

Socio-Economic Implications of SARA

White Sturgeon

Discussion Document - Draft

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Preface

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 white sturgeon.

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

1. Background

- COSEWIC has designated white sturgeon as “endangered” – the 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 white sturgeon.

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 (see panel following)

- Recovery will take several decades for Kootenay, Columbia & Nechako River stocks.
- Fraser River stock already on road to recovery.
- Severe impacts on Fraser angling guide businesses if catch & release angling banned.
- First Nation impacts could be significant under changes to FSC fishery practices.
- Increased sturgeon populations would increase existence or intrinsic values to Canadians from knowing the resource is healthy.

5. Conclusions

- The MAE approach allows the consistent and fair treatment of the impacts of SARA on First Nations, people, businesses, communities, 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 – WHITE STURGEON SARA IMPACTS

Current Situation & Potential SARA Actions	
Current Situation	<ul style="list-style-type: none"> - severe declines in abundance in Kootenay, Columbia, Nechako (all dammed) and Fraser (undammed) River systems over past 100 years - Fraser population increasing in recent years but other populations still decreasing - significant catch & release angling on Fraser but entails almost no mortality - illegal harvest is a significant source of mortality on the Fraser - FSC fishery bycatch and mortality of sturgeon in the salmon fishery is significant and has the potential to affect sturgeon recovery - lack of recruitment limiting factor on other systems
Fisheries Actions	<ul style="list-style-type: none"> - angler permit system or ban catch & release angling - management changes to FSC fishery on Fraser to reduce bycatch
Habitat Actions	<ul style="list-style-type: none"> - changes to hydroelectric dam, gravel extraction, development practices
Potential Impacts of SARA	
Environmental Impacts	
1. Biological	<ul style="list-style-type: none"> - recovery will take several decades as species long-lived, late-maturing - recruitment challenges in Kootenay, Columbia & Nechako systems to be addressed in short term through hatchery efforts
2. Ecosystem	<ul style="list-style-type: none"> - return to traditional predator-prey
3. Science/Other	<ul style="list-style-type: none"> - spur additional research - but also jeopardise existing research as angling guides may withdraw from current research if species listed
Socio-Economic Impacts	
4. First Nations	<ul style="list-style-type: none"> - impact on FSC fishing practices - enhance cultural benefits & potentially provide long term opportunity for harvest
5. Business	<ul style="list-style-type: none"> - most angling guides go out of business, reduction in angler expenditures - emerging aquaculture industry could be stalled - BC Hydro recovery efforts embedded in Water Use Plans & not attributable to SARA per se - unknown impacts from other habitat measures
6. Government	<ul style="list-style-type: none"> - loss of personal, corporate & commodity (e.g., fuel) taxes
7. Regional Development	<ul style="list-style-type: none"> - loss in GDP, wages and employment
8. Social & Community	<ul style="list-style-type: none"> - species existence or intrinsic value enhanced with recovery - negative impacts in tourism on Chilliwack & other Fraser Valley communities
Key Assumptions, Uncertainties and Risks	
1.	cause of recruitment failure in Kootenay, Columbia & Nechako is unknown
2.	discussions with First Nations as to changes to FSC fishery practices ongoing
3.	proposed habitat measures and their impacts unknown
4.	much better data on FSC harvests and bycatch mortality for sturgeon required on Fraser
5.	current assumption is that listing would apply to all stocks even though Fraser stock is much more abundant and increasing
6.	can a directed catch-and-release fishery, with very low mortality, be permitted under SARA?

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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 the species white sturgeon (designated as "endangered" 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 report. 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 There was little information available on the growing Fraser River angling guide industry focused on a catch-and-release fishery for white sturgeon. As a result, with the cooperation of the Fraser Valley Angling Guide Association (FVAGA) and the support of the Province of British Columbia, the consultant launched an economic survey of Fraser River angling guides – see Appendix A.

- 1.9 The consultant interviewed 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 recreational fishing organizations and industry.
- 1.10 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.
- 1.11 This report is informed by more than 20 broad-based DFO consultations to date.
- 1.12 This report also reflects input and advice received from the:
- DFO/Province of BC working group
 - Participants at the January 17/05 technical review meeting (including First Nations, Marine Conservation Council, and recreational fishing representatives), and
 - Methodological review conducted by an academic

1.3 More First Nations Consultations

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

1.4 Report Outline

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

Section	Type
2	Impact Framework
3	Socio-economic Impacts

- 1.15 An appendix provides additional data and analysis.

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.

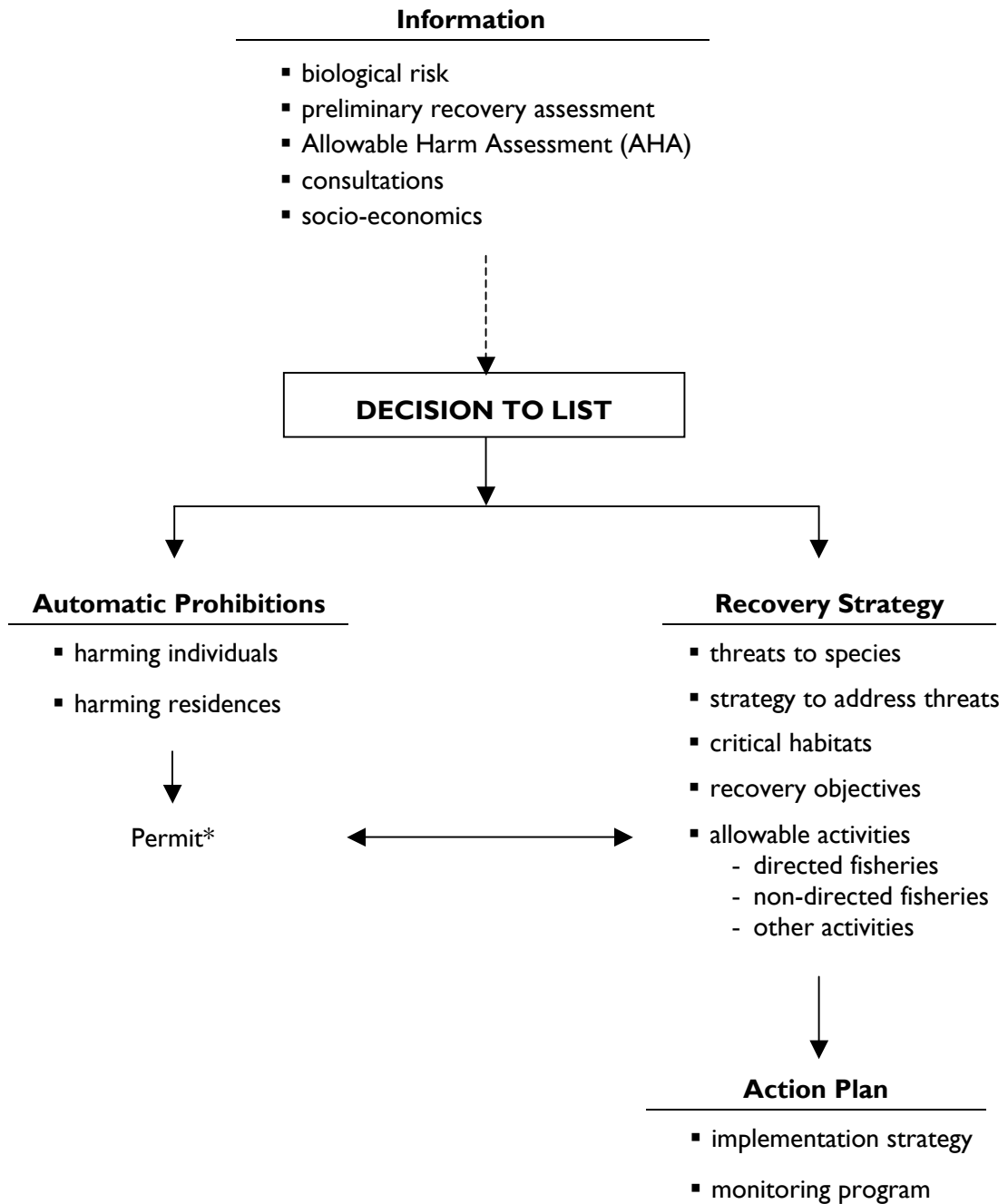
The Recovery Strategy for an "endangered" species must be completed within 1 year of legal listing. The Recovery Strategy for a "threatened" species must be completed within 2 years of legal listing. The Recovery Strategy typically runs for 5 years. Exhibit 1 displays the process.

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".

Exhibit 1: The SARA Listing Process

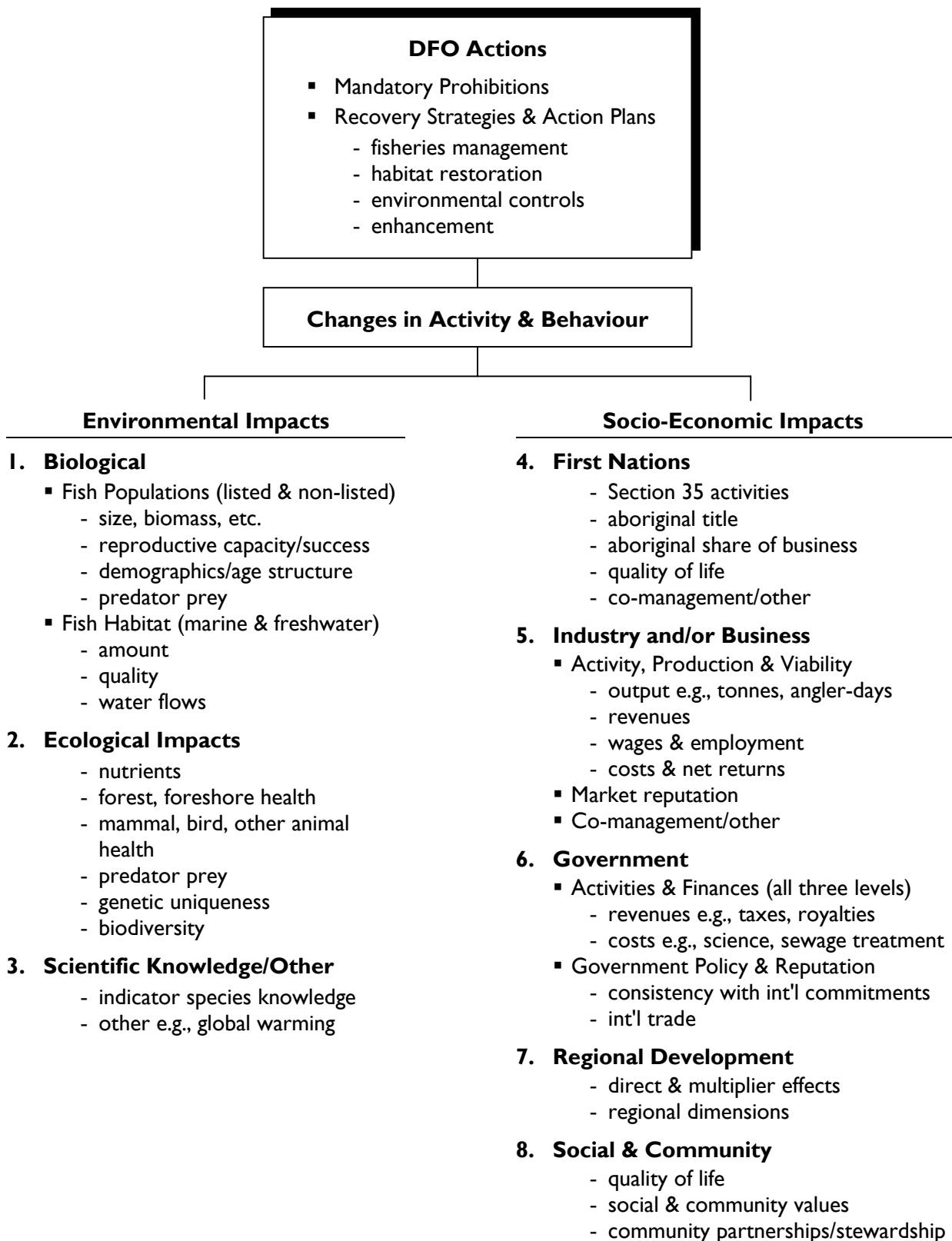


* A permit may be issued for non-directed fisheries.

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.

Exhibit 2: SARA Impact Framework



- 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 Recovery Strategies and Action Plans detailing activities and initiatives to be carried out to promote species recovery do not exist at present for white sturgeon. 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 into the future. This is especially important for the environmental account where it likely will take several years or decades for species at risk to recover. It is also important for the business account where economic activity 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.
- 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, and the 1997 Oceans Act. 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 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.)

- 2.20 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

- 2.21 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.
- 2.22 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:

$$\text{Economic value} = \text{use value} + \text{option value} + \text{existence value}$$

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.

- 2.23 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.

3.0 SOCIO-ECONOMIC IMPACTS – WHITE STURGEON

- 3.1 This section applies the Multiple Account Evaluation Framework of Exhibit 2, Section 2 to the case of SARA-listing white sturgeon.

3-1 Background

Species Description and Status

- 3.2 The white sturgeon (*Acipenser transmontanus*) is the largest, longest-lived freshwater fish in North America, sometimes exceeding 3m in length, 200 kg in weight, and 100 years in age. White sturgeon spawn in large river systems including the Sacramento and the Columbia River systems as well as rivers in British Columbia.
- 3.3 Spawning populations of white sturgeon in British Columbia are only known from the Fraser and Columbia watersheds and six stock groups have been identified. The Upper Columbia and Kootenay stock groups are transboundary populations shared with Washington and Idaho respectively. Three stock-groups have been identified from the lower, mid and upper Fraser River while the final stock group inhabits the Nechako River (a Fraser River tributary).
- 3.4 Some sturgeon undertake marine migrations and may be found in the lower ends of a number of rivers from Vancouver Island to the North Coast. It is not known what proportion of these fish are from the Fraser River versus the Columbia River stocks which are known to be migratory.
- 3.5 White sturgeon are long-lived with a 30-40 year generation time and late maturity. They have suffered a 50% decline in the last three generation i.e. over the last 100 years. They are primarily bottom feeders, are found in turbid waters, and do not spawn every year. In the lower Fraser, sturgeon primarily spawn in side channels in low velocity areas (Perrin et al 2003).
- 3.6 White sturgeon are particularly vulnerable to overfishing due to their slow growth, late maturity and long life. Their habitat quantity and quality has declined – the diversion and regulation of water flows, through dams on the Columbia, Kootenay and Nechako Rivers for example have diminished their habitat. Dams reduce spring water flows and turbidity and change river morphology (white sturgeon spawn in spring or early summer). Dams also reduce access to marine nutrients via salmon, eulachons and other fish (sturgeon will feed seasonally on salmon carcasses).

White sturgeon eat a variety of organisms from benthic invertebrates like crayfish, shrimp and clams to fish such as lamprey, salmon, eulachon and smelt...smaller sturgeon tend to eat smaller invertebrates, while larger sturgeon consume mainly fish. White sturgeon will readily take live prey as well as carcasses (COSEWIC 2003).

- 3.7 For the Fraser River, sturgeon habitat has declined with the advance of human settlement over the past 100 years e.g., through dredging, dyking and channelization, gravel extraction (there are no dams on the Fraser mainstem).
- 3.8 Detailed information on trends in population size is not available, but there is strong evidence that recruitment in the Nechako, Columbia, and Kootenay Rivers has consistently failed for several decades i.e., there are no fish younger than 20 years of age in these systems. The Fraser population, in contrast, has shown successful recruitment and the population is much more healthy. However, there is a preponderance of males in the adult Fraser population i.e., the demographic structure is a worry.

	Sturgeon Populations	
	Adult	Total
Fraser - Lower*	7,650	47,431
- Middle**	749	3,745
- Upper**	185	815
Nechako***	457	571
Upper Columbia***	942	1,469
Kootenay***	<u>752</u>	<u>760</u>
Source: COSEWIC 2003	10,735	54,791

* the Lower Fraser population has shown growth since this date to 60,000+ fish (Nelson et al 2004).

** there is no evidence of declines in these populations.

*** there is strong evidence of decline and recruitment failure in these three populations (all three river systems have hydroelectric facilities).

- 3.9 Man is the only significant predator of sturgeon adults in BC riverine systems (COSEWIC 2003). No reliable data are presently available on the level of human-induced mortality.
- 3.10 The two major sources of mortality today, in no particular order, are thought to be "poaching" and bycatch mortality from the in-river Food Social & Ceremonial (FSC) salmon fishery conducted primarily by set nets. In 2003, DFO identified 224 sturgeon poached over 6 months – 62% by net, 37% by rod & reel, 1% by set net – with 97% of the fish poached after dark (Zunti 2004). Poaching is lucrative as sturgeon meat and caviar have high value.
- 3.11 The First Nation FSC gillnet fishery catches and releases over 1,000 sturgeon a year and the mortality on sturgeon bycatch released appears to exceed 10% (COSEWIC 2003). Some sturgeon are harvested by First Nations. The Fraser River Sturgeon Conservation Society has been working with First Nation peoples under the Lower Fraser First Nation Sturgeon Stewardship Program to reduce bycatch mortalities.
- 3.12 The Sturgeon Society through their mark – recapture work has tagged close to 20,000 sturgeon caught by rod & reel – they have not identified one instance where a released fish has died due to the initial capture (COSEWIC 2003, Troy Nelson pers. comm.). The

Province of British Columbia recently funded a hook & line mortality study for sturgeon that should report more definitive results by mid 2005.

- 3.13 Sturgeon are also caught accidentally in the commercial salmon gillnet fishery downstream of Mission. Gillnetters use drift nets which are picked frequently and do not operate at night – accordingly, mortality in released sturgeon is thought to be very low (they can not retain sturgeon). Moreover, some of the sturgeon caught in marine waters could be green sturgeon, a different species than white sturgeon.
- 3.14 White sturgeon are managed cooperatively between the provincial and federal governments. COSEWIC declared white sturgeon to be "vulnerable" in 1991. In the mid 1990s the BC government classified Fraser River sturgeon as "red listed" indicating endangered status. In 1994, the Kootenay River population on the US side of the border was listed as "endangered" under the US Endangered Species Act. In 2003 COSEWIC reclassified sturgeon – all four river systems – as "endangered".
- 3.15 Recovery processes are underway for all four BC river systems although to date Recovery Strategies, Action Plans, and Allowable Harm Assessment have not been completed.

Conservation Measures to Date

- 3.16 Today there are no directed First Nation or commercial sturgeon fisheries in British Columbia. There are no directed retention or catch-and-release recreational fisheries in the Nechako, Columbia or Kootenay systems. There is only a directed catch-and-release recreational fishery for sturgeon on the Fraser River.
- 3.17 Up until the 1980s sturgeon were caught commercially in the Fraser River only incidentally by salmon gear. In 1994 some First Nations on the lower Fraser established rules that restricted their members from targeting sturgeon in traditional fisheries. They also agreed to release any live sturgeon caught incidentally. Province-wide later in 1994 the federal and provincial governments banned the retention of sturgeon in both commercial and sport fisheries. (Prior to 1995, the Province required all anglers fishing for sturgeon in freshwater to have a zero fee sturgeon permit in addition to a regular fishing licence).
- 3.18 During the 1990s the province undertook a significant series of studies on Columbia and Fraser sturgeon stocks to evaluate their life history, population structure and size, movements, habitat utilization and to identify conservation issues that needed to be addressed. In the late 1990s, the provincial and federal governments, in partnership with stakeholders and First Nations established recovery planning processes for the Nechako and Upper Columbia stock groups. Provincial and federal governments also participated in the U.S. led recovery planning process for Kootenay sturgeon.

Exhibit 3: Fisheries Management and Harvest Scenarios Under SARA – White Sturgeon

	Base & SARA Scenario			Fraser River		
	Nechako	Columbia	Kootenay	Base	Options	
					#1 Minimal	#2 Severe
A. Objective	*** achieve self-sustaining natural populations ***					
Present # Mature Fish	457	942	752	8,584	8,584	8,584
Target # Mature Fish	2,500	5,000	2,500	10,000	10,000	10,000
B. Fisheries Measures						
Management						
Aboriginal - Retention	no targeted	none	none	no targeted/ set & drift nets allowed	no targeted/ set & drift nets allowed	no targeted/ management changes*
Commercial - Retention	none	none	none	none	none	none
Recreational - Retention	none	none	none	none	none	none
- Non-retention	none	none	none	yes/no permit	yes/permit required	no
Recreational Activity						
Sturgeon Angler Days - Guided**	0	0	0	14,000	11,200	0
- Other	0	0	0	9,300	7,440	0
- Total	0	0	0	23,300	18,640	0
C. Habitat/Other Measures						
Hydro Operating Changes	yes	yes	yes	n/a	n/a	n/a
Gravel Extraction Impacts	n/a	n/a	n/a	no	yes	yes
Land Use Impacts	n/a	n/a	n/a	no	yes	yes

* First Nation fisheries management measures will be reviewed during DFO First Nation consultation sessions e.g., measures could include maximum soak times for gear, gear restrictions, "daylight only" fisheries etc.

** Guides also guide clients for 6,000 angler days of salmon fishing, half of which would be lost with the cessation of catch & release angling for sturgeon.

Note: 1. There are 6 distinct white sturgeon populations in BC river systems – Nechako, Columbia, Kootenay and 3 from the Fraser.

2. The target population for Columbia River sturgeon is 5,000 since there are two stretches of the system i.e. above and below Hugh Keenleyside Dam.

3. The tentative population target for Fraser River white sturgeon is 5,000 females. Since these populations exhibit sex ratio bias, and females are the limiting sex, for consistency with the other population targets the Fraser target has been presented as 10,000 to include both males and females. At present this value applies to the entire Fraser.

4. Many conservation protection measures were implemented in the 1990s e.g., non-retention for commercial and recreational fisheries. Rebuilding efforts will continue even in the absence of SARA-listing.

5. Prior to 1995, the Province required all anglers fishing for sturgeon in freshwater to have a zero fee sturgeon permit in addition to a regular angling licence. The permit requirement was discontinued in 1995.

Source: COSEWIC (2003), DFO, BC Ministry of Water, Land & Air Protection, and discussions with Fraser River sportfishing guides.

- 3.19 In 1997, the Fraser River Sturgeon Conservation Society (FRSCS), a not-for-profit charitable organization, was created. The Society has worked closely with Fraser River fishing guides, provincial and federal governments, and others conducting biological research and educating the public as to sturgeon issues. Federal and Provincial government are actively working with the society and others to develop a conservation plan for white sturgeon.
- 3.20 US operators of the Libby Dam on the Kootenay River south of the border also have made operational changes and altered flow regimes to assist the sturgeon population. Flow experiments by BC power producers in the Nechako and Columbia are being considered. There is a hatchery facility near Cranbrook that has been used to enhance Kootenay and Columbia River populations. A hatchery facility is proposed for the Nechako River population.

3-2 Fisheries Management and SARA

- 3.21 There are no directed retention or non-retention sturgeon fisheries on the Nechako, Columbia, and Kootenay Rivers i.e., there are no direct "users" of the resource in these three systems. Therefore, for these three river systems we consider the Base Case and SARA scenarios to be equivalent i.e., SARA-listing will have little effect on fisheries management.
- 3.22 The Fraser River is different. There is a substantial catch-and-release recreational fishery directed at sturgeon, a fishery that is growing rapidly. There is also a substantial aboriginal Food Social & Ceremonial (FSC) gillnet fishery targeted at salmon, specifically sockeye, that encounters significant numbers of sturgeon. Some sturgeon are harvested – see Exhibit 4. Fisheries management changes under SARA are considered only for the Fraser River recreational and aboriginal FSC fisheries in this report – see Exhibit 3.

Base Case

- 3.23 The Base Case scenario is the status quo. Catch-and-release angling is allowed on the Fraser. Existing catching methods and management methods for the in-river FSC salmon fishery are continued e.g., typically the Fraser FSC sockeye fishery is open for three days each week from 6pm Thursday through 6pm Sunday. Set nets are the predominant gear utilized (2004 was the first year that DFO authorized the use of drift nets for the FSC fishery upstream of Mission).

Exhibit 4: FSC Fraser River Sturgeon Catch 1983 to 2000

	Region		
	Lower Fraser ^a	Upper Fraser	Total
1983 ^b	2,060	0	2,060
84	2,364	0	2,364
85	1,112	0	1,112
86	1,794	0	1,794
87	1,479	0	1,479
88	6,032	0	6,032
89	4,086	0	4,086
1990	5,815	0	5,815
91	1,459	0	1,459
92	3,126	0	3,126
93	215	0	215
94	0	0	0
95	74	0	74
96	87	0	87
97	58	0	58
98	84	0	84
99	52	0	52
2000	26	0	26

^a below Sawmill Creek (includes Fraser estuary where approximately 28 First Nations fish).

^b no catch estimates are available prior to 1983.

Source: DFO estimates (figures may be underestimated).

SARA Scenarios

- 3.24 White sturgeon would be listed under SARA in 2006 at the earliest. The SARA scenarios for this study are:

Scenarios	
No SARA "Base Case"	- catch & release angling allowed - normal FSC fishery regulations
SARA "Minimal"	- \$10 annual permit (say) required for catch & release angling - normal FSC fishery regulations
SARA "Severe"	- no catch & release angling for sturgeon - management measures to decrease First Nation FSC/white sturgeon interactions

The scenarios are not recommendations or predictions as to management response to SARA. Rather the SARA scenarios illustrate the range of management options that could be implemented. Meaningful consultations with First Nations and the angling community on management options are required.

- 3.25 The permit system for anglers would allow the Province of British Columbia to track the number of sturgeon anglers and their catches through a post-season census (somewhat akin to what is now in place for steelhead anglers). We also considered the "guided angler only" option but our discussions with guides, the Sturgeon Society and government personnel did not suggest that there was an appreciable difference in handling practices of sturgeon between guided and non-guided anglers. Our discussions, however, did indicate that further education of guided and non-guided anglers as to proper sturgeon catch and release techniques would be useful e.g., a formal pamphlet on proper techniques.
- 3.26 The SARA "Severe" scenario of no catch & release angling reflects a strict interpretation of the mandatory prohibition against killing, harming, taking, possessing, capturing, and collecting legally-listed species (unless such a directed fishery is allowed explicitly in the Recovery Strategy – see Section 2-1).
- 3.27 Changes to FSC fisheries as a consequence of SARA listing would be established in consultation with First Nations. Possible measures include maximum specified soak times for gear and/or "daylight only" fishing, as well as gear modifications. The rationale for the "daylight only" FSC fishery measure is that prompt attention to the gear increases the survival of bycatch species substantially – but it is difficult to attend to the gear hourly overnight. Fisheries Officers report that much of the sturgeon mortality from FSC set nets occurs in nets left in the water overnight (Barry Zunti, DFO pers. comm.).

- 3.28 One possible gear modification is to move towards drift nets and away from set nets. Drift nets are attended to or "picked" much more frequently than set nets and accordingly, fish caught in drift nets typically have a much better chance of surviving than do fish caught in set nets (set nets could still be allowed in the Fraser Canyon where drift nets are not suitable). However, drift nets are much more efficient at catching fish than set nets in most circumstances. Therefore, the move to drift nets would require the First Nations fishery to fish to a "hard" Total Allowable Catch (TAC) ceiling and would require stringent monitoring.

DFO has indicated that they would welcome any ideas from First Nations about changes to fishing methods or gear that could reduce sturgeon mortality.

Delisting Assumptions

- 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., if the probability of extinction is not appreciable.
- 3.30 However, given the 30 to 40 year generation lifetime of white sturgeon, it is unlikely that the species would be recommended for listing any sooner than 40 years after its listing date. This is the assumption used in the analysis for all six stock groups.

3-3 Habitat Measures and SARA

- 3.31 Specific habitat measures under SARA could include:
- operational changes to existing Canadian hydroelectric dams on the Nechako and Columbia Rivers (to alter flow regimes)
 - restrictions on gravel extraction from the Lower Fraser
 - restrictions on dyking and urban/shoreline developments on all the river systems

It is unlikely that hatchery developments would be affected by SARA

- 3.32 BC Hydro has undergone an extensive Water Use Planning (WUP) process under provincial authority. The process, which has addressed water flow requirements for fish including sturgeon on the Columbia River, leads to an agreed-upon operating regime and permitted activities. It may be that the WUP permits to be issued to BC Hydro will be deemed to make the operations of the utility "SARA-compliant".
- 3.33 The specification of specific habitat measures and their impact on white sturgeon stock rebuilding is a key component of the Recovery Strategy and Action Plan process. Critical habitat has not been designated. Several Recovery Strategy initiatives are underway but none has been completed in British Columbia to date (on the Kootenay it is planned to extract relevant material from the US Recovery Strategy).

3-4 MAE – Biological Impacts

- 3.34 Improvements in sturgeon numbers and sturgeon habitat can not be projected at this time. What can be said is that any recovery will take decades to achieve.
- 3.35 The Nechako, Columbia and Kootenay populations are at extreme risk of becoming extinct within 40 years without SARA intervention (Dan Sneep DFO pers. comm.). As noted previously, habitat degradation resulting in zero recruitment rather than human-induced mortality is the issue for these systems.
- 3.36 For the Fraser, young fish are recruiting to the river system and the overall population is growing (Nelson et al 2004). Nevertheless, reducing FSC fishery bycatch mortality of white sturgeon under SARA would improve population health.
- 3.37 Moreover, any FSC night-fishing restriction may produce other benefits through reducing poaching as most poaching appears to occur at night (Zunti 2004) i.e., prohibiting FSC night fishing would enhance enforcement of poachers.
- 3.38 In contrast, banning catch & release angling for white sturgeon would remove fishing guides from the river. Guides play a guardian role as they report infractions and suspicious activity, an important role given cutbacks in DFO funding and enforcement. This benefit could be lost.
- 3.39 Increases in Fraser sturgeon populations may affect predator-prey relationships, specifically with respect to eulachon. During April Fraser sturgeon migrate downstream of Mission to gorge themselves on the eulachon run. It is unknown as to how sturgeon predation affects eulachon population health.

3-5 MAE – Ecosystem Impacts

- 3.40 White sturgeon plays an integral part in the BC aquatic ecosystems through natural predator-prey relationships. SARA-listing of white sturgeon will promote recovery and abundance allowing them to play a greater role within the aquatic ecosystem.
- 3.41 White sturgeon are a rare species with prehistoric lineage only found on North America's Pacific Coast and in Canada. They are unique in British Columbia residing only in parts of the Columbia, Nechako, Kootenay, and Fraser rivers. These lineages cannot be replaced once lost, and the more numerous they are, the greater the chances for White Sturgeon to adjust to future environmental changes.
- 3.42 Actions taken to protect these six populations (Columbia, Nechako, Kootenay, and the three Fraser regions) may also benefit a wide range of resident and anadromous species that share the same habitat and water quality requirements.

3-6 MAE – Science & Other Environmental Impacts

- 3.43 If white sturgeon are listed under SARA, there undoubtedly will be additional research on the biology of the species, their distribution, and their habitat. There is a substantial amount of research underway or planned on the species – under SARA there could be greater probability this work goes ahead on its original timetable.

However, any such funding for white sturgeon 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.

- 3.44 The SARA "Severe" scenario could compromise existing research programs that the Sturgeon Society has conducted on a cooperative basis with Fraser River guides and with First Nations. If guides do not participate in the tagging by the Society research, as may happen under the "Severe" scenario where catch & release angling is banned, then the reliability of the research program and its results would be compromised.

3-7 MAE – First Nations Impacts

- 3.45 White sturgeon is important to First Nation people along the Fraser, Nechako, Columbia, and Kootenay Rivers. In times past, sturgeon formed a part of their diet. On the lower Kootenay, First Nations settled at specific locations where sturgeon were prevalent (Bill Green, CRITFC pers. comm.).

Sturgeon also are a focal point of several stories that are passed from one generation to the next and as such, comprise an important component of First Nations culture in these regions.

People often are transformed into various animals, plants and objects in Sxwoxwiyam Xeyt te Xwelmexw (Central Coast Salish Transformation Stories). One story relates to how sturgeon were first created through the transformation of a young woman who was cast into the water. These stories emphasize the relationship between the modern First Nation people and the natural environment, a representation of continuity with ancestors.

Source: Sonny McHalsie, Shxw'ow'hamel First Nation in (Long et al 2004)

Recovery of white sturgeon, therefore would enhance social and cultural benefits to First Nations.

Exhibit 5: Profile of the Fraser River Fishing Guide Industry

<u>Operations¹</u>	<u>2003</u>	<u>2004</u>	<u>2006^{p*}</u>
No. of Active Operations	39	45-50	50-60
Total Client Base			
Guided Boat Trips	3,675	5,175	6,675
Guided Angler-Days	11,000	15,500	20,000
Species Focus of Angler-Days			
Sturgeon	6,700	10,000	14,000
Salmon/Other	<u>4,300</u>	<u>5,500</u>	<u>6,000</u>
	11,000	15,500	20,000
Client Residence			
BC	27%	24%	20%
Other Canada	13%	11%	10%
Outside Canada	60%	65%	70%
Financial \$000			
Guiding Business			
Guide - Revenues	2,700	4,400	6,400
- Wages Paid ²	1,100	1,500	2,100
- Capital Expenditures	1,600	4,400**	2,500
Ancillary Client Expenditures			
Accommodation & Meals ³	600	800	1,000
Licences Fees/Surcharges	100	150	200
Retail & Other	<u>500</u>	<u>800</u>	<u>1,100</u>
	1,200	1,750	2,300

* Projection

** Includes the cost of a major new fishing lodge constructed in 2004

1. Refers only to Region 2 licenced guide operators that served at least one client on the Fraser River.
2. Wages include wages paid to guides, assistant guides, and employees (administration, housekeeping, chefs, etc.) of guide businesses - guides/assistant guide wages assumed to be \$180 per boat trip.
3. Not included in guide revenues packages.

Source: GSGislason & Associates Ltd. estimates based on: 1) BC Ministry of Water, Lands & Air Protection 2003 guide reports, 2) financial survey of guides, and 3) interviews with guides.

- 3.46 In addition, with recovery of white sturgeon populations, there is potential for in-river harvests in the future (albeit several decades in the future).
- 3.47 Changes to the FSC fishery as a consequence of SARA listing would impact First Nations. For example, any "daylight only" regulations likely would require an extension of the present three days fishing for sockeye per week i.e., more days fishing would be required to catch the same amount of fish. Improved monitoring also would be required.
- 3.48 A move towards drift nets in the FSC salmon fishery in the Lower Fraser, similar to that for the commercial fishery in tidal waters, would be disruptive. Larger boats and different gear would be required. Since driftnets are much more efficient at catching salmon, a rigid monitoring and enforcement system would need to be adopted e.g., adherence to a TAC, dockside monitoring, perhaps "hail in-hail out".
- 3.49 It may be that the SARA-listing of white sturgeon could have a greater impact on the in-river FSC fishery for salmon than would SARA-listing of Interior Fraser coho, another species under consideration for listing.
- 3.50 There are no First Nation fishing guide businesses at present on the Lower Fraser.

3-8 MAE – Business Impacts

Angling Impacts

- 3.51 The guiding of anglers to fish for sturgeon on the Fraser River is an important business and a business that is growing rapidly. Yet little is known about the sector. The consultant, with the cooperation of the Fraser Valley Angling Guide Association (FVAGA) and the support of BC Ministry of Water, Lands & Air Protection, conducted an operating and financial survey of guides in the region. The response was excellent with 20 guides representing over 80% of total sector revenues responding to the survey. The provincial guide report data allowed the consultant to extrapolate the survey results to the population of all angling guides in the region. The results of the survey and guide reports analysis are given in Appendix A and summarized in Exhibit 5.
- 3.52 Sturgeon fishing is the main/only reason that out-of-province clients of Fraser River guides visit British Columbia – sturgeon angling on the Fraser is a destination attraction. Other insights from Exhibit 5 include:
- an industry growing from 20 to 40% in recent years
 - an industry primarily focused on sturgeon with the sturgeon share of total activity growing over time
 - an industry with long "coattail effects" on the tourism sector (e.g., accommodation, meals, retail) as well as dependent sporting goods stores
 - an industry with the majority of clients coming from outside the country i.e., it has a strong export component

- 3.53 We note also that guided angling for sturgeon comprises an estimated 60% of total sturgeon angling - there are substantial numbers of non-guided sturgeon anglers and these numbers are growing rapidly as well. By 2006 we project a total of 23,300 sturgeon angler days on the river – 14,000 guided and 9,300 non-guided. (We also note that sturgeon angling under federal licence in saltwater downstream of the Mission Bridge also occurs – but our discussions with industry and DFO suggest that it may only be 10% of upstream activity. It is not included in our analysis).
- 3.54 Clearly loss of the opportunity for catch and release angling for sturgeon would have a severe impact – the vast majority of guide businesses would close. Guides also note that even if catch & release sturgeon angling is still allowed, but white sturgeon is listed as "endangered", then this would have a negative impact on their business (e.g., how do you sell or market an angling experience targeted at an endangered species?).
- 3.55 For this study, we assume that the "Minimal" scenario – a \$10 annual permit to continue catch & release angling for sturgeon – would reduce activity by 20% due to diminished demand.
- 3.56 The "Severe" scenario in which catch & release angling for sturgeon is banned would result in the complete loss of all 23,300 sturgeon angling days. Some small share of these days may get redirected to other fisheries but this share is likely to be small, as sturgeon angling requires specialized equipment and the majority of guided anglers have the sturgeon guide package as a destination attraction (in addition, sturgeon are available year round whereas salmon are available for less than half the year).
- 3.57 Guides also note that the loss of sturgeon opportunities could affect salmon guiding opportunities e.g., a client from Europe may fish 5 days for sturgeon, 2 days for salmon on his 7 day package. If he cancels the package then the loss includes the loss of salmon angling as well. We assume loss of half of the 6,000 guided angler-days for salmon.
- 3.58 The recreational sector results of Exhibit 5 can be summarized as:

		Annual Recreational Expenditure Losses \$000
SARA	- "Minimal"	2,112
	- "Severe"	9,255

The above are annual losses. Discounting these annual losses over say 40 years in the future, the minimum time for delisting to occur, at a 6% real discount rate results in a Net Present Value (NPV) loss greater than 15 times the annual loss e.g., the cumulative loss in angler expenditures over 40 years under the "Severe" option would exceed \$130 million (\$ 2004).

Exhibit 6: Impact of SARA on Sturgeon Angler Expenditures

	Annual Angler Expenditures \$000		
	Guided	Non-Guided	All
A. PROJECTED SCENARIO			
No SARA - "Base"	8,700	1,860	10,560
SARA - "Severe"	1,305	0	1,305
B. IMPACT OF SARA			
"Minimal"	(1,740)	(372)	(2,112)
"Severe"	(7,395)	(1,860)	(9,255)

Note: 1 The "impact" of SARA is the SARA scenario less the "Base Case" scenario e.g., the impact of "Minimal" SARA on guided angler expenditures is (\$1.74 million) or \$6.96 million less \$8.70 million.

2 The "Base Case" reflects 20,000 guided angler days – 14,000 sturgeon and 6,000 salmon – plus 9,300 non-guided angler days for sturgeon.

Source: Derived from: 1) guided angler-days in Exhibit 4, 2) the assumption that guided days represents 60% of total days, 3) average daily expenditures of \$435 for guided anglers including ancillary expenditures (see Exhibit 4) and \$200 for non-guided anglers, and 4) the assumption that all sturgeon angler-days and half of guided angler-days for salmon would be lost if catch & release angling for sturgeon was banned.

Sturgeon Aquaculture Impacts

- 3.59 Presently there is one sturgeon aquaculture company in the province, Target Marine Hatcheries Ltd. on the Sunshine Coast. The province has drafted a sturgeon aquaculture policy and there is substantial interest in expanding the sector. New entrants may require access to wild broodstock from the Lower Fraser – but Target Marine does not as it accesses broodstock originally developed in the 1980s by Malaspina University College (Justin Henry, Target Marine pers. comm.).
- 3.60 Although the COSEWIC Assessment Report identifies sturgeon aquaculture as a threat to the wild population (COSEWIC 2003), the recent draft policy outlines ways and means that sturgeon aquaculture can be conducted in a responsible and sustainable way. These controls include:
- use of land-based production facilities
 - measures to prevent predation, escapes, inappropriate discharge of water
 - tracking requirements for producers, transporters, and retailers (whole fish and slaughtered products)
- 3.61 Tracking and tagging requirements already exist for export shipments of farmed sturgeon under CITES (the Convention for International Trade on Endangered Species).
- 3.62 A key issue for aquaculture producers is access to new broodstock. It is unclear how SARA-listing of white sturgeon would affect such access even if an Allowable Harm Assessment may indicate limited removals from the Fraser pose no risk to stock health.
- 3.63 Moreover, it is also unclear as to how SARA-listing would affect live product shipments/sales and consumer demands. Some BC seafood distributors presently import wild and farmed white sturgeon from Columbia and Sacramento producers.

Power Generation Impacts

- 3.64 Any changes to operating practices of power generators on the Nechako and Columbia Rivers could result in increased costs and/or reduced power.
- 3.65 BC Hydro has provided estimates of increased costs on the Columbia River to help white sturgeon recover as proposed under the Water Use Planning process. The additional costs for hatchery development, tagging, brood collection and special studies exceed \$0.5 million annually (Bonnie Hill, BC Hydro pers. comm.).

BC Hydro also notes that the cost of periodic simulation of the natural hydrograph on the Columbia River would be much more expensive at \$10 million plus for each such “event”. There would be high social and financial costs including significant effects on First Nations interests, housing and recreational infrastructure due to flooding. Such events also would violate provisions of the international Columbia River Treaty triggering significant compensation to US interests.

3.66 No information is available as to potential costs of other power generators, such as Alcan on the Nechako and Columbia Power Corp on the Columbia system, to help white sturgeon recover.

Urban Development Impacts

3.67 SARA-listing could significantly affect gravel removal, shoreline and urban development, and a host of other activities in the Fraser Valley. Quantitative estimates of impacts are not possible at this stage as Action Plans have not been formulated.

3-9 MAE – Government Impacts

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

Federal & Provincial SARA Costs 2004/05	
Person-Years	4.0
Costs - Labour*	\$440,000
- Other	<u>\$160,000</u>
- Total	\$600,000

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

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

	Annual Government Tax Losses \$ 000		
	Personal*	Corporate**	Commodity
"Minimal"	120	20	270
"Severe"	540	90	1,200

* Assumed to be 20% of wages.

** Assumed to be 1% of expenditures.

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.

3.70 There would be losses to provincial revenues through reduced licence sales in the "severe" option where 26,300 angler-days are lost (23,300 sturgeon, 3,000 salmon), an estimated \$180,000. In contrast under the "Minimal" option, the new sturgeon \$10 permit fee would raise about \$50,000 (assuming 5,000 people take out the permit) but this gain would be counterbalanced by the loss in regular licence fees under the 20% reduction in activity.

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.

3-10 MAE – Regional Development Impacts

3.71 The impacts of the three SARA scenarios on provincial measures of Gross Domestic Product or GDP (\$ 000), wages (\$ 000), and employment (person-years) under the SARA scenarios are:

	Annual Direct Loss			Annual Total Loss		
	GDP	Wages	Employment	GDP	Wages	Employment
"Minimal"	1,160	610	19	1,740	910	30
"Severe"	5,090	2,680	85	7,640	4,020	140

The estimates are derived from the recreational sector SWOT study (GSGislason & Associates Ltd. 2004), the guide survey conducted for this study (Exhibit 5) and provincial multiplier analysis (Horne 2004). Total impacts include indirect supplier plus induced consumer responding impacts as well as direct impacts.

3-11 MAE – Social & Community Impacts

3.72 Sturgeon 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 continue existence of sturgeon regardless of whether or not or they or their ancestors "use" the resource. Evidence of this are the hundreds of volunteers to the Sturgeon Society and the broad public concern expressed when several large dead sturgeon washed up upon the shore of the Fraser River in 1993 and 1994.

3.73 The guiding of sturgeon anglers and associated expenditures are concentrated in the Fraser Valley east of Greater Vancouver. Several communities such as Chilliwack, Mission and Agassiz would see reduced tourism and tourist expenditures with the loss of sturgeon catch & release angling opportunities.

3-12 SARA Impact Summary

3.74 The following summarizes the potential SARA measures and associated impacts.

SUMMARY – WHITE STURGEON SARA IMPACTS

Current Situation & Potential SARA Actions	
Current Situation	<ul style="list-style-type: none"> - severe declines in abundance in Kootenay, Columbia, Nechako (all dammed) and Fraser (undammed) River systems over past 100 years - Fraser population increasing in recent years but other populations still decreasing - significant catch & release angling on Fraser but entails almost no mortality - illegal harvest is a significant source of mortality on the Fraser - FSC fishery bycatch and mortality of sturgeon in the salmon fishery is significant and has the potential to affect sturgeon recovery - lack of recruitment limiting factor on other systems
Fisheries Actions	<ul style="list-style-type: none"> - angler permit system or ban catch & release angling - management changes to FSC fishery on Fraser to reduce bycatch
Habitat Actions	<ul style="list-style-type: none"> - changes to hydroelectric dam, gravel extraction, development practices
Potential Impacts of SARA	
Environmental Impacts	
1. Biological	<ul style="list-style-type: none"> - recovery will take several decades as species long-lived, late-maturing - recruitment challenges in Kootenay, Columbia & Nechako systems to be addressed in short term through hatchery efforts
2. Ecosystem	<ul style="list-style-type: none"> - return to traditional predator-prey
3. Science/Other	<ul style="list-style-type: none"> - spur additional research - but also jeopardise existing research as angling guides may withdraw from current research if species listed
Socio-Economic Impacts	
4. First Nations	<ul style="list-style-type: none"> - impact on FSC fishing practices - enhance cultural benefits & potentially provide long term opportunity for harvest
5. Business	<ul style="list-style-type: none"> - most angling guides go out of business, reduction in angler expenditures - emerging aquaculture industry could be stalled - BC Hydro recovery efforts embedded in Water Use Plans & not attributable to SARA per se - unknown impacts from other habitat measures
6. Government	<ul style="list-style-type: none"> - loss of personal, corporate & commodity (e.g., fuel) taxes
7. Regional Development	<ul style="list-style-type: none"> - loss in GDP, wages and employment
8. Social & Community	<ul style="list-style-type: none"> - species existence or intrinsic value enhanced with recovery - negative impacts in tourism on Chilliwack & other Fraser Valley communities
Key Assumptions, Uncertainties and Risks	
<ol style="list-style-type: none"> 1. cause of recruitment failure in Kootenay, Columbia & Nechako is unknown 2. discussions with First Nations as to changes to FSC fishery practices ongoing 3. proposed habitat measures and their impacts unknown 4. much better data on FSC harvests and bycatch mortality for sturgeon required on Fraser 5. current assumption is that listing would apply to all stocks even though Fraser stock is much more abundant and increasing 6. can a directed catch-and-release fishery, with very low mortality, be permitted under SARA? 	

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Appendix A

Fraser River Fishing Guide Profile 2003

Exhibit A.1: Overview of Fraser River Angling Fishing Guides 2003

Operations		Income Statement (\$ 000)	
No. of Operations	39	Revenues	2,700
Total Client Base		Expenses	
Boat Trips	3,650	Wages, Salaries & Benefits ²	1,100
Angler-Days	11,000	Fuel & Bait	300
		Insurance	100
Client Residence		Other Expenses	<u>500</u>
BC	27%		2,000
Other Canada	13%		
Outside Canada	<u>60%</u>	Income Before Interest, Depreciation & Taxes	700
	100%		
		Investment (\$ 000)³	
Species Focus		2003 Capital Expenditures - Facilities	400
Sturgeon	61%	- Boats & Motors	900
Salmon/Other	<u>39%</u>	- Other	<u>300</u>
	100%		1,600
Employment			
Total Jobs			
Guides	39		
Assistant Guides	41		
Others	<u>30</u>		
	110		
Employment PYs¹	40		

1 Person-years.

2 Includes wages to guides and assistant guides (assumed to be \$180 per day) plus wages to administration, housekeeping, chefs, etc. for those with facilities.

3 Includes investment by assistant guides.

Source: Fraser River Guide Survey.

Exhibit A.2: Fraser River Angling Guide Operations 2003

A. Overview of Operations^a

No. of Active Operations	39	Activity	
		Av. Months per Operation	6.5
Guides		No. of Guided Days	3,650
Licensed Guides	39	No. of Guided Angler Days	11,000
Assistant Guides	<u>41</u>		
Total	80	Angler Residence	
		BC	27%
Guide Operations by Region		Rest of Canada	13%
Fraser Mainstem	39	Outside Canada	60%
Harrison River	26		
Other	19		

B. Species Focus of Guide Operations

	Region of Operation ^c			All
	Fraser Mainstem	Harrison River	Other ^d	
Angler Days Guided				
Sturgeon Fishing ^b	6,250	450	0	6,700
Other Fishing	<u>2,900</u>	<u>800</u>	<u>600</u>	<u>4,300</u>
Total	9,150	1,250	600	11,000

- 1 A Fraser River angling guide is deemed to be an angling guide who served at least one client on the Fraser River during 2003/04 i.e., excludes inactive guides, guides who guided in the tributaries only.
- 2 A sturgeon fishing day is one in which the party fished for sturgeon for all or part of the day i.e., a non-sturgeon fishing day is one in which the party fished for species other than sturgeon, but did not fish for sturgeon.
- 3 A "Fraser Mainstem" fishing day is one in which the party fished on the Fraser Mainstem for all or part of the day. A "Harrison River" fishing day is one in which the party fished on the Harrison River for all or part of the day, but did not fish in the Fraser Mainstem. An "Other" fishing day is one in which the party fished but did not fish on either the Fraser Mainstem or the Harrison River.
- 4 Vedder, Pitt, Chehalis, Lillooet, and other tributaries.

Source: GSGislason & Associates Ltd. estimates based on guide reports – corrected for underreporting - submitted to BC Ministry of Water, Lands & Air Protection.

Exhibit A.3: Fraser River Guided Angler Catch 2003

	Fishing Region			Total
	Fraser Mainstem	Harrison River	Other ^a	
A. Guided Angler-Days	9,150	1,250	600	11,000
B. Guided Angler Catch				
Fish Harvested				
Sturgeon	0	0	0	0
Salmon - chinook	740	10	30	780
- sockeye	2,060	0	0	2,060
- coho	20	80	50	150
- pink	1,310	790	15	2,115
- chum	110	190	30	330
Other e.g. cutthroat, bull trout	<u>15</u>	<u>5</u>	<u>10</u>	<u>30</u>
All	4,255	1,075	135	5,465
Fish Released				
Sturgeon	14,200	670	0	14,870
Salmon - chinook	280	30	30	340
- sockeye	1,620	5	50	1,675
- coho	40	290	200	530
- pink	5,070	4,050	105	9,225
- chum	550	1,070	115	1,735
Other e.g. cutthroat, bull trout	<u>50</u>	<u>400</u>	<u>1,910</u>	<u>2,360</u>
All	21,810	6,515	2,410	30,735
Total Fish Caught				
Sturgeon	14,200	670	0	14,870
Salmon - chinook	1,020	40	60	1,120
- sockeye	3,680	5	50	3,735
- coho	60	370	250	680
- pink	6,380	4,840	120	11,340
- chum	660	1,260	145	2,065
Other e.g. cutthroat, bull trout	<u>65</u>	<u>405</u>	<u>1,920</u>	<u>2,390</u>
All	26,065	7,590	2,545	36,200

^a Vedder, Pitt, Chehalis, Lillooet, and other tributaries.

Source: GSGislason & Associates Ltd. estimates based on guide reports – corrected for underreporting – submitted to BC Ministry of Water, Lands & Air Protection.