="list-style-type: none"> <li>- decline in bocaccio abundance since 1980s</li> <li>- stable commercial catches ~300 t in last several years</li> <li>- commercial trawl about 85% of catch, 15% commercial hook &amp; line, trace other</li> <li>- no TAC set for bocaccio since little is known about the species</li> </ul>
Fisheries Actions	<ul style="list-style-type: none"> <li>- set a TAC arbitrarily at say 300 t, 150 t or 75 t, or</li> <li>- have fleet implement voluntary measures to reduce catch to 150 t (the trawl fleet implemented such a program in 2004/05)</li> </ul>
Habitat Actions	<ul style="list-style-type: none"> <li>- not relevant/effective since bocaccio is a demersal marine species</li> </ul>
<b>Potential Impacts of SARA</b>	
<b>Environmental Impacts</b>	
1. Biological	<ul style="list-style-type: none"> <li>- little known about productivity &amp; sustained yield potential</li> <li>- Allowable Harm Assessment (AHA) concluded:                             <ul style="list-style-type: none"> <li>- 300 t mortalities do not jeopardize the survival or recovery of the species</li> <li>- but advisable to enhance recovery through catch reductions</li> <li>- trawl fleet in 2004/05 has demonstrated ability to avoid bocaccio</li> </ul> </li> </ul>
2. Ecosystem	<ul style="list-style-type: none"> <li>- return to traditional predator-prey role</li> </ul>
3. Science	<ul style="list-style-type: none"> <li>- spur additional research</li> </ul>
<b>Socio-Economic Impacts</b>	
4. First Nations	<ul style="list-style-type: none"> <li>- no impact on FSC catch since has allocative priority after conservation</li> <li>- 5 of 142 trawl licence holders are aboriginal</li> </ul>
5. Business	<ul style="list-style-type: none"> <li>- trawl and hook &amp; line fleets, plus processors affected</li> <li>- manageable impacts under 300 t TAC or 150 t voluntary “target” (with no TAC)</li> <li>- significant impacts under 150 t TAC scenario and very serious impacts under 75 t TAC scenario (latter results in loss of 40% of quota groundfish catch)</li> <li>- fleet and processor viability, benefits of IVQ system compromised under 75 t scenario</li> </ul>
6. Government	<ul style="list-style-type: none"> <li>- loss of personal, corporate &amp; commodity (e.g., fuel) taxes</li> </ul>
7. Regional Development	<ul style="list-style-type: none"> <li>- loss in GDP, wages and employment</li> </ul>
8. Social & Community	<ul style="list-style-type: none"> <li>- species existence or intrinsic value enhanced with recovery</li> <li>- significant crew employment, trucking, processing in communities affected</li> </ul>
<b>Key Assumptions, Uncertainties and Risks</b>	
<ol style="list-style-type: none"> <li>1. lack of scientific basis for setting a TAC at present</li> <li>2. research programs should result in science-based TAC in a few years</li> <li>3. in meantime, it may be difficult to adjust TAC even if indices indicate significant recovery</li> <li>4. projected catch declines somewhat subjective, particularly for hook &amp; line fleet (their avoidance potential is unknown)</li> <li>5. 100% monitoring of landings (trawl plus hook &amp; line) and of releases (trawl in place now, hook &amp; line in place for 2006/07) mean that effectiveness of implemented strategy can be assessed</li> <li>6. DFO needs to consult with hook &amp; line fleet to reduce management uncertainties</li> <li>7. delisting process for a species is unknown</li> </ol>	

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# Appendix A

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## BC Commercial Salmon Catch 2000 to 2003

## Exhibit A.1: BC Commercial Salmon Catch 2000 to 2003

SPECIES/GEAR	2000		2001		2002		2003	
	Pieces	kg	Pieces	kg	Pieces	kg	Pieces	kg
<b>Chinook</b>								
Seine - "A"	3	15	-	-	-	-	13	34
- "B"	9	17	-	-	-	-	11	58
Gillnet - "C"	26,128	213,263	32,012	304,728	19,885	178,797	17,846	156,848
- "D"	244	1,202	194	1,349	849	4,996	6,851	52,035
- "E"	5,825	47,322	4,770	39,638	7,419	62,463	9,993	84,276
Troll - "F"	9,854	89,901	13,302	127,298	98,239	833,550	124,465	1,071,203
- "G"	25,740	129,367	44,992	180,197	107,956	593,328	137,327	799,658
- "H"	487	2,938	393	2,522	322	2,039	692	4,481
All	68,293	484,025	95,663	655,732	234,671	1,675,173	297,198	2,168,594
<b>Sockeye</b>								
Seine - "A"	829,766	2,114,296	607,630	1,753,041	131,082	352,210	233,791	545,466
- "B"	293,801	836,104	79,059	204,606	922,997	2,321,887	589,528	1,539,279
Gillnet - "C"	1,619,239	3,914,819	1,605,735	4,452,860	1,160,027	3,273,461	953,934	2,687,097
- "D"	152,830	417,951	125,153	322,399	338,847	948,364	263,788	672,943
- "E"	437,102	1,996,675	41,285	116,960	744,812	2,243,076	201,730	543,150
Troll - "F"	2,033	5,859	2,825	8,140	326	905	3,715	11,606
- "G"	3,896	10,964	21,861	62,691	185,456	556,252	-	-
- "H"	82,937	237,709	50,766	147,283	112,560	369,274	100,927	286,550
All	3,421,606	8,734,378	2,534,315	7,067,981	3,596,108	10,065,429	2,347,413	6,286,091
<b>Coho</b>								
Seine - "A"	1,191	4,538	2,264	7,609	923	3,665	9,719	33,425
- "B"	71	196	10	18	-	-	158	594
Gillnet - "C"	2,215	8,918	248	839	748	2,861	692	2,711
- "D"	22	67	7	15	-	-	4,016	15,554
- "E"	-	-	9	31	-	-	1	3
Troll - "F"	8	63	11,470	37,617	115,101	453,123	203,058	747,364
- "G"	-	-	-	-	3	13	106	363
- "H"	-	-	-	-	1	2	2	7
All	3,508	13,782	14,008	46,130	116,776	459,663	217,751	800,021
<b>Pink</b>								
Seine - "A"	2,632,747	4,332,821	4,992,668	8,819,993	4,732,781	7,659,299	8,230,086	11,675,157
- "B"	1,118,742	1,685,142	536,546	959,945	65,987	88,279	928,824	1,548,431
Gillnet - "C"	404,639	765,828	359,864	734,195	436,518	736,882	959,951	1,815,102
- "D"	121,751	205,116	16,744	29,779	38,119	60,135	27,700	50,530
- "E"	26	35	5,110	12,412	66	94	16,397	32,664
Troll - "F"	68,122	105,374	137,474	241,808	26,824	50,222	108,835	207,294
- "G"	100	164	3,183	7,581	1,169	1,770	133	226
- "H"	84,331	125,840	75,241	165,914	8,410	12,495	59,959	117,470
All	4,430,458	7,220,320	6,126,831	10,971,629	5,309,877	8,609,179	10,331,886	15,446,874
<b>Chum</b>								
Seine - "A"	129,169	653,255	219,824	1,159,516	424,592	2,171,762	626,743	3,096,954
- "B"	183,814	935,946	258,735	1,240,247	1,076,085	5,164,160	740,834	3,771,300
Gillnet - "C"	184,362	946,903	391,560	2,144,486	530,687	2,919,900	794,791	3,972,867
- "D"	27,232	141,951	130,555	600,820	317,157	1,503,865	381,870	1,657,580
- "E"	23,281	131,622	147,513	664,294	82,993	421,315	198,417	840,856
Troll - "F"	4,924	25,998	1,823	8,482	904	4,535	4,002	17,938
- "G"	192	1,028	90	385	1,386	6,990	2,089	9,275
- "H"	1,952	10,879	5,773	31,670	29,657	148,835	81,156	355,681
All	554,926	2,847,582	1,155,873	5,849,900	2,463,465	12,341,364	2,829,861	13,722,450

Source: DFO Catch Statistics



# Appendix B

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## Commercial Salmon Sector Assumptions & Scenarios

## Exhibit B.1: Base Case Assumptions for Commercial Operations

Assumptions	Southern Commercial Fleet				
	Seine	Gillnet		Troll	
	Area B	Area D	Area E	Area G	Area H
<b>Catch Share<sup>1</sup></b>					
Chinook	0%	5%	10%	85%	0%
Chum	50%	30%	15%	0%	5%
Coho	0%	10%	0%	90%	0%
Pink	90%	5%	0%	0%	5%
Sockeye	40%	15%	30%	0%	15%
<b>Weight per Fish kg</b>					
Chinook	8.0	8.0	8.0	6.0	6.0
Chum	5.0	5.0	5.0	5.0	5.0
Coho	3.7	3.7	3.7	3.7	3.7
Pink	1.5	1.5	1.5	1.5	1.5
Sockeye	2.7	2.7	2.7	2.7	2.7
<b>Landed Prices \$/kg</b>					
Chinook	2.97	3.63	3.63	6.27	6.27
Chum	.88	.77	.77	1.32	1.32
Coho	1.50	2.00	2.00	3.30	3.30
Pink	.33	.15	.15	.77	.77
Sockeye	4.95	4.95	4.62	6.82	6.82
<b>Processed Prices \$/kg</b>					
Chinook	4.95	6.05	6.05	7.84	7.84
Chum	3.20	2.80	2.80	1.76	1.76
Coho	2.00	3.64	3.64	4.40	4.40
Pink	1.89	.86	.86	1.23	1.23
Sockeye	7.92	7.92	7.39	8.53	8.53

<sup>1</sup> Sum of catch shares across regions/gears totals 100%.

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**Exhibit B.2: 2005 Commercial Salmon Catch Scenarios '000 Fish**


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	<u>Base/Low Survival</u>	<u>Base/Improved Survival</u>	<u>Base/Superior Survival</u>
Chinook	150	150	180
Chum	1,400	1,400	1,400
Coho	5	35	200
Pink	1,000	1,000	1,000
Sockeye	1,650	1,650	1,650
	<u>Minimal/Low Survival</u>	<u>Minimal/Improved Survival</u>	<u>Minimal/Superior Survival</u>
Chinook	150	150	173
Chum	1,400	1,400	1,400
Coho	5	28	151
Pink	1,000	1,000	1,000
Sockeye	1,650	1,650	1,650
	<u>Moderate/Low Survival</u>	<u>Moderate/Improved Survival</u>	<u>Moderate/Superior Survival</u>
Chinook	150	150	165
Chum	1,400	1,400	1,400
Coho	5	20	103
Pink	1,000	1,000	1,000
Sockeye	1,650	1,650	1,650
	<u>Severe/Low Survival</u>	<u>Severe/Improved Survival</u>	<u>Severe/Superior Survival</u>
Chinook	150	150	158
Chum	1,400	1,400	1,400
Coho	5	13	54
Pink	1,000	1,000	1,000
Sockeye	1,650	1,650	1,650

Notes: 1. There are 12 projections comprising combinations of 4 SARA-restrictions – "Base/No SARA", "Minimal", "Moderate", "Severe" – and 3 marine survivals – "Low", "Improved", "Superior".

2. The pink and chum catches do not vary by scenario – they represent average catches in the recent past.

3. Coho catches include catches of both wild and hatchery coho.

Source: Discussions with DFO

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### Exhibit B.3: 2006 Commercial Salmon Catch Scenarios '000 Fish

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	<u>Base/Low Survival</u>	<u>Base/Improved Survival</u>	<u>Base/Superior Survival</u>
Chinook	150	150	180
Chum	1,400	1,400	1,400
Coho	5	35	200
Pink	1,000	1,000	1,000
Sockeye	3,400	4,000	5,100
	<u>Minimal/Low Survival</u>	<u>Minimal/Improved Survival</u>	<u>Minimal/Superior Survival</u>
Chinook	150	150	173
Chum	1,400	1,400	1,400
Coho	5	28	151
Pink	1,000	1,000	1,000
Sockeye	3,400	3,850	4,675
	<u>Moderate/Low Survival</u>	<u>Moderate/Improved Survival</u>	<u>Moderate/Superior Survival</u>
Chinook	150	150	165
Chum	1,400	1,400	1,400
Coho	5	20	103
Pink	1,000	1,000	1,000
Sockeye	3,400	3,700	4,250
	<u>Severe/Low Survival</u>	<u>Severe/Improved Survival</u>	<u>Severe/Superior Survival</u>
Chinook	150	150	158
Chum	1,400	1,400	1,400
Coho	5	13	54
Pink	1,000	1,000	1,000
Sockeye	3,400	3,550	3,825

- Notes: 1. There are 12 projections comprising combinations of 4 SARA-restrictions – "Base/No SARA", "Minimal", "Moderate", "Severe" – and 3 marine survivals – "Low", "Improved", "Superior".
2. The pink and chum catches do not vary by scenario – they represent average catches in the recent past.
3. Coho catches include catches of both wild and hatchery coho.

Source: Discussions with DFO

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**Exhibit B.4: 2007 Commercial Salmon Catch Scenarios '000 Fish**


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	<u>Base/Low Survival</u>	<u>Base/Improved Survival</u>	<u>Base/Superior Survival</u>
Chinook	150	150	180
Chum	1,400	1,400	1,400
Coho	5	35	200
Pink	1,000	1,000	1,000
Sockeye	940	1,000	1,060
	<u>Minimal/Low Survival</u>	<u>Minimal/Improved Survival</u>	<u>Minimal/Superior Survival</u>
Chinook	150	150	173
Chum	1,400	1,400	1,400
Coho	5	28	151
Pink	1,000	1,000	1,000
Sockeye	940	985	1,030
	<u>Moderate/Low Survival</u>	<u>Moderate/Improved Survival</u>	<u>Moderate/Superior Survival</u>
Chinook	150	150	165
Chum	1,400	1,400	1,400
Coho	5	20	103
Pink	1,000	1,000	1,000
Sockeye	940	970	1,000
	<u>Severe/Low Survival</u>	<u>Severe/Improved Survival</u>	<u>Severe/Superior Survival</u>
Chinook	150	150	158
Chum	1,400	1,400	1,400
Coho	5	13	54
Pink	1,000	1,000	1,000
Sockeye	940	955	970

- Notes: 1. There are 12 projections comprising combinations of 4 SARA-restrictions – "Base/No SARA", "Minimal", "Moderate", "Severe" – and 3 marine survivals – "Low", "Improved", "Superior".
2. The pink and chum catches do not vary by scenario – they represent average catches in the recent past.
3. Coho catches include catches of both wild and hatchery coho.

Source: Discussions with DFO

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**Exhibit B.5: 2008 Commercial Salmon Catch Scenarios '000 Fish**


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	<u>Base/Low Survival</u>	<u>Base/Improved Survival</u>	<u>Base/Superior Survival</u>
Chinook	150	150	180
Chum	1,400	1,400	1,400
Coho	5	35	200
Pink	1,000	1,000	1,000
Sockeye	0	0	0
	<u>Minimal/Low Survival</u>	<u>Minimal/Improved Survival</u>	<u>Minimal/Superior Survival</u>
Chinook	150	150	173
Chum	1,400	1,400	1,400
Coho	5	28	151
Pink	1,000	1,000	1,000
Sockeye	0	0	0
	<u>Moderate/Low Survival</u>	<u>Moderate/Improved Survival</u>	<u>Moderate/Superior Survival</u>
Chinook	150	150	165
Chum	1,400	1,400	1,400
Coho	5	20	103
Pink	1,000	1,000	1,000
Sockeye	0	0	0
	<u>Severe/Low Survival</u>	<u>Severe/Improved Survival</u>	<u>Severe/Superior Survival</u>
Chinook	150	150	158
Chum	1,400	1,400	1,400
Coho	5	13	54
Pink	1,000	1,000	1,000
Sockeye	0	0	0

- Notes: 1. There are 12 projections comprising combinations of 4 SARA-restrictions – "Base/No SARA", "Minimal", "Moderate", "Severe" – and 3 marine survivals – "Low", "Improved", "Superior".
2. The pink and chum catches do not vary by scenario – they represent average catches in the recent past.
3. Coho catches include catches of both wild and hatchery coho.

Source: Discussions with DFO

## Exhibit B.6: Impact of SARA on Commercial Sector Revenues

A. PROJECTED SCENARIO	Landed Value \$ million				Processed Value \$ million			
	2005	2006	2007	2008	2005	2006	2007	2008
<b>Current Marine Survival ~2 to 3%</b>								
No SARA - "Base"	34.9	59.1	25.0	12.0	63.5	102.6	50.4	30.5
SARA - "Minimal"	34.9	59.1	25.0	12.0	65.5	102.6	50.4	30.5
- "Moderate"	34.9	59.1	25.0	12.0	65.5	102.6	50.4	30.5
- "Severe"	34.9	59.1	25.0	12.0	65.5	102.6	50.4	30.5
<b>Improved Marine Survival ~5%</b>								
No SARA - "Base"	35.2	67.8	26.2	12.4	66.0	115.8	52.2	31.0
SARA - "Minimal"	35.1	65.6	25.9	12.3	65.9	112.5	51.8	30.9
- "Moderate"	35.0	63.4	25.6	12.2	65.7	109.2	51.3	30.8
- "Severe"	34.9	61.3	25.3	12.1	65.6	105.9	50.9	30.6
<b>Superior Marine Survival ~8%</b>								
No SARA - "Base"	38.2	86.0	30.1	15.4	70.0	143.2	57.5	35.0
SARA - "Minimal"	37.4	79.3	28.8	14.5	68.9	133.1	55.8	33.9
- "Moderate"	36.5	72.6	27.5	13.7	67.8	122.9	54.0	32.8
- "Severe"	35.7	65.9	26.3	12.9	66.7	112.8	52.2	31.7
<b>B. IMPACT OF SARA</b>								
<b>Current Marine Survival ~2 to 3%</b>								
"Minimal"	0	0	0	0	0	0	0	0
"Moderate"	0	0	0	0	0	0	0	0
"Severe"	0	0	0	0	0	0	0	0
<b>Improved Marine Survival ~5%</b>								
"Minimal"	(0.1)	(2.2)	(0.3)	(0.1)	(0.1)	(3.3)	(0.4)	(0.1)
"Moderate"	(0.2)	(4.4)	(0.6)	(0.2)	(0.3)	(6.6)	(0.9)	(0.2)
"Severe"	(0.3)	(6.5)	(0.9)	(0.3)	(0.4)	(9.9)	(1.3)	(0.4)
<b>Superior Marine Survival ~8%</b>								
"Minimal"	(0.8)	(6.7)	(1.3)	(0.9)	(1.1)	(10.1)	(1.7)	(1.1)
"Moderate"	(1.7)	(13.4)	(2.6)	(1.7)	(2.2)	(20.3)	(3.5)	(2.2)
"Severe"	(2.5)	(20.1)	(3.8)	(2.5)	(3.3)	(30.4)	(5.3)	(3.3)

Note: 1. The "impact" of SARA is the SARA scenario less the "Base Case" scenario e.g., the impact of "Minimal" SARA restrictions in 2005 on landed value under the Low Marine Survival scenario is (\$.059 million) or \$27.983 million less \$27.924 million.

Source: Derived from catch projections and assumptions in Exhibits B.1 to B.5. (All values are gross values.)

## Exhibit B.7: Impact of SARA Listing of Interior Coho – Commercial Fishing Sector

\$ MILLIONS	SARA Listing Period												SARA Delisting	NPV @6%
	05	06	07	08	09	10	11	12	13	14	15	16		
<b>Landed Value Losses</b>														
<b>Current MS ~2 to 3%</b>														
“Minimal”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
“Moderate”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
“Severe”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Improved MS ~5%</b>														
“Minimal”	0	0	0	0	0.1	2.2	0.3	0.1	0.1	2.2	0.3	0.1	0	3.4
“Moderate”	0	0	0	0	0.2	4.4	0.6	0.2	0.2	4.4	0.6	0.2	0	6.8
“Severe”	0	0	0	0	0.3	6.5	0.9	0.3	0.3	6.5	0.9	0.3	0	10.0
<b>Superior MS ~8%</b>														
“Minimal”	0	0	0	0	0.8	6.7	1.3	0.9	0.8	6.7	1.3	0.9	0	12.1
“Moderate”	0	0	0	0	1.7	13.4	2.6	1.7	1.7	13.4	2.6	1.7	0	24.2
“Severe”	0	0	0	0	2.5	20.1	3.8	2.5	2.5	20.1	3.8	2.5	0	36.1
<b>Processed Value Losses</b>														
<b>Current MS ~2 to 3%</b>														
“Minimal”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
“Moderate”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
“Severe”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Improved MS ~5%</b>														
“Minimal”	0	0	0	0	0.1	3.3	0.4	0.1	0.1	3.3	0.4	0.1	0	4.9
“Moderate”	0	0	0	0	0.3	6.6	0.9	0.2	0.3	6.6	0.9	0.2	0	10.0
“Severe”	0	0	0	0	0.4	9.9	1.3	0.4	0.4	9.9	1.3	0.4	0	15.0
<b>Superior MS ~8%</b>														
“Minimal”	0	0	0	0	1.1	10.1	1.7	1.1	1.1	10.1	1.7	1.1	0	17.5
“Moderate”	0	0	0	0	2.2	20.3	3.5	2.2	2.2	20.3	3.5	2.2	0	35.2
“Severe”	0	0	0	0	3.3	30.4	5.3	3.3	3.3	30.4	5.3	3.3	0	52.9

Source: Projections for years 2005 to 2017 derived from Exhibit B.6. (All values are gross values.)

- Notes:
1. Listing assumed in 2005.
  2. Current Marine Survival (MS) of ~2 to 3% assumed under all scenarios for years 2005 to 2008.
  3. Illustrative probabilities of post 2008 Marine Survival (MS) are: 75% Current (or lower), 20% Improved, and 5% Superior (Ian Perry, DFO pers. comm.).
  4. Delisting assumed after 12 years in 2017.
  5. Net present value (NPV) calculated using 6% real discount rate to 2004.



# Appendix C

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## Recreational Salmon Catch Scenarios

## Exhibit C.1: Recreational Salmon Catch Scenarios

	Coho				Sockeye				Chinook			
	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008
<b>Current Marine Survival</b>												
No SARA - "Base"	70	70	70	70	100	100	50	0	100	100	100	100
SARA - "Minimal"	70	70	70	70	100	100	50	0	100	100	100	100
- "Moderate"	70	70	70	70	100	100	50	0	100	100	100	100
- "Severe"	70	70	70	70	100	100	50	0	100	100	100	100
<b>Improved Marine Survival</b>												
No SARA - "Base"	420	420	420	420	150	150	75	0	100	100	100	100
SARA - "Minimal"	333	333	333	333	138	138	69	0	100	100	100	100
- "Moderate"	245	245	245	245	125	125	63	0	100	100	100	100
- "Severe"	158	158	158	158	113	113	56	0	100	100	100	100
<b>Superior Marine Survival</b>												
No SARA - "Base"	660	660	660	660	150	150	75	0	150	150	150	150
SARA - "Minimal"	513	513	513	513	138	138	69	0	138	138	138	138
- "Moderate"	365	365	365	365	125	125	63	0	125	125	125	125
- "Severe"	218	218	218	218	113	113	56	0	113	113	113	113

Notes: 1. There are 12 projections for each year comprising combinations of 4 SARA-restrictions – "Base/No SARA", "Minimal", "Moderate", "Severe" – and 3 marine survivals – "Current", "Improved", "Superior".

2. Coho catches include catches of both wild and hatchery coho.

Source: Discussions with DFO

## Exhibit C.2: Impact of SARA on Recreational Fishing Expenditures

Angler Expenditures \$ million				
A. PROJECTED SCENARIO	2005	2006	2007	2008
<b>Current Marine Survival ~2 to 3%</b>				
No SARA - "Base"	162.0	162.0	157.5	153.0
SARA - "Minimal"	162.0	162.0	157.5	153.0
- "Moderate"	162.0	162.0	157.5	153.0
- "Severe"	162.0	162.0	157.5	153.0
<b>Improved Marine Survival ~5%</b>				
No SARA - "Base"	198.0	198.0	191.3	184.5
SARA - "Minimal"	189.1	189.1	182.9	176.7
- "Moderate"	180.0	180.0	174.4	168.9
- "Severe"	171.1	171.1	166.0	160.9
<b>Superior Marine Survival ~8%</b>				
No SARA - "Base"	224.1	224.1	217.4	210.6
SARA - "Minimal"	208.7	208.7	202.5	196.3
- "Moderate"	193.1	193.1	187.5	181.8
- "Severe"	177.7	177.7	172.5	167.5
<b>B. IMPACT OF SARA</b>				
<b>Current Marine Survival ~2 to 3%</b>				
"Minimal"	0	0	0	0
"Moderate"	0	0	0	0
"Severe"	0	0	0	0
<b>Improved Marine Survival ~5%</b>				
"Minimal"	(8.9)	(8.9)	(8.4)	(7.8)
"Moderate"	(18.0)	(18.0)	(16.9)	(15.6)
"Severe"	(26.9)	(26.9)	(25.3)	(23.6)
<b>Superior Marine Survival ~8%</b>				
"Minimal"	(15.4)	(15.4)	(14.9)	(14.3)
"Moderate"	(31.0)	(31.0)	(29.9)	(28.8)
"Severe"	(46.4)	(46.4)	(44.9)	(43.1)

Note: 1. The "impact" of SARA is the SARA scenario less the "Base Case" scenario e.g., the impact of "Minimal" SARA restrictions in 2005 under the Improved Marine Survival scenario is (\$8.9 million) or \$189.1 million less \$198.0 million.

Source: Derived from catch projections in Exhibit C.1 and 1) 2005 current marine survival Base Case angler expenditures of \$162 million (\$240 per angler day, catch rate of 0.4 fish per day), and 2) changes in catches from this 2005 Base Case valued at \$90 per fish i.e., 85% of changes in angling effort represents effort redirected to/from other fisheries. (All values are gross values.)

### Exhibit C.3: Impact of SARA Listing of Interior Coho – Recreational Fishing Sector

\$ MILLIONS	SARA Listing Period												SARA Delisting 17+	NPV @6%
	05	06	07	08	09	10	11	12	13	14	15	16		
<b>Angler Exp Losses</b>														
<b>Current MS ~2 to 3%</b>														
“Minimal”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
“Moderate”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
“Severe”	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Improved MS ~ 5%</b>														
“Minimal”	0	0	0	0	8.9	8.9	8.4	7.8	8.9	8.9	8.4	7.8	0	41.9
“Moderate”	0	0	0	0	18.0	18.0	16.9	15.6	18.0	18.0	16.9	15.6	0	84.5
“Severe”	0	0	0	0	26.9	26.9	25.3	23.6	26.9	26.9	25.3	23.6	0	126.7
<b>Superior MS ~8%</b>														
“Minimal”	0	0	0	0	15.4	15.4	14.9	14.3	15.4	15.4	14.9	14.3	0	73.9
“Moderate”	0	0	0	0	31.0	31.0	29.9	28.8	31.0	31.0	29.9	28.8	0	148.7
“Severe”	0	0	0	0	46.4	46.4	44.9	43.1	46.4	46.4	44.9	43.1	0	222.7

Source: Projections for years 2005 to 2017 derived from Exhibit C.2. (All values are gross values.)

- Notes:
1. Listing assumed in 2005.
  2. Current Marine Survival (MS) of ~2 to 3% assumed under all scenarios for years 2005 to 2008.
  3. Approximate probabilities of post 2008 Marine Survival (MS) are: 75% Current (or lower), 20% Improved, and 5% Superior (Ian Perry, DFO pers. comm.).
  4. Delisting assumed after 12 years in 2017.
  5. Net present value (NPV) calculated using 6% real discount rate to 2004.

# Appendix D

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## Commercial Groundfish Sector Assumptions & Scenarios

## Exhibit D.1: Fisheries Management and Harvest Scenarios Under SARA – Bocaccio

	Base Case	Options			
		#1 Minimal Cap Catches with TAC	#2A Moderate 50% Reduction no TAC	#2B Moderate 50% Reduction with TAC	#3 Severe 75% Reduction with TAC
<b>Bocaccio Assumptions</b>					
Objective	Maintain Status Quo	Maintain Status Quo	Rebuild	Rebuild	Accelerated Recovery
Biomass Level	Unknown	Unknown	Unknown	Unknown	Unknown
Exploitation Rate	Unknown	Unknown	Unknown	Unknown	Unknown
<b>Management Regime</b>					
Commercial - GF Trawl "T"	Status Quo	TAC & IVQ	Avoidance	TAC & IVQ	TAC & IVQ
- Hook & Line	Status Quo	TAC	Avoidance	TAC	TAC
Recreational	Status Quo	Status Quo	Status Quo	Status Quo	Zero Retention
Aboriginal	Status Quo	Status Quo	Status Quo	Status Quo	Status Quo
<b>Commercial GF Landings tonnes</b>					
Groundfish Trawl "T" - Bocaccio	~260	~260	~130	~130	~65
- "Other RF"	~1,000	~900	~700	~600	~500
- Hake	~145,000	~145,000	~145,000	~145,000	~145,000
- Other	<u>~39,000</u>	<u>~38,220</u>	<u>~38,220</u>	<u>~35,100</u>	<u>~23,400</u>
- Total	~185,260	~184,380	~184,050	~180,830	~168,965
Hook & Line - Bocaccio	~40	~40	~20	~20	10
- Other	<u>~15,000</u>	<u>~14,700</u>	<u>~14,700</u>	<u>~13,500</u>	<u>~9,000</u>
- Total	~15,040	~14,740	~14,720	~13,520	~9,010
All Commercial - Bocaccio	~300	~300	~150	~150	75
- "Other RF"	~1,000	~900	~700	~600	~500
- Hake	~145,000	~145,000	~145,000	~145,000	~145,000
- Other	<u>~54,000</u>	<u>~52,920</u>	<u>~52,920</u>	<u>~48,600</u>	<u>~32,400</u>
- Total	~200,300	~199,120	~198,770	~194,350	~177,975

- Notes: 1. First Nations food, social, and ceremonial (FSC) requirements and treaty obligations to First Nations are second only to conservation in fisheries allocation.
2. Very little is known about bocaccio – no biomass or exploitation rates exist. Bocaccio is not a targeted species in the commercial fishery.
3. The options are consistent with the precautionary approach whereby fisheries can continue, in the absence of concrete biomass data, if fisheries management includes defined objectives, assessment and monitoring.
4. "Other RF" is other rockfish not under GF trawl TAC but subject to 15,000 lb (6,800 kg) trip limit.
5. The commercial hook & line fleet does not catch hake.

Source: DFO and discussions with groundfish trawl industry and the groundfish hook & line industry.

## Exhibit D.2: Impact of SARA on Commercial Groundfish Fishery

	Landed Value \$000					Processed Value \$000				
	Bocaccio	"Other" RF	Hake	Other GF	All	Bocaccio	"Other" RF	Hake	Other GF	All
<b>GROUND FISH TRAWL</b>										
<b>A. PROJECTED SCENARIO</b>										
No SARA - "Base"	320	1,210	29,000	45,000	75,530	640	2,420	58,000	90,000	151,060
SARA - "Minimal"	320	1,090	29,000	44,100	74,510	640	2,180	58,000	88,200	149,020
- "Moderate A"	0	850	29,000	44,100	73,950	0	1,700	58,000	88,200	147,900
- "Moderate B"	0	730	29,000	40,500	70,230	0	1,460	58,000	81,000	140,460
- "Severe"	0	610	29,000	27,000	56,610	0	1,220	58,000	54,000	113,220
<b>B. IMPACT OF SARA</b>										
"Minimal"	0	(120)	0	(900)	(1,020)	0	(240)	0	(1,800)	(2,040)
"Moderate A"	(320)	(360)	0	(900)	(1,580)	(640)	(720)	0	(1,800)	(3,160)
"Moderate B"	(320)	(480)	0	(4,500)	(5,300)	(640)	(960)	0	(9,000)	(10,600)
"Severe"	(320)	(600)	0	(18,000)	(18,920)	(640)	(1,200)	0	(36,000)	(37,840)
<b>GF HOOK &amp; LINE</b>										
<b>A. PROJECTED SCENARIO</b>										
No SARA - "Base"	60	NA	NA	60,000	60,060	80	NA	NA	80,000	80,080
SARA - "Minimal"	60	NA	NA	58,800	58,860	80	NA	NA	78,400	78,480
- "Moderate A"	0	NA	NA	58,800	58,800	0	NA	NA	78,400	78,400
- "Moderate B"	0	NA	NA	54,000	54,000	0	NA	NA	72,000	72,000
- "Severe"	0	NA	NA	36,000	36,000	0	NA	NA	48,000	48,000
<b>B. IMPACT OF SARA</b>										
"Minimal"	0	NA	NA	(1,200)	(1,200)	0	NA	NA	(1,600)	(1,600)
"Moderate A"	(60)	NA	NA	(1,200)	(1,260)	(80)	NA	NA	(1,600)	(1,680)
"Moderate B"	(60)	NA	NA	(6,000)	(6,060)	(80)	NA	NA	(8,000)	(8,080)
"Severe"	(60)	NA	NA	(24,000)	(24,060)	(80)	NA	NA	(32,000)	(32,080)

- Notes: 1. The "impact" of SARA is the SARA scenario less the "Base Case" scenario e.g., the impact of "severe" SARA restrictions on trawl landed value for other groundfish is (\$18 million) or \$27 million less \$45 million.
2. Landed value assumed to be half of processed value for GF trawl, 75% of processed value for hook & line.
3. "Other RF" is other rockfish species not under quota but subject to the 15,000 lb trip limit e.g., darkblotch, redbanded, sharpchin.
4. GF trawl landed prices/values - \$1.21/kg for bocaccio and "other rockfish", \$0.20/kg for hake, and all other groundfish valued at \$45 million landed in aggregate.
5. Hook & line landed prices/values - \$1.50/kg for bocaccio and all other groundfish valued at \$60 million landed in aggregate.

Source: Derived from catch projections in Exhibit 10 and the above price projections. (All values are gross values.)