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# Proceedings of the National Science Review Meeting on Species at Risk Issues, December 9-13, 2002, Halifax, Nova Scotia.

# Compte rendu de la réunion de revue nationale des sciences au sujet des espèces en péril, du 9 au 13 décembre 2002, Halifax, Nouvelle-Écosse.

**Howard Powles – Chairperson/président**

**Fisheries and Oceans Canada / Pêches et Océans Canada**
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# Summary

The second DFO National Advisory Process meeting to discuss science issues related to the assessment, protection and recovery of marine fish species at risk, was held in Halifax, Nova Scotia, December 9-13, 2002. Information held by DFO on upcoming marine fish species to be assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) was reviewed at the meeting. In addition, methods for determining allowable mortality for species listed as endangered or threatened under the Species at Risk Act (SARA), as a basis for assessing whether incidental harm permits (IHPs) could be issued, were reviewed. Participants included DFO scientists and fisheries management representatives, academia, authors of COSEWIC status reports, COSEWIC members, and a scientist from the US National Marine Fisheries Service.

These proceedings include presentation summaries for working papers that reviewed information held by DFO which could be used by COSEWIC in assessing status and extinction risk of several marine/diadromous fish species, including: American shad (*Alosa sapidissima*), blue hake (*Antimora rostrata*), winter skate (*Leucoraja ocellata*), Acadian redfish (*Sebastes fasciatus*), golden redfish (*Sebastes marinus),* porbeagle (*Lamna nasus*), and striped bass (*Morone saxatilis*). Also included are the minutes of discussion, and the recommendations and conclusions for each species. In addition, these proceedings include the presentation summaries for working papers presented as case scenarios for the following species that will be subject to IHPs upon the proclamation of SARA: leatherback turtle (*Dermochelys coriacea*), northern wolffish (*Anarhichas denticulatus*) and spotted wolffish (*Anarhichas minor*), and Interior Fraser River coho salmon (*Oncorhynchus kisutch*). The minutes of discussion, and conclusions and recommendations for these species are also included.

# Résumé

La deuxième réunion du Processus consultatif national du MPO pour discuter des aspects scientifiques de l'évaluation, de la protection et du rétablissement d'espèces de poissons marins en péril a eu lieu à Halifax, en Nouvelle-Écosse, du 9 au 13 décembre 2002. L'information dont disposait le MPO sur les espèces de poissons marins qu'évaluera bientôt le COSEPAC (Comité sur la situation des espèces en péril au Canada) a été passée en revue. De plus, des méthodes de détermination du taux de mortalité admissible pour les espèces désignées comme étant en voie de disparition ou menacées en vertu de la *Loi sur les espèces en péril* (LEP) ont été revues, à titre d'assise pour déterminer si des permis de tort incident peuvent être délivrés. Les participants à cette réunion incluaient des représentants de la gestion des pêches et des scientifiques du MPO, des gens du monde universitaire, des auteurs de rapports COSEPAC, des membres du COSEPAC et un scientifique du National Marine Fisheries Service des États-Unis.

Le présent compte rendu inclut des résumés des documents de travail présentés portant sur l'information dont dispose le MPO qui pourrait servir au COSEPAC à évaluer la situation et le risque de disparition de plusieurs espèces de poissons marins et diadromes, y compris l'alose savoureuse (*Alosa sapidissima*), l'antimore bleu (*Antimora rostrata*), la raie tachetée (*Leucoraja ocellata*), le sébaste acadien (*Sebastes fasciatus*), le sébaste orangé (*Sebastes marinus),* le requin-taupe commun (*Lamna nasus*) et le bar d'Amérique (*Morone saxatilis*). Le procès-verbal des discussions est aussi inclus, ainsi que les recommandations et les conclusions pour chaque espèce. Ce compte rendu comprend aussi les résumés des documents de travail présentés à titre de scénarios de cas pour les espèces suivantes, qui seront visées par un permis de tort incident lorsque la LEP sera promulguée : la tortue luth (*Dermochelys coriacea*), le loup à tête large (*Anarhichas denticulatus*), le loup tacheté (*Anarhichas minor*) et le saumon coho (*Oncorhynchus kisutch*) du bassin intérieur du Fraser. Le procès-verbal des discussions, ainsi que les conclusions et les recommandations pour ces espèces, sont aussi inclus.

# Introduction

Terms of reference for the meeting are in Appendix 1. Under the proposed Species at Risk Act (SARA), assessment of a species' status and the designation of risk categories are the responsibility of the Committee on Status of Endangered Wildlife in Canada (COSEWIC). The Department of Fisheries and Oceans holds information and expertise that will be essential to COSEWIC in assessing status and extinction risk for aquatic species.

One objective of this meeting was to review all relevant DFO data and information on several marine species, with the intent of providing this information to COSEWIC authors to assist with the preparation of their status reports.

Working papers summarising the information held by DFO on the following species were reviewed:

- American shad (*Alosa sapidissima*)
- Blue hake (*Antimora rostrata*)
- Winter skate (*Leucoraja ocellata*)
- Acadian redfish (*Sebastes fasciatus*)
- Golden redfish (*Sebastes marinus)*
- Porbeagle (*Lamna nasus*)
- Striped bass (*Morone saxatilis*)

The type of information reviewed for each species included (where available):

- Relevant life history characteristics such as growth parameters, age (and/or length) at maturity, maximum age (or length), fecundity, production of young per year, duration of planktonic larval life, and specialised habitat requirements
- Abundance
- Distribution
- Threats to the species survival

The second objective of this meeting was to present case scenarios for the development of incidental harm permits (IHPs). The Species at Risk Act prohibits the killing, harming, harassing, capturing or taking an individual of a species that is listed as extirpated, endangered or threatened (SARA section 32), and prohibits damaging the residences of such species (SARA section 33). The competent minister can permit prohibited activities if the purpose is either research on the listed species or to improve the prospects for survival of the species or if the permitted activity has an incidental impact on the listed species (SARA sections 73 and 74).

The competent minister for aquatic species is the minister of Fisheries and Oceans. Such a permit can be granted only if the minister is satisfied that all reasonable alternatives have been considered, harm to the listed species will be minimised, and any harm caused will not jeopardise the survival or recovery of the listed species. An individual, who is lawfully engaged in an activity permitted by a recovery strategy, action plan, or management plan, is exempt from the provisions of SARA Subparagraph 83(4). Incidental harm permits will be required, if incidental mortality is allowable, for the following species that will be placed on Schedule 1 upon the proclamation of SARA:

- Leatherback turtle (*Dermochelys coriacea*)
- Northern wolffish (*Anarhichas denticulatus*)
- Spotted wolffish (*Anarhichas minor*)
- Interior Fraser River coho salmon (*Oncorhynchus kisutch*)

These proceedings document a summary of the presentations made, along with the discussion and conclusions resulting from this national review meeting to consider certain questions related to species at risk protection and recovery.

Unlike typical science advisory process meetings, science advice was not provided. Research Documents summarising the available information on the above species will be produced from this meeting, in addition to the summary of discussions in these proceedings.

# 1. Species Status Assessments

## Redfish

### 1.1(a) Working Paper SARA NAP 02b-01a

***Overview of the genetic structure of redfish species in Atlantic Canada***

*Authors: Sévigny, J.M., L. Bernatchez, S. Roques, B. Morin, D. Power, R. Branton, A. Valentin, É. Parent, J.-P. Chanut, B. Desrosiers, and R. Mayo.*

***Presentation Summary***

There are four redfish species in the North Atlantic: *Sebastes viviparus*, *S. fasciatus*, *S. mentella* and *S. marinus*. The distribution of *S. viviparus* and *S. fasciatus* is restricted to the Northeast and Northwest Atlantic respectively while the other two are present on both side of the ocean. Although some of them are difficult to discriminate on a morphological basis, the application of microsatellite DNA markers has established that they all belong to genetically differentiated groups.

*Sebastes fasciatus* and *S. mentella* are the two most abundant species in the Northwest Atlantic where their geographic distribution differs. While the distribution of *S. mentella* extends from the Gulf of St. Lawrence northward that of *S. fasciatus* extends from the southern Grand Banks southward. *Sebastes fasciatus* is also found in the southern Labrador Sea where the species appears to reach its northernmost limit. The distribution of the two species overlaps mainly in the Gulf of St. Lawrence and the Laurentian Channel, around the Grand Banks and on Flemish Cap. This area sympatry comprises a limited zone of introgressive hybridisation in the Gulf of St. Lawrence, the Laurentian Channel and Flemish Cap. Hybridisation between *S. fasciatus* and *S. mentella* is bi-directional and higher for *S. mentella* than for *S. fasciatus*.

*Sebastes fasciatus* and *S. mentella*, show differences in body shape and in a number of other morphological characters such as the number of soft rays at the anal fin (AFC) and extrinsic gasbladder musculature (EGM) and variability at the *MDH** locus. The last three criteria are useful for the description of geographic distribution and the determination of species composition on a routine basis except in the area of hybridisation where the congruence among them is lower.

Introgressive hybridisation appears to be a key factor in the determination of population genetic structure of *S. fasciatus* and *S. mentella*. Indeed, for *S. mentella* there was no difference among samples collected outside the introgression zone except at the very large geographical scale of the North Atlantic where three broad groups could be recognised: Eastern (Norway and Barents Sea), Panoceanic and Western (Gulf of St. Lawrence and Laurentian Channel). The existence of heterogeneity on smaller scale could not be excluded for this species. For *S. fasciatus*, differences in genetic variability were detected between samples collected in the Gulf of Maine, Scotian Shelf and

Laurentian System (Gulf of St. Lawrence and the Laurentian Channel) although differences between the Gulf of Maine and Scotian Shelf were very small.

### *Discussion*

Differences in gas bladder musculature from that used in the GBM technique does not necessarily designate a hybrid *Sebastes*, according to matched genetic studies. Three "stocks" of *S. fasciatus* have been suggested from statistically significant microsatellite DNA allele frequency variation. The differences are not great, but a high degree of differentiation within marine species is not expected. There were only 6 sampling sites, however, a current, ongoing study will increase the sample size.

There was some discussion that introgression may be driving this level of variation as compared to that observed in the Eastern North Atlantic. The question was raised as to whether the microsatellite allele patterns could represent a cline in *S. fasciatus* characters, rather than stock differentiation. In the working paper the pattern of heterogeneity was attributed to differentiation in levels of introgression. For example, samples MES 1-3 were relatively close together geographically, and these samples exhibited relatively high intogression. A possible explanation of this pattern may be due to linkage disequilibrium.

The authors did test for linkage disequilibrium in the genetic data, but not in the analysis of morphometric characters. Specimens used for the genetic description of the stock structure were pre-selected based on the two morphological (AFC, EGM) and the genetics (MDH) characters.

The work presented in this working paper represents a synthesis of research undertaken in the High Priority Research Project, and as such represents the "final product" on species-level geographic structure analyses of *Sebastes* in Atlantic Canadian waters. Current work examines stock structure rather than species structure. Four "types" of *Sebastes* (including the introgressed groups) can be identified. There was some discussion concerning the status and stability of the hybrid group. It was suggested that if the hybrid group is stable over time, then the possibility exists that the hybrids represent another adaptive group. However, if the two *Sebastes* species have differing reproductive success, backcrossing rates could be equal and survivorship unequal. Therefore, one group would appear to exhibit higher introgression. Linkage disequilbrium could be used to determine if hybrids are first generation offspring, rather than a stable group. This analysis could be undertaken with the shape analysis, but has not been attempted as of yet

## 1.1(b) Working Paper SARA NAP 02b-01b

### *Description of the methods used to separate the redfish species of the groundfish surveys in Units 1 and 2*

*Authors: Méthot, R., B. Morin, and D. Power (for Unit 2)*

### *Presentation Summary*

Visual distinction between the redfish species (*S. mentella*, *S. fasciatus* and *S. marinus*) is very difficult. Some methods have been developed to separate species but are costly and/or time consuming. Due to this taxonomic difficulty, the redfish in NW Atlantic is currently managed as one "species" although various morphologic and biochemical characters that could be use to separate those species have been recorded by DFO in the last years in some regions.

Morphological and genetic data collected under the 1995-1998 strategic redfish research project were analysed to describe the proportions of *S. fasciatus*, *S. mentella* and heterozygotes by depth zone and to develop corrections to the anal fin rays count (AFC). Data available were mainly AFC, but is the most variable criteria. The methods to convert AFC to genotypes and to get a relationship between depth and genotype were presented. Finally, the methods used to get mature population abundance were described.

### *Discussion*

Inclusion of temperature as an explanatory variable in the separation of redfish species was discussed. The utility of temperature has not been demonstrated fully (for Canadian waters), but it was noted that temperature is related to depth, and depth is used as a criterion. Redfish occupy a range of temperatures across their geographic range (from 3-4 C, to 6-8 C). Temperature has been investigated in research on redfish residing in the Eastern North Atlantic, but a signal/relationship has not been resolved.

## 1.1(c) Working Paper SARA NAP 02b-01c

### *Status of Unit 1 redfish species in the context of species at risk*

*Authors: Morin, B. and R. Méthot*

### *Presentation Summary*

This paper presented DFO information on redfish species in management Unit 1 (4RST + 3Pn + 4Vn) to support the COSEWIC process of assessment of species status and designation of risk categories for species on its candidate list.

The methods developed to separate by species (see section 1.1(b)) were applied to the research surveys available for Unit 1, when it was possible.

The abundance indices for the DFO summer and sentinel summer surveys in 4T, and DFO winter surveys by species (all ages and mature population) were presented. Also, the distribution and concentration indices (DWAO, D95 and GINI index) were discussed. The catch distributions by genotype of each survey were also described. Finally, commercial landings figures from 1953 to 2002, and the standardised catch rates since 1986, were presented.

### *Discussion*

Spatial indices were calculated for all ages, not just using the mature ages. The difference in the abundance estimated from the RV survey versus the sentinel surveys is likely due to the use of different gear, with gear and survey design differences affecting redfish catchability. Gears used have differences in swept area and selectivity.

The estimates of decline were based on the difference between the earliest and most recent estimates. There was a discussion of alternative hypotheses to be investigated using the null model hypothesis of a constant threatening process; i.e. fit a logistic model of decline. However, a constant decline may not be the most tenable hypothesis. Another hypothesis is that fisheries have targeted approximately three year classes (e.g. 1970s, early 1980s year classes). After those year classes petered out, declines were observed. The question was raised as to whether it is appropriate to extrapolate beyond the range of the data, using the slope of the log model of abundance trend. An alternative method is to calculate an average for the early period (historic) and an average for the recent period, then compare these averages to estimate abundance change (decline).

## 1.1(d) Working Paper SARA NAP 02b-01d

### *Status of Unit 2 redfish species in the context of species at risk*

*Authors: Méthot, R., B. Morin, and D. Power*

### *Presentation Summary*

This paper presented DFO information on redfish species in management Unit 2 (3Ps4Vs4Wfg + 3Pn4Vn) to support the COSEWIC process of assessment of species status and designation of risk categories for species on its candidate list.

Redfish are traditionally not identified to the species level on DFO research surveys. Morphological and genetic data collected under the 1995-1998 strategic redfish project were utilised to derive proportions of *Sebastes fasciatus* and *S. mentella* by depth zone, which were then applied to the bottom trawl survey abundance data. The depth zones employed were consistent with the depth stratification utilised on the stratified-random surveys. Redfish are considered to inhabit waters primarily from 100m-750m

There are a number of DFO bottom trawl surveys that occur within the Unit 2 boundary. The DFO summer bottom trawl surveys in 3P4V, conducted from 1994-1997, 2000 and 2002, are the only series that cover sufficient area of the redfish habitat within the management area and thus provide the only essential index of the abundance. Redfish are a semi-pelagic species. A concurrent acoustic estimate from the 2000 survey suggests that about 80% of the redfish abundance were available to the survey gear.

Over the time period covered by the surveys, the abundance index from the bottom trawl survey has ranged from about 600-900 million redfish with *S. fasciatus* comprising more than 60% annually. Recent information suggests that the strongest year classes, since the 1980s, have been *S. fasciatus*.

Indices of area of occupancy for all species suggest stability. Indices of concentration also suggest relative stability for each species.

Information on life history characteristics of redfish by species is very limited. Information specific to Unit 2 suggests the following:

Length at 50% maturity for sexes combined for Unit 2 redfish based on sampling from the strategic project suggests 22cm for *S. fasciatus* and 24 cm for *S. mentella*. These estimates were used to define the mature population (>= L50 sexes combined).

General life history characteristics for redfish spp. suggest the following:

Maximum age in recent years is 30+
Age at 50% maturity is about 12(±) 2 years.
Natural mortality rate is about 0.1 (approximately 10%).
Fecundity between 20000-40000 eggs per mature female
*Sebastes* are ovo-viviparous (females bear live young)

### *Discussion*

Analyses of redfish in area 4V used all size groups, not just mature fish. This summer RV survey of the Scotian shelf includes only depths ≤ 200 fathoms, and thus does not include all available redfish habitat. The "spikes" in abundance exhibited by the summer survey were thought to be due to noise/variation and relatively low catchability. Also have an RV survey undertaken in area 3PS,N, but this data has yet to be converted into a standard gear across various vessel/gear combinations since 1973, and there are some concerns if this survey is representative of stock abundance throughout the entire Unit 2 area.

## 1.1(e) Working Paper SARA NAP 02b-01e

### *Review of the abundance and distribution of Sebastes fasciatus in Unit 3 in a species at risk context*

*Authors: Jewett, T. and B. Branton*

### *Presentation Summary*

This paper presented DFO information on redfish species in management Unit 3 (4WdehklX) to support the COSEWIC process of assessment of species status and designation of risk categories for species on its candidate list.

Using data from the High Priority Redfish Project we determined that the frequency of *S. fasciatus* among the population in Unit 3 is significantly higher than *S. mentella*, therefore, all further analysis considered *S. fasciatus* as the only redfish species in Unit 3. We used the summer RV survey data series (1970 to present) for our review because it is the longest time series for Unit 3 redfish data. Due to the high variability of this data and a change in research vessels and gear in the early 80s, we chose several ranges in time to calculate rate of decline of the population. We compared the extreme years of the data set; we excluded the data prior to the vessel/gear change and compared the extreme years of this data set; we used a 5 year running average of the extreme years for the original data set and the subset of the data; and we used a conversion factor to correct the data from the different vessel/gear. The different methods for comparing the data produced rates of decline ranging from a 70% decline (comparing 1970-2002 with the conversion factor applied) to a 20% increase (5-year running averages for 1982-1986 and 1998-2002) in population. The number of mature individuals was determined using a length at 50% maturity of 21cm. Length frequencies of redfish caught on the summer RV survey illustrated the size distribution for each year from 1970 to the present. The area of occupancy index shows some variability, but overall there appears to be no trend in the extent of area where redfish are present. The Gini index shows no variability over time, yet the D95 index is extremely variable, but without an apparent trend. Other surveys conducted by DFO that have covered only parts of Unit 3 are referred to with distribution maps that illustrate the number of fish caught and the areas these surveys covered. The landings for Unit 3 redfish have been relatively high and stable in the past decade. Historically, redfish landings were mainly from large stern and side trawlers. However, in the past 10 years, smaller stern trawlers have dominated the redfish fishery.

### *Discussion*

The variability of the summer RV index was discussed. This survey is a multipurpose survey directed at the major commercial groundfish species. Redfish are semi-pelagic and exhibit a diurnal vertical migration, therefore, not all redfish in an area are available to the bottom trawl gear used.

A 5-year running mean has been used in the past to smooth the series. The data presented do not include the deep-water strata added in 1996.

## 1.1(f) Working Paper SARA NAP 02b-01f

### *Methods used to separate redfish species found in the rest of the Newfoundland stock areas (2GHJ3K, 3LN, 3O)*

*Author: Power, D.*

### *Presentation Summary*

This paper presented DFO information on redfish species within the 2J3KLNO area to support the COSEWIC process of assessment of species status and designation of risk categories for species on its candidate list.

Redfish are traditionally not identified to the species level on DFO research surveys. Species identification data collected under the 1995-1998 strategic redfish project were considered insufficient to derive proportions of *Sebastes fasciatus* and *S. mentella*. For survey estimates the next best data source of data was the meristic database utilised in Ni (1982)[1]. This database was utilised to derive proportions of each species by depth zone based on the survey stratification for various survey series within the three “stock” areas (SA2+Div 3K, Div 3LN, and Div 3O).

Based on a published literature review tabled in Ni (1982), studies of meristic characters by the following researchers suggest the following: *S. mentella* has 30 vertebrae (V), 8-9 anal fin rays (AFR), 15 dorsal fin rays (DFR) while *S. fasciatus* has 29 V, 7-8 AFR, 14 DFR. Individual fish were assigned to one or the other species if two of the three characters exhibited the typical count. Ambiguous specimens were not used (eg. a fish with 30 V, 8 AFR and 14 DFR).

Surveys in 2J3K have been conducted since 1978 to at least 750 meters. The data series can be compared because vessel/gear conversions have been applied to data prior to 1995. Over the time period covered by the surveys, the bottom trawl abundance index (considered a minimum trawlable estimate) has ranged from about 36-8640 million redfish with *S. fasciatus* comprising from 10%-20% annually. Surveys in 3LN and 3O have been conducted since the early 1970s. Not all years are comparable because different vessels and gears were used. Data since 1984 have conversions, but data to 1990 have not covered beyond 200 fathoms (367 meters). Since 1991, the autumn 3LN survey index has ranged from 74-1130 million redfish with *S. fasciatus* usually comprising 70% or more annually. The autumn 3O index has ranged from 153-1060 million redfish with *S. fasciatus* usually comprising 80% or more annually. Indices of area of occupancy suggest a decreasing area in 2J3K from 1978-1994 but stability since. In 3LN and 3O, indices of occupancy suggest an increase since 1991. Information on life history characteristics of redfish by species is very limited.

Length at 50% maturity for sexes combined for 2J3KLNO was adopted from sampling from the strategic project for Unit2 and 3O and suggests 22cm for *S. fasciatus* and 24 cm

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[1] Ni I-H (1982). Meristic variation in beaked redfishes, *Sebastes mentella* and *S. fasciatus*, in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 39: 1664-1685.

for *S. mentella*. These estimates were used to define the mature population (>= L50 sexes combined).

### *Discussion*

See general discussion below.

## *Redfish— General discussion of terms of reference*

Life History

Redfish prefer depths greater than 200m, but exhibit shallower distribution during the summer in the Gulf of St. Lawrence. *S. fasciatus* is usually found in shallower waters than *S. mentella.* Both species appear to prefer continental slopes and the edges of channels, however *fasciatus* exhibits a generally southerly distribution, whereas *mentella* is more northerly. The age at 50% maturity is estimated at 12 (±) 2 years. The length at 50% maturity = 22 cm (*faciatus*), 24 cm (*mentella*). Natural mortality = 0.1 or 10% (0.05 during 1980s). Their fecundity is estimated at 20000 to 40000 eggs. They are ovo-viviparous (females bear live young), and their maximum age (lifespan) is estimated at 30+ years (most recently).

Population Structure

*S. fasciatus* can be divided into three "groups" (Gulf of Maine, Scotian Shelf, Gulf of St. Lawrence). These three groups are identified by microsatellite allele frequency variation. The number of anal fin rays does not provide complete and diagnostic separation from *mentella* (number of rays can overlap between species). It was noted that a comparison of groups identified by AFR techniques and microsatellites should be undertaken. The $F_{st}$ values from the microsatellite analysis should be compared to published $F_{st}$ estimates for cod. If possible, more detail concerning the shape/morphometric analyses should be provided. There was also a request to separate the age of maturity data based on male/female. The possibility of differences in the population dynamics (and trends) among the 3 putative groups, or among management units should be investigated (i.e. do the groups exhibit synchrony in recruitment?). Lack of synchrony is a sign of potential independence among the groups.

(i) Maturity

- 1 ogive used by management unit
- If possible, ogives should be estimated for the 3 individual units and compared
- Similar exploratory analyses involving other life history characters may be useful

(ii) Extend ogive analyses to include management units of the Northeast Newfoundland Shelf, since this area used to support a relatively large fishery

(iii) Patterns in data, irrespective of management units, should be investigated: let data define boundaries among units

- note that current management units were set with biological and ecological information taken into consideration

Trends In Abundance

It was noted that tables of relevant data used in the production of population trends should be included in the Research Documents. Abundance figures with axes on log scale should be included. Interpretation of abundance trends calculated using RV catches might be aided by consideration of the longer landings time series (i.e. in deciding if a constant harm model is appropriate).

Decline calculations should not be provided in the research document(s) as a table of the relevant data is sufficient. When writing up research documents, include why certain analyses aren't done (i.e. why certain datasets aren't pieced together).

For total abundance, include a best estimate of the current number of mature individuals.

Distribution

Maps of geographic distribution for a period early in the time series and a recent period should be provided. Plots of the 3 spatial indices presented should be included.

Threats

The greatest threat to redfish is directed fishing. In addition, changing environmental conditions have been a factor. As an example, for some stocks, production of strong year-classes occurred in years with higher than average temperatures (1956, 1958, and 1980) and there have been no large year classes in the recent cold conditions.

Bycatch may also be an issue as small redfish are being taken in shrimp trawls. Nordmore grates became mandatory in shrimp trawls in the early 1990's and are effective at reducing bycatch of redfish > 15 cm, but not very effective for smaller fish. Predation by seals is a possible threat. Although estimates have declined, at one point the take was estimated at 80,000 tons. The effects of predator and prey fluctuation are unknown. There is no evidence of top-down depletion of food resource, nor of bottom-up failure. The competition theory would require some very fancy modelling. Redfish at the size of the year-class failures (~ age 3-4) feed on shrimp and euphasids.

The possibility that trawl damage to habitat could be a threat was raised. Although redfish are usually considered a midwater species, there is some information suggesting association with specific bottom types. It was noted that groundfish trawling was much more intrusive prior to the 1990's than in recent years.

# Porbeagle

## 1.2 Working Paper SARA NAP 02b-02

***Status of the porbeagle shark (Lamna nasus) population in the Northwest Atlantic in the context of species at risk***

*Authors: Campana, S., L. Marks, and W. Joyce*

### *Presentation Summary*

Porbeagle sharks produce few offspring and mature at a late age compared to the age of first capture. This combination of life history characteristics makes porbeagle highly susceptible to over-exploitation. A single, largely Canadian population inhabiting the area from Georges Bank/Gulf of Maine to Newfoundland and the Gulf of St. Lawrence represents the ESU for porbeagle in the NW Atlantic.

The virgin porbeagle population in the NW Atlantic was fished intensively at catch levels of about 4500t per year in the early 1960s before the fishery collapsed 6 years later. The population slowly recovered during the 1970s and 1980s when annual landings averaged 350t. Catches of 1000-2000t throughout the 1990s appear to have once again reduced population abundance, resulting in very low catch rates and disturbingly low numbers of mature females. Based on an extensive reconstruction of porbeagle shark abundance, all indicators of population size have declined substantially since 1961. Current population size is estimated to be 10-20% of that of the virgin 1961 population. All lines of evidence indicate that fishing mortality is largely or solely responsible for the decline in population abundance since 1961.

The most recent stock assessment indicates that catches averaging 1000t per year in the 1990s have resulted in an F of about 0.20. Life table analysis indicates that a fishing mortality above 0.08 will cause the population to decline. The current catch quota of 200-250t corresponds to fishing at or below MSY (F of 0.04-0.05), and will allow population recovery. Thus the population decline has ceased, is reversible, and will increase in numbers at a rate of about 2.5% per year. The maximum rate of increase in an unfished population is about 5% per year.

The current area of occupancy varies seasonally due to large-scale migrations. Summing across the yearly distributional range (Gulf of Maine, Scotian Shelf, southern NF, Gulf of St. Lawrence) gives a total area of about 425,000 $km^2$. There does not appear to have been any change in area of occupancy or degree of fragmentation since 1961.

The current estimate of mature females in the population is 6075, which is about 10% that of the virgin population 3 generations earlier.

## *Discussion*

Life History

The probeagle shark is the only shark species in Canada subject to directed fishery. Co-operation of the current participants allows an intensive research program.

Reliable ageing is available and fisheries samples allow specification of ages of interest (age at first reproduction, population age distributions, maximum ages). Therefore, from confirmed vertebral ageing, age at first reproduction for females is 13, and 8 for males. Growth rate is sexually dimorphic diverging at age of first reproduction. Fecundity is 4 pups/female and appears to be invariant. There is no resting period during reproductive ages, and the porbeagle has a nine month gestation period.

Evolutionary Significant Units

The porbeagle shark comprises a single ESU occupying the area from Georges Bank and Gulf of Maine north to southeast NFLD and Gulf of St. Lawrence. This is essentially a Canadian population although not completely restricted to Canadian waters.

The fishing fleet is highly mobile. Fishing pattern is very consistent with results of tagging and recovery study component allowing seasonal movements to be inferred from catch. Conclusion is that there is a seasonal migration moving from the Scotian Shelf in late winter to southern Newfoundland by May, remaining there and in the Gulf until sometime in the winter when the fish return to the south. Mating is in the fall off southern Newfoundland. There appears to be no interchange between the Canadian population and the little known population in E Atlantic. Other populations are known from Australia and South America. The inference is that there is a single population in Canada.

Trends in Abundance and Area of Occupancy

All indicators of population size have declined substantially since 1961 and the current population size is estimated to be between 10% and 20% of the biomass in 1961, which is presumed to be the virgin biomass. The population characteristics of porbeagle are well defined and a wide variety of biological, age-and sex-structured models were used and gave quite consistent results. Maximum Sustainable Yield (MSY) was 1000-1200t at an $F_{MSY}$ of 0.04 to 0.05.

The time series of porbeagle abundance, reconstructed based on several extensive time series, could be largely or entirely explained as a response to two periods of over-harvest separated with a period of low catches and slow recovery. The current bycatch quota of 250t corresponds to a fishing mortality (F) of <=0.05 and should result in a slow recovery of the population.

The area of occupancy is quite large (about 425 000 km$^2$ due to seasonal migrations). It has shown no change since 1961 and shows no evidence of fragmentation. There are regular migrations from juvenile rearing areas on the Scotian shelf to summer feeding and spawning grounds in southeastern Newfoundland and the Gulf of St. Lawrence.

Porbeagle are cold-tolerant pelagic sharks and although they appear to have a preferred temperature range, they appear to be distributed along fronts possibly associated with high densities of coldwater prey.

<u>Threats</u>

The current estimate of mature females is 6075 or about 10% of the number in the virgin population in 1961. The characteristics of porbeagle make them very susceptible to over-exploitation and the authors characterised the population as 'seriously depleted'.

**General discussion**

There was general consensus that this was an exemplary summation of the available information on the species.

There were three issues in the general discussion:

1. Regarding the comparative rate of decline during the two apparent periods of fishing (Norwegian/Faeroese and Canadian). It was suggested that the rates were comparable although consensus was not reached on this. This discussion highlighted the need of authors to put graphs of abundance and index time series on logarithmic scales so that the rates of decline are apparent regardless of absolute values of indices. There was a suggestion to insure that magnitudes of decline should be shown over three generations to conform to COSEWIC listing criteria.
2. Regarding the appropriateness of the recommended rate of increase of 2.5%/year. The authors were requested to document more fully the rationale for this recommendation. Such a discussion would serve well as an illustration of DFO process in pragmatic resource management and conservation objectives.
3. The third issue discussed was the process involved in selecting species for evaluation. The author and others suggested that there were more serious concerns with other species of shark (e.g. basking shark, spiny dogfish). This prompted discussion of the need for improved co-operation between COSEWIC and DFO to insure that DFO expertise and experience could be better used to identify species with conservation issues possibly requiring priority consideration. This prompted an offer for a summary of COSEWIC processes meant to describe the approach to identifying candidate species and the different ways in which a status report can be submitted for consideration.

**Instructions to authors**

1. Provision of graphs using log scales where appropriate to display population abundance change rates (e.g., Figs. 6,8,9,10)
2. Commentary on species identification problems (re. Mako shark) and effect on analyses.
3. Provide a more detailed rationale for recommendation of an exploitation rate of 2.5%/year.
4. Area of occupancy should be defined as where the fish are concentrated, not their total distribution.

# Winter skate

## 1.3 Working Paper SARA NAP 02b-03

### *Distribution and abundance of winter skate (<u>Leucoraja</u> <u>ocellata)</u> in the Canadian Atlantic*

*Authors: Simon, J. E., L. Harris, and T. Johnston*

### *Presentation Summary*

Data derived from five principal sources in the Canadian Atlantic zone, spanning several decades, were examined for the occurrence of winter skate. The data reviewed included standardised research vessel (RV) surveys conducted by Fisheries and Oceans Canada (DFO), non-standard research vessel surveys and recent industry/science surveys. Some persistent areas of concentration were evident, notably Georges Bank and the eastern Scotian Shelf. Secondary concentrations are found in the Bay of Fundy, the Laurentian Channel, inshore waters of 4T and the southern flanks of the Grand Banks. Winter skate are not and have never been common in most of the Newfoundland area. This species appears to be adequately surveyed in the zone. Winter skate occur in areas deeper than the regular groundfish surveys but not in any great quantities. However, given the distribution in 4T, it is more likely that winter skate will be inshore of the areas surveyed. In general, winter skates abundance in the southern part of the range has remained stable, while further north declines have been evident, especially larger individuals. Winter skate are the 3$^{rd}$, 22$^{nd}$ and 13$^{th}$ most common species in the Georges, summer and spring RV surveys, respectively. Total numbers in the zone have exceeded 4 million and have averaged 1.5 million in the last 5 years, based on the summer RV survey. A skate industry/science survey in Division 4VsW yielded biomass estimates that were 6-12 times greater than the summer RV survey in the same area, suggesting that the RV population numbers are most likely an underestimate of the population. Limited information exists on the biology of winter skate, however recent studies have shown that length at 50% maturity is 75 cm for females in Div. 4VsW. Given that no individuals greater than 70cm have been caught in Div. 4T during the 32 years of their survey it is unlikely that this value will hold for the entire range of the species. Collectively, the review of these data suggests that winter skate is currently sufficiently numerous to ease concerns about its conservation status.

### *Discussion*

<u>Life History</u>

Age-length and unvalidated maturity-length relationships are available, but only from the Scotian shelf (4VsW). Maximum age estimated from vertebrae is 21 years. First maturity occurs at 65 cm (age 6) and 50% maturity at 75 cm (age 8-10). Natural mortality (M) was estimated at 0.20 implying a generation time of approximately 10 + 1/0.2 = 15 years.

Evolutionarily Significant Units

Information was insufficient to delineate ESUs within the Canadian range. It was noted however that the distribution of winter skate is not contiguous within the RV survey area. Current management reflects the break in distribution between the eastern and western concentrations on the Scotian shelf and eastern bank. Other discontinuities are evident between 4T, 3P, 4X , 4W and 5Z. Juveniles emerge at 15cm in length so there is no larval stage subject to dispersal by currents. There may be evidence that the 4T winter skate is a different population. In that area winter skate are found in the shallows close to shore. Also, no individuals greater that 75 cm (age of 50% maturity on the Scotian Shelf) are caught although the presence of small, newly emerged fish suggests spawning activity. This could indicate a different life history in that area, thus a separate ESU. More research is needed.

Trends in Abundance and Area of Occupancy

Gulf of St. Lawrence (4T) - RV survey data indicate that both total abundance (Figure 9 in working paper) and proportion of the survey area occupied (Figure 10) have declined in 4T. Only a small and declining proportion of samples included fish larger than 70 cm (Figure 11) implying that mature fish are relatively uncommon and declining in abundance in 4T. This suggests that most reproduction may occur elsewhere, in which case 4T should be considered part of a larger population. Alternatively, mature fish may be more abundant than has been inferred perhaps because skate mature at a smaller size in 4T than 4VsW, or are less available to the sampling gear (i.e., under-represented in 4T samples). This uncertainty has important implications for interpreting population structure and stock status. No data exist to resolve the issue and sampling for maturity status in 4T was recommended.

Scotian Shelf – Summer RV surveys from 1970 to 2002 indicate that both total abundance (Figure 15b) and proportion of survey area occupied (Figure to be provided) increased in the late 1980s, then declined through the 1990s. Current indices are among the lowest on record, similar to (abundance) or lower (biomass) than those in the early 1970s. The recent decline is likely to be more evident in indices for mature skate. Identification is clear at 35 cm, the commercial fishery begins at 60 cm, and 75 cm+ represents 50% age of maturity.

Georges Bank – Research survey indices of total abundance (Figure 24) and proportion of area occupied (Figure 25) have been stable or increasing since the surveys began in 1986. Indices of biomass declined from a peak value in 1987, but have increased gradually since 1994.

Species in Canada (Overall) – Index of total abundance increased from 1970 to 1990 but subsequently has declined to a record low in 2002. A minimum estimate of total abundance is 3 million.

Threats

The greatest threat is fishing. The directed fishery for skate started in 1994 and is currently limited to 200 t (one vessel only), taken only from the eastern part of the Scotian shelf. The decline in abundance at that location preceded the directed skate fishery (Figure 41), which raises the question of why a directed fishery was permitted. However, more skate are probably caught and discarded (unreported) in various fisheries directed at other species. This bycatch has decreased as total landings in groundfish fisheries have declined. Two possible approaches for reducing bycatch mortality were discussed: 1) use a horizontal bottom panel in trawl gear to allow skate to escape, and 2) spatial management to restrict fishing activity in areas where skate are most abundant (this requires further analysis).

Seismic testing was noted as a possible threat. Fishermen have stated that catch rates for skate are reduced for up to one month following seismic tests. Similar reductions in catch rate for cod have been reported for studies in Norway. Seismic testing is probably a recent activity in this area; the authors are attempting to obtain time series data on the extent of seismic activity, and on changes in climate or ecosystem productivity.

**Instructions to authors**

1. For Scotian Shelf/Georges Bank— figures showing trends should be broken down by size classes 35-39, 60-74, and 75+ cm.
2. Figure 54, to be redrawn without stacking index for Georges Bank where survey only began in 1986.
3. For the index of decline in total abundance for the entire species, suggest adding corresponding figure for mature fish (i.e., large size class). Also add total abundance estimate for large (mature) size class.
4. Figure to be provided to show the trend in overall fishing effort, or best surrogate for skate bycatch.

Recommendations:

Sampling for maturity status in 4T is recommended.

## Blue hake

### 1.4 Working Paper SARA NAP 02b-04

***Blue Hake (Antimora rostrata) in the northwest Atlantic in a species at risk context***

*Authors: Kulka, D. W. and M.R. Simpson*

***Presentation Summary***

Blue hake form a continuous distribution in slope waters off North America and into the northeast Atlantic. Our study describes their distribution from the Scotian Shelf in the south to Arctic waters at the mouth of Davis Strait. In relation to depth, 91% of survey sets containing blue hake occurred at greater than 500 m even though most survey effort took place at less than this depth. They were found as shallow as 200 m but percent occurrence at less than 500 m (0.25%) was much lower than at depths exceeding 500 m (reaching 70% at the greatest depths sampled). Catch rate increased steadily out to the maximum depths fished for commercial gear and peaked at about 1 400 m for survey trawls although depths greater than 1 200 m were poorly sampled. Deep (1 371-2 286 m) longline sets from the 1960s indicated that blue hake were relatively common beyond the standard depths surveyed and beyond depths commercially fished. The deepest capture was from the deepest set fished at 2 286 m. Catch rate increased faster with depth in the southern part of our study area.

Sets with blue hake spanned a range of bottom temperatures between 0.9 and 8.7°C although only 97% of the survey sets with blue hake were associated with bottom temperatures greater than 3°C and less than 4.5°C. Fish size ranged between five and 65 cm. Only 29 of 74 569 fish measured from otter trawls were less than 15 cm but in longline catches, 37 of 867 fish averaging 10 cm TL were taken, amongst the smallest recorded worldwide.

Previous studies in US waters found no evidence of spawning and scant evidence of mature individuals and it was hypothesized that spawning might take place to the north in Canadian waters. As with past studies, no mature fish, eggs or larvae have been found in Canada.

The key meristic character used by Small (1981) to distinguish North Pacific blue hake from those in other parts of the world was the count of gill filaments. We found considerable overlap in the range of number of gill filaments from our area compared with those in the North Pacific.

The work also examined annual trends in a) mortality attributable to fishing and b) trends in abundance. Trends in deepwater fisheries that captured blue hake as a bycatch were examined and fisheries observer data are used to estimate amounts of blue hake captured in the fisheries. On average, about 75 t have been removed annually as bycatch in the slope fisheries off Canada since 1985. Given the greater deepwater effort in the 1960's and 1970's catches were likely greater during that period. Catch rate increased steadily out to the maximum depths fished for commercial gear and peaked at about 1

400 m for survey trawls although depths greater than 1 200 m were poorly sampled. Deep (1 371-2 286 m) longline survey sets from the 1960s indicated that blue hake were relatively common well beyond depths commercially fished.

In terms of using standard surveys to estimate abundance, 98% of survey sets containing blue hake occurred at depths greater than 500 m while less than 5 % of survey sets occurred at those depths. In addition, maximum depth surveyed changed from year to year (deeper in recent years). Thus, only a fringe of the blue hake population in Canadian waters falls within the survey area. Most of the population is well beyond depths surveyed (or fished). The limitations and the difficulties associated with using a shelf-based survey to study changes in the abundance of a slope species are discussed.

## *Discussion*

### Life History

Information on life history is very limited. Maximum age is reported to be about 25 years. Mean length is substantially greater for females than males. Few small fish have ever been captured, and all from northern areas, suggesting that spawning occurs to the north or at greater depth. Larval stages are unknown.

### Evolutionarily Significant Units

Information was insufficient to delineate more than one ESU within the Canadian range. Blue hake appear to be widespread and continuously distributed along the entire continental slope of North America with a latitudinal cline in depth (temperature).

### Trends in Abundance and Area of Occupancy

Indices of abundance, biomass, and average weight all declined from 1978, when surveys began, to 1994 (Figure 7b in Research Document). However, blue hake occur only at the deep margin of the surveyed area and this trend may not reflect overall population status. It's also possible, as an alternative hypothesis that blue hake moved into deeper water during this period. The trend is assumed to reflect abundance and biomass within the survey area; there was much discussion as to whether it was an artifact of inconsistent sampling with respect to depth, and about ways to test this given that the issue may arise repeatedly for other deepwater species.

Since 1994, deepwater survey effort has been more intensive and consistent, and both abundance and biomass indices in the survey area have increased steadily; average weight declined to 1995 and has subsequently been stable. There may be a need to look at size composition to determine if average weight decline was due to fewer large fish (a bad thing) or an increase in the number of small fish (a good thing).

Trends in these data since 1994 are considered more reliable then those before 1994 because of the recent increase in sampling deeper waters. Recent index values cannot be compared to pre-1994 values because of the change in survey design. Total abundance in Canada is estimated at 33 to 200 million fish.

Threats

Fishing is the only known threat but exploitation rates are thought to be very low. Blue hake were captured frequently in the fishery for grenadier, but that fishery no longer exists.

**Instructions to authors**

1. Also present length/weight frequency data if available?

## Striped bass

### 1.5 Working Paper SARA NAP 02b-05

***Assessment of striped bass (Morone saxatilis) in the Maritime Provinces from a species at risk context***

*Authors: Douglas, S.G., R.G. Bradford, and G. Chaput*

***Presentation Summary***

There are two extant populations of striped bass in the Maritime Provinces: the southern Gulf of St. Lawrence population that spawns in the Northwest Miramichi River in northern New Brunswick, and a population in the Bay of Fundy that spawns in the Shubenacadie-Stewiacke River, Nova Scotia. Evidence of extirpated striped bass populations exist for the Annapolis and Saint John rivers that flow into the Bay of Fundy. Genetic discreteness between the two extant Canadian populations and their discreteness from adjacent spawning populations of the eastern U.S.A. has been demonstrated from analyses of mitochondrial and nuclear DNA. There are no reported occurrences of fish tagged in either the NW Miramichi or the Shubenacadie-Stewiacke having been recaptured as spawners in any river other than their presumed river of origin. Both populations of striped bass in the Maritime Provinces are managed as discrete biological units. Their genetic structuring relative to the larger striped bass assemblage in eastern North America, in combination with evidence for unique life-history attributes of probable adaptive significance at the population level, and their contribution to biodiversity within two recognizable biogeographic regions within Canada lend support to their designation as "evolutionarily significant units". As such, the present DFO management framework for this species is already applied at the level that reflects their conservation significance.

Assessment of the striped bass spawning run to the NW Miramichi since 1993 reveals that this population has undergone large fluctuations in size. Spawner estimates for the NW Miramichi peaked in 1995 at 50,000 fish, dropped to approximately 4,000 fish between 1998 and 2000, but have recovered to between 24,000 and 29,000 in 2001 and 2002. Spawner abundance data available for the Shubenacadie-Stewiacke population does not yet lend itself to analysis of interannual trends. Provisional estimates of spawner abundance for 2002 are in the range of 20 to 30 thousand fish of minimum reproductive age (age 3+ years). Available data indicate that several age classes have contributed eggs to the population every year since 1999. Based on landings, and tag returns, the area of occupancy for striped bass in the southern Gulf of St. Lawrence appears unchanged with striped bass occurring seasonally throughout the inshore, coastal portions of the whole region. Beach seine surveys indicate that young-of-the-year striped bass leave the Miramichi system during summer and are distributed throughout much of the southern Gulf by the end of their first growing season. Tag returns from fish marked while descending the Shubenacadie River in May (1999-2002) suggest a summer range within Minas Basin, although this interpretation is likely confounded by low recreational fishing effort outside of Minas Basin. The summer seaward distribution of young-of-the-year Shubenacadie-Stewiacke striped bass appears to be limited to the inner, turbid, and relatively warm water portions of Minas Basin. All indications are that there are in excess of 10,000 mature individuals in both extant Maritime populations.

## *Discussion*

Life History

The age of 50% maturity (first maturity) is age 4 (3) for males, and age 5 (4) for females. Maximum life span is about 25 years with a maximum length of about 115-cm (in the absence of a fishery). Natural mortality is 0.15 in US waters and there is no estimate for Canadian waters. Generation time has been estimated at about 12 years.

Females produce about 40 000 to 50 000 eggs per kg of fish per year, with a 5-7 year old fish producing about 100,000 eggs per year.

Striped bass have specialised niche or habitat requirements with the populations inhabiting an extremely narrow breeding range (part of an individual river system).

Population Structure

Striped bass in Canadian waters are at the northern limit of its range and thus may be more vulnerable to changes in the environment than populations further to the south. Each population is thought to be genetically discrete (mitochondrial and nuclear DNA analyses). Both mitochondrial and nuclear DNA haplotypes common to USA populations are rare in Canadian waters, and vice versa. Each population represents an important component of biodiversity within separate biogeographic regions and each inhabits an extremely narrow breeding range (part of an individual river system). There are no reported occurrences of fish tagged in either Shubenacadie-Stewiacke R. or Northwest Miramichi R. having been recaptured as spawners elsewhere (other rivers) indicating high spawning site fidelity. Fish spawn in very restricted sites, but are widely distributed in coastal areas when not spawning.

### Gulf of St. Lawrence populations

Northwest Miramichi R. (southern Gulf of St. Lawrence) - extant
St. Lawrence estuary – extirpated

*Southern Gulf of St. Lawrence*

Trends in Abundance

Mark-recapture experiments were used to estimate adult abundance. The spawner estimates for the NW Miramichi R. fluctuated widely peaking in 1995 at 50,000 total spawners (from 5,500 in 1993). The estimate for 2002 was 29,000, up from about 3,900 in 2000. Tagging studies of adults indicate the existence of repeat spawners.

Natural fluctuations in abundance may be highly exaggerated by mortality due to fishing. Specific examples of fishing mortality are young-of-the-year taken as bycatch in the smelt fishery throughout the southern Gulf of St. Lawrence and (suspected) illegal fishing of the adults. Other sources of mortality are cold conditions affecting spawning and growth including size dependant winter mortality (young of the year < 10 cm as winter approaches have a low chance of survival) and (possibly) effluents from pulp and paper mills in the proximity of the spawning grounds. Although mill effluent effects from two mills, one starting up in the 1950's, another in the 1970's are unknown, effluents have been reduced in recent years and the mills are in compliance with the federal Environmental Effects Monitoring regulations.

Landing data are available back to 1917 but reliability is questionable (Fig. 2, WP). Landings occurred in every district of the southern Gulf of St. Lawrence but was consistently highest in rivers of Kent Co. NB (Richibucto, Kouchibouguac). Landings fluctuated over time, peaking most recently in the early 1980's. There are no records of commercial catch between 1935 and 1968. Whether this gap reflects a lack of landings or lack of reporting is unclear.

Management milestones are summarized in Table 1 of the working paper. The most significant management measure was the permanent closure of the commercial fishery in 1996 under the Fisheries Act. In 1998 a zero tolerance for any bass bycatch of any size was imposed.

<u>Area of Occupancy</u>

Its area of occupancy is the entire southern Gulf of St Lawrence (Percé to Gaspé) during different times of the year and this is consistent over time. In terms of spawning, area of occupancy has diminished with the extirpation of the St. Lawrence estuary component.

Spawning areas are currently restricted to the NW Miramichi River. The last 10 years of data are consistent with one spawning area in the Gulf of St. Lawrence. It is unknown whether or not other rivers in the southern Gulf of St. Lawrence may historically have supported spawning populations. It is hypothesized that the physical exchange of water masses in these other areas may not be appropriate for the spawning behaviour of striped bass. They seem to require very specific conditions for spawning.

*St. Lawrence Estuary*

The (extirpated) St. Lawrence Estuary population occurred along a 300 km stretch of the lower St. Lawrence estuary, the spawning ground thought to be Lac St. Pierre.

Commercial catches are known to have occurred from 1920 to 1965. Data on the catches from 1944 to 1962 have recently been recovered and analysed. Catches fluctuated between about 5 and 55 t, peaking in the 1940's. The abundance and distribution changed drastically between 1944-56 and 1957-62. It is unclear whether fishing effort changed (became more intense) between the periods of low and high abundance. However, it is felt that fishing effort became more concentrated as population and area occupied declined. The fish taken in the fishery were mostly immature. Larger fish became scarce after overfishing reduced the overall abundance. Management steps were not successful in reducing fishing effort. Extirpation is thought to have occurred as the result of overfishing, dredging of the ship channel in the 1950's, and pollution, all of which would have resulted in the destruction of spawning grounds and alteration of juvenile habitat. Fishermen also believe that the construction of the island for Expo '67, is responsible for the decline even though the decline was at a latter date and much farther upriver.

**Bay of Fundy populations**

Shubenacadie-Stewiacke R. (Bay of Fundy) - extant
Annapolis R. (Bay of Fundy) - extirpated
St. John R. (Bay of Fundy) - extirpated

*Shubenacadie-Stewiacke R.*

Trends in Abundance

There is no recent information on abundance trends for the Shubenacadie-Stewiacke R. The first estimate of the number of breeders was done in May 2002.

For the extant population, which spawns in the Shubenacadie-Stewiacke R., spawners, recruits, and alternate migrants have been examined in relation to the habitat in developing an assessment framework. Required research includes studies relating to genetic structure, range dynamics, size dependent mortality, growth, and the relation between physiology and the environment.

In terms of the extirpated populations (Annapolis and St. John Rivers) issues relate to restoration, in particular to conditions in the river that constrain the reproductive elements of the life cycle. The failure of naturally spawned eggs in the Annapolis R. to yield viable offspring, and the absence of age 0+ striped bass in the river system, suggests either inadequate water chemistry or quality, or perhaps deleterious alteration to the physical circulation of the estuary. Tidal power development, natural pH depression, and agricultural runoff impact the Annapolis River and Estuary. In the Saint John R., construction of the Mactaquac hydroelectric impoundment on and upstream of the spawning grounds is believed to be the single greatest factor contributing to the cessation of spawning.

Protection of this population has been provided under the Fisheries Act. The commercial fishery was closed in 1993 with bycatch tolerance limits set. For example, on the Shubenacadie, 3 striped bass weighing < 3.6 kg are allowed per day in the shad gillnet fishery, 1 per day in the weir fisheries of the inner Bay of Fundy. Bag limits are imposed for the recreational fishery, one fish per day > 68 cm and closure of the Annapolis R. occurs May 30.

Fish that spawn in the USA are taken in the Bay of Fundy recreational fishery, were taken in the past commercial fishery, and would be taken in any illegal fishing. However, there are no harvest statistics available since the closure of the commercial fishery in 1993 resulting in a deficiency in our knowledge of fishing mortality.

Threats

Threats in the Bay of Fundy include fishing (angling, gillnetting, hook and release mortality, illegal harvest), incidental catch in smelt fisheries, pollution and changes in species composition in Grand Lake (introduction of chain pickerel), and natural constraints such as overwinter survival in a marginal environment (although these threats are not all equally plausible or adequately assessed).

The primary threat inferred in the extirpation of the Saint John River population is the Mactaquac dam, as there has been no evidence of spawning since the dam's construction. PCB pollution has been suggested as a threat here also, although there is little evidence for this. In the Annapolis River, low PH in May and June, agricultural runoff, changes in flow regimes, and the turbine passage (Jessop 1990, 1995) have all been inferred.

Evidence that the declines have ceased, are reversible, and likely time scales for reversibility

Striped bass have been re-introduced in places in the USA. In the Saint John R. the causes of the decline are uncertain (other than the dam). In the Annapolis R. the constraints on the reproductive stage need to be removed. The declines in the Gulf of St. Lawrence can be reversed. In the Shubenacadie-Stewiacke R and Miramichi R. there is uncertainty about the degree of decline and whether the populations can be increased.

**Instructions to authors**

1. Add area of occupancy for extant spawning areas if known.
2. Need to add Shubenacadie data for trends in population size.
3. Add citations where noted.

## American shad

### 1.6 Working Paper SARA NAP 02b-06

***Assessment of American shad (<u>Alosa</u> <u>sapidissima</u>) in Atlantic Canada from a species at risk context***

*Authors: Chaput, G. and R.G. Bradford*

***Presentation Summary***

The document collated and summarized information held by Fisheries and Oceans Canada (DFO) which could be used by the Committee on Status of Endangered Wildlife in Canada (COSEWIC) to assess the status of American shad (*Alosa sapidissima*) in Canadian waters. The information was not intended as a complete review of all the biological knowledge of shad in eastern Canada. The mandate for management of American shad in the St. Lawrence River was delegated to the province of Quebec in 1922. Extensive information on American shad from the Annapolis River relative to the impacts of tidal water generating project are available from “Estuarine Centre” at Acadia University (Wolfville, NS).

Fisheries for shad in Maritime provinces are managed under the *Fisheries Act* under regulations described in the Fishery (General) Regulations and the Maritime Provinces Fishery Regulations. Shad are exploited in commercial, recreational and First Nations fisheries. Shad are fished commercially in directed shad fisheries and as bycatch in gaspereau fisheries. These fisheries are local in nature, generally small in individual landings, and of small capitalization which makes landings difficult to track. In the last decade, the data quality has diminished and the reported landings are minimal and in some cases represent but a minor portion of the actual harvests. Recreational fishing for shad is not widespread in the Maritimes but of generally moderate to high participation where these fisheries occur. There is no effort or catch data from the recreational fisheries. There is an allowance for shad in the licenses issued to several First Nations in the Maritime Provinces for Food, Social and Ceremonial Purposes but harvest statistics are not available.

The marine distribution of shad in eastern Canada extends from the Bay of Fundy to Labrador. There are few observations of shad catches in marine fisheries off Newfoundland. Shad were captured exlcusively in the nearshore shallow waters of the southern Gulf of St. Lawrence. The locations of capture are consistent with a migration of shad into the Gulf of St. Lawrence in the spring and migration out of the Gulf in the fall. Shad are frequently represented in the catches from research surveys along the Atlantic coast of Nova Scotia and in the Bay of Fundy. Summer catches are consistent with the well-described occurrence of migrant feeding shad originating from virtually all rivers along the eastern seaboard into the Bay of Fundy and Gulf of Maine. Late fall surveys suggest a ‘winter’ distribution at depths of between 100 and 200 m along the edges of Georges Bank and the Scotian Shelf and within the basins along the top of the shelf.

Shad have been reported from essentially all coastal areas of the Maritimes. In the Bay of Fundy, the largest catches are from the inner portions (Chignecto Bay which includes both

Shepody Bay and Cumberland Basin; and Minas Basin and Approaches which includes Scots Bay, Minas Basin, Southern Bight, and Cobequid Bay). Fish captured in the Bay of Fundy include shad from virtually every shad population on the eastern seaboard of North America.

Shad have been observed in rivers from the Bay of Fundy to Labrador but occur infrequently in Labrador and Insular Newfoundland. In the Gulf of St. Lawrence, shad are abundant in the Miramichi River and have been observed at the counting facilities of the major rivers of the southern Gulf, the Restigouche River (NB) and the Margaree River (Cape Breton, NS). Shad are most abundant in the Miramichi River in May to mid-July, consistent with a spawning run into that river. Spawning shad occur in the lesser tributaries flowing into the lower Saint John River below Mactaquac Dam. Within Minas Basin shad runs occur on the Shubenacadie-Stewiacke River and the Kennetcook River. There is a large spawning run of shad on the Annapolis River. Shad have also been observed in rivers along the Atlantic coast of Nova Scotia.

Spawning runs of shad are identified on the basis of the presence of ripe and running fish, both males and females, from the presence of eggs/larvae or juveniles, and from anectodal reports of mature fish. There is no evidence of spawning runs of shad in Newfoundland and Labrador. In the southern Gulf of St. Lawrence, spawning runs of shad have only been confirmed in the Northwest and Southwest Miramichi rivers. There are spawning runs of shad to the lesser tributaries flowing into the lower Saint John River below Mactaquac. Within Minas Basin shad runs occur on the Shubenacadie-Stewiacke River and the Kennetcook River. There is a large spawning run of shad on the Annapolis River as evidenced by the large number of adult shad in the river and the presence of eggs and larvae. It is suspected that shad spawn in the LaHave River (Atlantic coast of Nova Scotia).

### *Discussion*

The discussion began with a note that scientific advice had never been requested for management purposes. American Shad is an anadromous clupeid that feeds and grows in marine water but reproduces in freshwater. There are two management units, one in the Gulf of St. Lawrence and one in the Bay of Fundy. Fisheries in the Bay of Fundy are on mixed stocks from Canada and the US. There are rare occurrences of shad noted on counting fences in Newfoundland and Labrador.

During the presentation, it was noted that in the Bay of Fundy/Gulf of St. Lawrence areas there exist eight confirmed spawning runs, three lost runs, and 14 with a status of unconfirmed. There was considerable discussion about the classification of the unconfirmed runs. The presenter explained that on the assumption that the shad occurring in Newfoundland do not spawn in Newfoundland, he considered that the appearance of shad in a river system does not necessarily infer spawning. Spawning can be inferred either by the presence of mature individuals or presence of eggs at the spawning site.

It was noted that there is considerable information external to DFO through work done at Acadia University on mortality rates and trends in juvenile abundance that could be provided by J. Gibson, Maritimes Region.

## Life History

American shad is an anadromous fish spawning in freshwater, lower portions of rivers in spring, from May to July in the Maritimes. The northern extent of spawning distribution is the Gulf of St. Lawrence and the St. Lawrence River. Juveniles spend a brief time in freshwater before migrating downstream to brackish waters (especially so in northern populations).

The age at maturity varies from 3 to 6 years of age, earlier for males than females. There is a latitudinal gradient in fecundity (negative association) and proportion of runs which are repeat spawners (positive association). Shad are iteroparous in northern rivers, with previous spawners representing greater than 50% of the spawning runs (depending on exploitation rates in the fisheries). Fecundities of maiden shad are in the order of 100 to 175 thousand eggs in northern populations. Maximum size of shad in Maritime populations is determined to be over 60 cm fork length.

Shad leave the Gulf of St. Lawrence and overwinter on the Scotian Shelf and further south. Migration ranges for shad at sea extend from Labrador to Florida. Shad from different river populations are mixed to varying degrees while at sea, and they have high spawning site fidelity.

Given the age of 50% maturity is about five-six years for females, maximum age is over 10 years (information from the Annapolis River within DFO literature suggests 12-13 years), and natural mortality is a guess at 0.2 (it may be similar to gaspereau at 0.4.) a simple calculation of generation time is therefore 6+ 1/0.4 = 8-9 years.

## Evolutionary Significant Units

Repeat spawners are generally absent in shad runs south of 36˚N and a high proportion of repeat spawning occurs in rivers north of 40˚ latitude. A number of studies of American shad have found significant differences in meristic and morphometric characteristics among shad sampled from rivers on the eastern seaboard of North America. A study of mitochondrial DNA polymorphism in American shad indicated that there was sufficient isolation among the shad runs of the sampled rivers for genetic differences to have become established but there was no evidence of a phylogenetic split between northern and southern shad (i.e. genotypes were commonly distributed over the entire geographic range). The fisheries management regime within the Maritime provinces is organized regionally and is therefore consistent with the principle of managing discrete units which are at least if not at a finer scale than the ESU definitions which may develop for shad. The present structure for the management of fisheries for spawning shad could accommodate further divisions should genetic and life-history data indicate more than one ESU occurs within a particular region.

## Trends in Abundance

Shad spend the majority of their life at sea and utilize the freshwater habitat for the purpose of spawning. Estimates of total numbers of shad in the population are therefore not available since fish observed in the rivers are only the mature component of the populations. Estimates of the size of spawning runs of American shad are limited to a few rivers in Atlantic Canada. Run sizes to the major rivers of the Maritimes (Miramichi, Saint John, Shubenecadie-Stewiacke, Annapolis) are expected to be in the order of 100s of thousands of fish. There is insufficient information to draw conclusions on the trends in abundance of American shad in Atlantic Canada. Fisheries landings have declined over the past 5 decades but some of the decline can be attributed to reduced effort. Where indices of abundance are available, there is no significant temporal trend in the indices.

There are three rivers in the Maritimes, all in the Bay of Fundy, where declines in abundance of shad have been observed: Petitcodiac River, Saint John River above Mactaquac Dam, and St. Croix River. Specifically for Petitcodiac, and the Saint John River (upstream of Mactaquac), declines have not ceased and are not reversible under present conditions. The major impediment to shad in these rivers is fish passage, both upstream and downstream. A large portion of the southern Uplands of Nova Scotia has been impacted by acid precipitation. The impact of acid depositions on American shad production in Nova Scotia rivers has not been studied but it is not expected to have improved the spawning habitat of shad in this area.

There is no evidence of fisheries induced declines in American shad in Atlantic Canada. The directed fishery for shad is by small boats in very small fisheries. The bulk of the removals is as bycatch, predominantly from gaspereau fisheries. The historic landings records are considered incomplete. There is no data on catch or effort from recreational gillnet fisheries and no data from aboriginal fisheries. Landings data are available from 1991-94 but shad are considered under-reported. Fisheries for shad are regulated by season and gear restrictions and there are no new entrants into the fishery.

There was a peer-reviewed abundance estimate for the Annapolis River in 1981-82 based on a pre-operational assessment of the Annapolis tidal generating station. Subsequent investigations from the Acadia work suggest there was no significant decline in CPUE data. As a basis for other rivers, the presenter suggested current abundance of mature fish is a magnitude higher than the COSEWIC benchmark of 10,000 mature individuals.

Shad are rarely captured in DFO groundfish surveys off Newfoundland and in the Gulf of St. Lawrence. In the latter survey since 1971, shad were present in only 23 of 3000+ sets accounting for a total of 89 fish and were only caught in nearshore strata.

Abundance is variable with no trend, based on counts of American shad from trap nets on the Miramachi.

It was again mentioned that there was other information from the Acadia University research, which would be useful, and that this be noted to the COSEWIC report author.

Area of Occupancy

The Miramichi River is the only confirmed river within the southern Gulf of St. Lawrence that supports shad spawning. The presence of numbers of shad in the Chaleur Bay region and in the Margaree River do not preclude that spawning may also occur in those locations but run sizes would be small relative to the Miramichi. There is no reason to believe this has changed from historical conditions. Shad are found throughout the Bay of Fundy in numerous rivers and within the bay itself. Spawning shad runs are known from three rivers and suspected in another six rivers. Along the Atlantic coast of Nova Scotia, shad runs are suspected in at least four rivers. In the Bay of Fundy, there is an appearance of a range contraction owing to the loss of the spawning run to the St. Croix River, New Brunswick. In combination with the loss of the upper Saint John River run (upstream of Mactaquac) and that to the Petitcodiac the net loss due to land-based human activities is three spawning runs that existed historically. Information is available to confirm that nine spawning runs are still sustained and the status of of 18 other rivers is unknown.

Three lost runs out of 11 are confirmed. The three lost runs are the St. Croix, the Pettiquac (absolutely extirpated) and the portion of the St. John River above Mactaquac. There was information on a spawning run in Cornwalis River in the 1700s reported in 1910, but is currently classified as uncertain.

There was discussion on the standard for categorisation as “lost” versus “uncertain”. It was noted that the “uncertain” status was relative to the occurrence of a spawning run, not whether fish were ever present. It was pointed out that there might be information within DFO archives to resolve this issue for some rivers.

<u>Threats</u>

Threats to this species include physical barriers (dams, tidal generating stations). Populations are vulnerable to catastrophic events because of dense aggregations in overwintering grounds.

**Instructions to authors**

It was suggested the authors include a map of the categorisation of spawning runs into the research document.

# 2. Incidental Harm Permits

# Leatherback turtle

## 2.1 Working Paper SARA NAP 02b-07

### ***Leatherback turtle (<u>Dermochelys</u> <u>coriacea</u>)— Incidental harm permitting and the pelagic longline fishery***

*Authors: McMillan, J. and D. Bowen*

### *Presentation Summary*

The Leatherback Turtle (*Dermochelys coriacea*) is listed on Schedule 1 of the SARA. On the day the SARA comes into force the Minister of Fisheries and Oceans must include a proposed recovery strategy for the Leatherback Turtle within three years after that day. During that time, section 73(1) allows the Minister of Fisheries and Oceans to authorise a person to engage in an activity affecting a listed species if affecting the species is incidental to the carrying out of the activity. The authorisation – the Incidental Harm Permit (IHP) - is subject to certain pre-conditions, including: considering all reasonable alternatives; using all feasible measures to minimise any impact; and, knowledge that the activity will not jeopardise the recovery of the species.

In Atlantic Canadian waters, Leatherback Turtles are incidentally taken by the offshore pelagic longline fishery, therefore, a candidate activity for an IHP.

In this paper, we review knowledge on leatherback biology, including distribution, abundance, and habitat, as well as the threats to leatherback survival and recovery in Canadian waters. Threat information is necessary to determine the conditions that should be considered in an IHP to minimize the impact of fisheries on this species. Several suggestions were put forth as potential conditions in an IHP. The suggestions include area closures; temporal closures; alternative gears and bait; corrodible hooks (when ingestion of hooks is a problem); training harvesters in dehooking and disentanglement technology. There was general consensus that the best fishing practices should be investigated and implemented in line with a code of conduct for responsible fishing.

There is still uncertainty regarding the abundance of Leatherback Turtles in Atlantic Canadian waters, juvenile and adult survival rates, age-at-maturity, and growth rates. These are important parameters and are required to attempt to predict the reduction in human-induced take needed for leatherback recovery.

### *Discussion*

<u>Description of the Species and Abundance</u>

It was acknowledged that females nest on southern beaches (Suriname, French Guyana, Guyana, Columbia, Panama, Trinidad, Tobago, Costa Rica, Gabon, Florida, St. Croix, and

Puerto Rico), therefore are not dependent on Canadian environments for reproduction. Satellite tagging studies based from nesting sites suggest a complex population structuring with a broad latitudinal distribution as a certain percentage head north, east, and south-east. It was noted that Leatherback Turtles use Canadian waters extensively – including some in the Gulf of St. Lawrence - and some venture close to shore. The percentage of the total population that spends time in Canadian waters (upwards of four to six months) was considered to be non-trivial but not quantified. Although it is difficult for the untrained person to distinguish males from females, information suggests there is a bias towards females in Atlantic Canadian waters.

It was also acknowledged that a population model for the Leatherback Turtle is not possible due to a lack of data. Recent studies to estimate population trends in the Atlantic were varied suggesting some indexed nesting beaches were stable and increasing but others possibly decreasing, leaving the overall status unclear.

Bycatch and Mortality

Analyses of observer information collected from the US pelagic longline fleet – but not presented here - estimated that an average of 986 Loggerhead and 796 Leatherback Turtles were captured in the fishery each year from 1992 to 1999, of which 8 and 11, respectively, were dead. US observer data obtained in 1999 and 2000 indicate that Loggerheads were hooked more frequently in their beak or mouth or had ingested the hook, while Leatherbacks were more frequently hooked in their flippers.

Encounters of Leatherbacks in the Canadian swordfish fishery, based on observer data, were considered to be much lower, estimated to be 160 animals in 2001 and 150 animals in 2002. Prior to 2001, leatherbacks were not identified.

It has been estimated (Prichard 1982; Spotila et al., 1996) that there has been a decline in nesting females (worldwide) from 115,000 in 1982 to 34,500 in 1996, or a 4.7% decline/year. Participants at this meeting agreed that very little data exists but very rough calculations could help with illustrating trends in the Atlantic (Appendix 2). Extrapolating the 4.7% estimate, assuming a 50/50 sex ratio and assuming 80% of the animals are in the Atlantic, the very rough calculation technique would estimate 41,352 Atlantic Leatherbacks in 2002. It can be very roughly estimated that about 0.4% of the Atlantic population is taken by Canadian fisheries on an annual basis (see Appendix 2 for calculations. Note that Appendix 2 does not reflect a proper scientific analysis).

It was noted that although the large pelagic fishing gears have experienced most of the attention on entanglements of leatherbacks, there are many other gears that have been observed to entangle the animals (lobster pots, crab pots, bottom gillnets). It was acknowledged that total entanglements might impede recovery but no conclusions can be made. Data requirements need to be reviewed and collected.

The maximum age of leatherbacks is unknown because a methodology to age them does not exist. It was also noted that it was more likely that most of the impact of mortality was occurring from incidental fisheries close to the nesting sites. In conclusion, it was considered that, based on the current information, fisheries in northern latitudes are probably having a greater impact on the older leatherbacks, while the younger animals are more impacted in the south.

The National Marine Fisheries Service (NMFS) has extrapolated some data collected on other turtles in the western Pacific Ocean to Leatherbacks. NMFS undertook an extensive survey effort and numerous deliberations to come up with the turtle mortality estimates used in the HMS Biological Opinion. The estimates were primarily based on data collected from a satellite telemetry study on Loggerhead, Olive Ridley, and Green Turtles captured in the Hawaii longline fishery operating in the western Pacific Ocean. In the absence of evidence to suggest that interactions with Leatherbacks would result in higher survival rates than for other species, the mortality percentages (as derived from hard-shelled turtles) were applied to Leatherbacks. Specifically, these percentages are as follows:

No hooking, no visible injury, entangled in gear but released with no trailing line and gear:
0% mortality

Hooked externally (hook does not penetrate internal mouth structure e.g., lip hook) or entangled with line left on animal:
27% mortality

Hooked in mouth (penetrates mouth tissue) or ingested hook:
42% mortality

Threats

Any fishery with a buoy line or highflyer line capable of entangling (longlines, bottom gillnets, crab/lobster pots) poses a threat to these animals. O'Boyle (2001) reported on the state of knowledge about the interaction of sea turtles and fisheries operating within the Canadian jurisdiction. A consensus opinion was reached and stated that it is not possible to make management recommendations about fisheries impacts until the appropriate information had been collected. To-date, this information has not been collected.

Leatherbacks come into Canadian waters to feed on jellyfish and an experimental fishery has recently opened for jellyfish.

In addition, offshore seismic and oil and gas work may interfere with foraging. These are large animals that rely on their hearing sense for foraging. (It was also noted that it would be hard to study this effect and leatherbacks in the Florida area are apparently increasing while there has been a lot of hydrocarbon work ongoing).

Plastics from shipboard discarding was mentioned as a possible threat, although not thought to be as extensive now due to regulations since the 1980s.

Finally, chemical contamination and ship strikes/collisions are also possible threats.

Alternative Measures to Mitigate Encounters/Conditions for Incidental Harm Permitting

- Area Closures

It was noted that the US has implemented an area closure of the “northeast distant” (east of 60° W and north of 35°) and is conducting test fisheries to investigate the use of alternate gears and bait to reduce the encounters of Leatherback Turtles in the pelagic longline fisheries. However, this was considered a temporary measure. This was not considered a potentially effective approach for Atlantic Canada due to the wide distribution of the turtles.

- Temporal Closures (not practical)
- Alternate gears and bait
- Corrosive hooks for those instances when hooks are ingested
- Training harvesters in dehooking and disentanglement technology
- A “Code of Conduct” approach whereby harvesters would commit to careful disentanglement and release unharmed of turtles was considered to be a potentially effective approach. This would be consistent with the Canadian Code of Conduct for Responsible Fishing and with the Stewardship approach envisaged under SARA. A formal code of operations could be become a condition for issuing an incidental harm permit.

Magnitude of Incidental Harm Permitting relative to Time of Recovery

It was acknowledged that there are many unknowns, and that for this reason, estimating allowable mortality would be very difficult as a basis for IHPs. However, there was general consensus that the best fishing practices should be investigated and implemented in line with a code of conduct for responsible fishing. It was suggested that IHPs could be issued only to those demonstrating this code of conduct for Leatherback Turtles.

Other

In addition to the offshore large pelagic fisheries (swordfish and tuna), other fisheries utilising entangling gear (crab and lobster pots, bottom gillnets) also represent a risk to Leatherback Turtles. There is presently little data to enable an evaluation of this.

The Canadian offshore pelagic longline fleet observer program has enhanced its data collection during the longline fishery when Leatherback Turtles are encountered and is following the US protocol on collecting information.

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# Wolffish

## 2.2 Working Paper SARA NAP 02b-08

### *Wolffish (Anarhichadidae)— Formulation of an incidental harm permit strategy*

*Authors: Simpson, M.R. and D.W. Kulka*

### *Presentation Summary*

In anticipation of the proclamation of Species at Risk Act (SARA), this paper examines conditions that would be included in an Incidental harm permit strategy using northern, spotted and striped wolffish as examples of marine fish. Critical knowledge was reviewed on wolffish biology, including distribution, abundance, and critical habitat, as well as patterns in fisheries mortality which must be known in order to determine the IHP conditions under which capture of wolffish could be allowed. Pre-conditions for the issuance of an IHP is demonstrating that incidental capture, or habitat destruction, will not prevent the survival or recovery of the species. In the case of wolffish, and other poorly understood species, estimates of population growth and viability under various levels of bycatch will be difficult, if not impossible to determine. For bycatch species, part of the IHP might constitute strategies such as spatial/temporal closures and gear restrictions that would minimize incidental capture in fisheries directed for other species. In this paper we discuss the efficacy of each of these potential measures. Due to their widespread distribution, diverse habitat preferences, and lack of particular spawning or feeding aggregations spatial closures are considered to be an ineffective method to reduce wolffish bycatch at this time. As well, since specific information on critical periods in the life history of these species is unknown, the efficacy of temporal closure is also limited. At present, wolffish live-release, which is particularly feasible in fisheries where the gear does not harm wolffish has been considered presently to be the most viable strategy to reduce wolffish mortality. Alternatively, consideration could be given to the imposition of a catch limit for each species based on an exploitation index (relative F) derived from a ratio of catch to biomass index observed in recent years.

### *Discussion*

**<u>Background</u>:**
There are currently three species of wolffish on the COSEWIC list:

**Threatened**: *Anarhichas minor* (spotted wolffish) and *Anarhichas denticulatus* (northern or broadhead wolffish)

**Special Concern**: *Anarhichas lupus* (Atlantic or striped wolffish)

Incidental Harm Permits would only be required for *A. minor* and *A. denticulatus*.

**<u>Terms of Reference</u>:**

Description of the Species and Abundance

Data is currently being acquired for the Arctic, Gulf of St. Lawrence, and the Scotian Shelf. Data on biology are currently very limited and in this study are based on elsewhere. Good biological data (lengths and weights) is coming out of the shrimp fishery. Northern wolffish are discarded, but spotted and striped have a small value so are kept. All three species have been treated as single ESUs, however, a genetic study is on the way.

Gear changes in the research vessel survey occurred in 1994 and no gear conversion studies were done for these species, so this study is only looking at abundance since 1994. All gears catch wolffish, with the catch composition being determined by location of fishing (i.e. higher latitudes are biased towards northern wolffish). It is extremely difficult to trawl wolffish habitat (rocks and crevices, particularly for egg masses), therefore abundance studies are likely to be an underestimate in these areas. However, it is a widely distributed species and they are still under-represented in sand and muddy areas, which are much easier to trawl.

Striped wolffish are generally concentrated further to the south and at shallower depths (100-350 m.) than the other two species, and are associated with water temperatures as cold as 0.4° C. Spotted and northern wolffish inhabit deeper waters to beyond 475 m and temperatures of 3.1-4.0°C. There has been a temperature shift in their habitat in recent years.

Description of Threats and Mortality

a. There are 33 fisheries (finfish and shellfish) in which wolffish are bycaught (particularly important are the snow crab and shrimp fisheries and the cod fishery in 3Ps). A preliminary analysis of total removals from bycatch has been conducted. Data are also available on juvenile bycatch in shrimp trawls (was not presented at the NAP but they are working on it). Also not presented was the ratio of wolffish bycatch relative to other species.
b. The rate of decline is greater in areas that are unfished. A number of hypotheses have been put forth but few analyses have been done (e.g. a correlation to environmental conditions such as cold water moving into their preferred habitat). Analyses done when the COSEWIC status reports were considered showed that the disappearance of large wolffish from the Grand Banks east of Newfoundland corresponded to the increase in cooler waters on the Plateau. These analyses were not included in the COSEWIC assessment which was based on population decline only. No other factors (e.g. environmental) were considered. Tagging studies may be initiated in the spring to study movement. Wolffish are typically a very sedentary species.
c. Seismic activity— the evidence for this threat is very limited.
d. Trawl damage— the evidence is very limited and speculative.

Alternative and Mitigating Measures

There is not a directed fishery for wolffish, fishing mortality is all from bycatch yet we do not know the extent of this mortality as population size has not been estimated. We also don’t know levels of natural mortality and this is very difficult to estimate.

a. Spatial closures— would probably not be effective due to the widespread nature of these species and lack of knowledge on stock structure. Also, no particular feeding or spawning aggregations are known. We wouldn't want to redirect the fishery elsewhere where it may do more harm. In addition we have no idea of genetic structure and uninformed spatial closures could result in the permanent loss of important genetic variants. However, given that greater declines in wolffish abundance have occurred in more northern areas, there may be potential for spatial closures there. Half of the bycatch is outside of the 200-mile limit. We have not yet thought of the implications for foreign fishing yet and these could be significant.

It was suggested that given all the unknowns for these species, it may actually be a reason for closures to protect biodiversity in areas for where we have little information or know that a species at risk exists. One suggestion was to experimentally close multiple areas with various habitat and temperature gradients, etc. and see if the species respond. This could reduce the uncertainty surrounding impacts on population structure and habitat. On the question of whether we could have depth-based closures, it was noted that depth preference analysis is biased in sampling and if you closed below 300m that is 95% of the fisheries anyway.

Pros for closed areas:

1) easy to exercise and communicate
2) public understands them and the reasoning for them

Cons for closed areas:

1) displaced fishing pressure
2) negative effects on genetic structure

More analysis of previously conducted studies on closed areas should be conducted (e.g. box on 4X, also grenadier fishery closed since 1993).

b. Temporal closures— are of limited value due to the uncertainties: we have no information on spawning times and our information on the timing of critical life history stages is very limited. Catchability does not appear to change over time. Until there is better information on spawning, this measure probably won't work. Basically, when fisheries occur, they will take wolffish.
c. Gear restrictions— although wolffish are mostly caught in trawls, there is no relative estimate of their impact on wolffish relative to other gear types. Also, shifts to other gear types have resulted in more catches in those gears.
d. Gear modifications—show a lot of potential, but studies remain to be done. The Nordmore grate attached to shrimp trawls resulted in bycatch of young fish above a certain size reduced to near zero. There is the potential to introduce other gear modifications to reduce bycatch.
e. Live-release— could "immediately" impose live-release on the fisheries, but half of the bycatch is outside of the 200mile limit. Also, the fish may not do well if taken from the nets. Studies on effects of live-release on survival need to be done.

It was noted that live-release is not a guaranteed recovery strategy, it is an area of study. We should be careful about making it a recommendation until we know more about survival after release and their contribution to future generations. Point was made that tagging studies have been initiated and 25% of those released alive have been recaptured (very high rate for marine fishes).

It was cocluded that more information shoud be included in the Working Paper on what is known about live-release. For this species, only Templeman's study on tagging is available, mentioned in Res Doc. Should also include information on other closely related species, possibly eelpout.

Incidental Harm in Relation to Survival or Recovery of the Species

Current removal estimates are based only on top ten fisheries (95%) of bycatch. Other very small fisheries have not yet been included. For all three species, the majority of removals are occurring in 3Ps (where the majority of fisheries are anyway).

According to information presented in the Working Paper, the striped and spotted wolffish are increasing in biomass and abundance. The northern wolffish, however, has not increased in abundance. Data for 2002 are currently being analysed.

- Spotted wolffish— current levels of bycatch are not considered to be jeopardising its recovery, since an increase in abundance is observed. This might form the basis for formal advice in relation to incidental harm.
- Northern wolffish— under current levels of bycatch, the population is stable (although it is not comforting to say this) albeit at very low levels. Although the northern wolffish have a similar distribution to the other two species of wolffish, their population concentration is further North. North of the Grand Banks is where all species of wolffish are not recovering. The prey differences between the spotted and northern wolffish are minor. There does not appear to be a clear basis for advice on incidental harm here.

There are several unknowns in assessing current levels of mortality. There have been large increases in shrimp quotas off northern Newfoundland and Labrador (where wolffish have declined the most). We need to know the spatial distribution of various fisheries in areas where bycatch is a concern. We also need to know the survival rates of live-released fish. Finally, information on environmental changes in unfished areas needs to be included (this type of information was not considered by COSEWIC when these species were assessed).

General Discussion

1) Biological information on wolffish is currently being collected?

- genetic structure
- maturity stages— a key being developed for gross morphology related to gonad maturity
- changing protocols for observers
- studies for ageing from otoliths
- length-based assessment models
- analysis of fisheries catch data

Basically we are trying to close as many data gaps as possible. Catherine Hood is leading development of the recovery strategy and its deadline is March 31, 2003.

2) Incidental harm permits can be issued on the basis of critical habitat, but information seems very imcomplete (except for rock crevices being used for spawning, yet we don't know where the appropriate rocky habitat is).

Known habitat preferences are by depth and temperature, and this is not a one to one relationship. Also, these may not be the critical variables, they may just be proxies for other variables such as prey distribution, oxygen content, etc. Habitat may be an issue, but it is unlikely to be used right now as we simply don't have the information to use critical habitat in the IHP.

3) Advice on whether IHPs can be issued should include both biological and socio-economic advice. What is the best venue for collecting and reviewing the required socio-economic information?

For example, we compare the biological effects of using either spatial closures or gear modifications, but do not consider socio-economic effects of either, because it wasn't in the TORs or mandate of the meeting, but maybe is something that we should have considered. Therefore, in the future, we may want to have economic people come to the table when discussing IHPs, so that we can present the whole picture.

Economic information is only required when choosing between two or more biologically equivalent mitigating measures.

# Interior Fraser Coho Salmon

## 2.3 Working Paper SARA NAP 02b-09

### *Interior Fraser Coho Salmon— Incidental harm permits and recovery planning*

*Author: Holtby, B.*

### *Presentation Summary*

The paper argued that if all the requirements of SARA were met during the development and approval of management plans for fisheries, fish habitat and fish culture that might affect a listed species, then an IHP would not be required unless one of the following three situations arose:

- The activity was not described in the management plan.
- All of the requirements of SARA had not been met in the development and approval of the management plan.
- A change was sought to an activity described in the approved management plan that would either lead to harm or increase the level of harm.

For the most part, the provisions of SARA are currently met in the development of Integrated Fisheries Management Plans (IFMP) for Pacific salmon. The process needs some improvements to fully insure that all of the activities permitted under the IFMPs meet SARA provisions, and that all of the decisions concerning impacts on listed species are properly documented.

Additional initiatives in fisheries management of Pacific salmon— the Wild Salmon Policy, the Pacific Salmon Treaty, and eco-certification of commercial salmon fisheries— were discussed. These initiatives share many of the same objectives, data requirements, approaches and processes with the process required under SARA, suggesting that considerable synergy could be achieved with the adoption of an integrated resource management framework. An outline of such a framework was presented along with a description of the normal management cycle and a proposed recovery planning process comprised of three levels.

The current management process was described using Interior Fraser coho to illustrate how the process already includes all of the substantive requirements of SARA. Four enhancements were described to ensure complete compliance with SARA requirements:

1) Mandatory inclusion of “zero mortality” as a reasonable option.
2) Explicit documentation of the criteria used for selection of “best” option.
3) Rapid inclusion of practices that minimise harm and acceleration of efforts to improve fishing technologies.
4) Greater awareness of fisheries interactions – greater interaction between species groups within DFO Science and Fisheries Management.

Modes of harm for habitat alteration and enhancement were described. For habitat alterations it was concluded that the prohibitions in SARA strengthen existing legislation and regulation but do not add new dimensions to the protection of aquatic habitats. Cumulative, sub-lethal habitat damage and loss will continue to challenge habitat management. Effective proactive habitat management will need models that relate population trajectories and viability to measurable habitat attributes but such models are not available. The importance of stewardship, education and collaborative land-use planning were emphasised. It will be mandatory to document how decisions made under the current habitat management framework took into account the requirements of listed species. Long-term monitoring of the impacts of approved habitat works on listed species will be required. Where the “no net loss” principles of the National Habitat Policy are satisfied through habitat rehabilitation or substitution it may be necessary to show in every instance that the mitigation works before allowing the damage or loss to occur. Finally more effective communication between DFO sectors will be required.

Some species of Pacific salmon are extensively cultured and released into the wild primarily to support ocean sport and commercial fisheries. In some areas over 50% of the catch is produced by the public hatchery system. Three modes of harm were identified. Fisheries impacts can intensify in response to increased abundance to the point where the less productive wild stocks decline severely. These impacts are well understood and are now explicitly managed. Modern hatcheries are extremely efficient and can release into the wild an order of magnitude more juveniles than the surrounding wild stocks produce. Large releases of cultured fish may strain the carrying capacities of juvenile rearing areas. Whether this actually occurs and under what circumstances are currently unresolved questions requiring research. These impacts could be remedied by matching hatchery production to the ecosystem carrying capacity. The third mode of impacts is genetic. Selection in hatcheries can result is rapid divergence of hatchery and wild stocks. Harm occurs when wild and hatchery fish interbreed, which they inevitably do because of straying of hatchery fish into surrounding wild systems. The potential for harm is clear and there are warning signs that harm is occurring but it is unknown whether the harm is sufficient to jeopardise the survival or recovery of wild salmon and research is needed. It was concluded that a process for explicitly considering the harm that could result from interactions of wild and hatchery fish needs to be developed, documented and systematically applied.

SARA and the Wild Salmon Policy will culminate a transition to conservation-based resource management for Pacific salmon that is already well underway. Managers increasingly recognise that avoiding invocation of SARA is more preferable than relying on it as a fisheries management tool. Since most of the conservation issues stem from mixed-stock fisheries and slow or inappropriate reactions to variability in productivity, and therefore can be resolved through fisheries management, fisheries managers are rapidly adopting practices that conform to SARA requirements. Experience in recovery planning for Pacific salmon is rapidly accumulating and the new decentralised management structure is promoting needed inter-sectoral cooperation. Progression beyond current regulatory framework for habitat management requires models that relate action to population impacts. Such models on small scale are possible but may be difficult to develop for large watersheds and regions. This and other aspects of habitat management strongly suggest that education, stewardship and cooperative land-use planning with fish valued should be pursued rather than IHPs. Finally, research is urgently required to validate the theory that predicts that harm to wild salmon results from enhancement and to demonstrate the magnitude of such harm in the context of SARA and listed species.

### *Discussion*

**Background:**

In Pacific Salmon resource management, there are four interlinked initiatives:

1. SARA—to address issues of extirpation
2. Wild Salmon Policy—to address issues of biodiversity
3. Pacific Salmon Treaty—to address issues of productivity
4. Marine Stewardship Council—associated with eco-certification of commercial salmon fisheries to address issues of ecosystem

Recovery planning and SARA are extensions of resource management. Pacific salmon stocks can be well modelled and predicted with a high level of confidence. The major causes of decline have been excessive exploitation in mixed stock fisheries.

Considering these, the Pacific salmon resource management process presently meets all requirements for IHP considerations. Prohibitions under SARA strengthen existing legislation and regulation but do not add new dimensions to protection of aquatic habitat.

Enhancement of salmon populations is a controversial activity which has to date not been considered as an activity which may require evaluation for IHPs. It is difficult to reconcile this activity in the spirit of SARA but also difficult to see how it could be considered under IHP.

1. SARA and Wild Salmon Policy will culminate to conservation based resource management.
2. Most conservation issues for Pacific salmon stem from mixed-stock fisheries and slow or inappropriate reactions to variable productivity.
3. Avoiding SARA is preferable to using it as a fisheries management tool.
4. There is rapidly accumulating experience in recovery planning.

## Comments and discussions

Enhancement concern would be a system level harm (potentially) which is in the spirit of SARA but IHPs are intended for individual harm, therefore this activity is indeed difficult to define. Enhancement activities need to be considered in the analysis by COSEWIC and also by the recovery team.

Wild Salmon Policy (WSP) guidelines will compel DFO to address stock issues listing under SARA. WSP will not prevent stocks from qualifying under the decline criterion but it may sway COSEWIC decisions that the policy is sufficient to address the declines and assist COSEWIC in assessing whether the measures are sufficient to lead to recovery. Some cases may still fall through the cracks in which case the normal process would be followed, i.e. status report, listing by COSEWIC, Governor in Council listing, review of causes/mitigation/recovery plan…

The issue of Critical Habitat was discussed at length. Is the issuance of a permit under the Fisheries Act similar to issuance of an IHP?

The answer seemed to be that once critical habitat is defined, then permits under the Fisheries Act could not simply be issued. However there would be instances where an IHP could be issued to allow an activity to occur on the basis of public safety for example, although the requirements under SARA for having considered all alternatives would still apply. Even in cases of protection of habitat under generic stress, the minister will have to show due diligence in the protection of the habitat to prevent harm to the animal and if shown then activities could still be authorized.

The Critical Habitat Workshop (December 2002) discussed a number of such issues. IHPs last until the recovery plan is in place, at least on condition that the recovery plan addresses the same issues as IHP assessments. It is expected that the definition of critical habitat after listing may take longer than the duration of the IHP. The difficulty with defining critical habitat is that the models relating action to expected benefits for the resource are lacking and may be difficult to develop because of the complexities of the ecosystem. However the way out of this is to initiate cooperative multi-use planning that considers all aspects of the resource and this should be in recovery strategies.
Critical habitat definitions will require science review, as there will be science components within the recovery plans.

There was discussion regarding the process of issuing SARA IHPs and of determining whether management plans for listed species are SARA compliant, etc. Basically, things would be as they are now— Fisheries Management would lead the development of the advice to the Minister indicating that the management plan or activity was consistent with SARA legislation and therefore the plan is equivalent to an IHP. Obviously, the generation of that advice from Fisheries Management or Habitat Management would require the same level of review by Science and others as is currently done.

Example of the Interior BC coho salmon—:

Were there examples of populations being extirpated and then recolonizing? There are examples of several NW Pacific (US) coho populations being extirpated and some chum and sockeye (ESUs) in BC. After Mt St. Helens eruption, some streams were destroyed and recolonized (many years later).

What is the probability of a correct assignment of an individual of a listed coho caught in a mixed stock fishery? Genetics work on Interior BC coho is very good and generally very good for most of the ESUs in BC. Since these fish can be identified with a high degree of confidence, it is possible to protect them.

For recent fisheries management, how was the acceptable level of exploitation on the listed coho stock determined? Is risk acceptance for SARA equivalent to risk acceptance for fisheries management? The analysis of exploitation levels which would allow the stock to recover was determined using stock recruit model, distributions of productivity, assumptions of levels of mortality at sea, projections of stock size into the future, probability of population increase under different exploitation scenarios. It was found that at a 3% exploitation rate (ER) on the stock, the trajectory had a very high probability of increasing, and that the 3% ER could be achieved within the considered fisheries adjustments. There are cases where the acceptable ER that would not jeopardise recovery could only be achieved by closing the fisheries, even after consideration of best practice. Although the Minister would approve the risk acceptance level for SARA, there are policies on risk management within government and the risk levels would ultimately be decided by the public (public policy) and would reflect the society issue (for example a risk level in terms of human health would likely be much lower than one for fish stock recovery).

Note to author:
Include in the research document more detail for the case studies (appendices) on status of the resource, recovery processes, etc.

# Appendix 1— Terms of Reference

## A. Background

The federal government is committed to delivering certain activities for protection and recovery of species at risk, based on the Federal Strategy on Species at Risk (2000) including SARA (near proclamation at time of writing). Activities under these initiatives relate to species assessment, protection, and recovery. The Minister of Fisheries and Oceans is identified as the Minister responsible for aquatic species at risk under these initiatives.

The various activities envisaged must be based on sound scientific knowledge of species at risk or potentially at risk and the threats facing them. The Department of Fisheries and Oceans intends to support species at risk protection and recovery activities by contributing to or providing scientific information, assessments, and advice.

Assessment of species status and designation of risk categories is the responsibility of the Committee on Status of Endangered Wildlife in Canada (COSEWIC). DFO holds information and expertise on aquatic species that should be put at the disposition of COSEWIC so that its assessments are based on the best information available. DFO's science review processes will be used to support the COSEWIC process. Once it is known that COSEWIC will assess a species, DFO will consolidate and review its information holdings on the species through a formal review meeting, and provide the available information to COSEWIC, with appropriate comments on completeness, reliability, etc.

In cases where the Minister of Fisheries and Oceans must make determinations, DFO will provide the Minister with scientific advice to support these determinations. This is the case for IHPs. There is a provision in the Act whereby a responsible Minister can issue a permit allowing for incidental harm to a species or its critical habitat, subject to specified conditions, as long as that incidental harm does not jeopardise the survival and recovery of the species.

A National Advisory Process (NAP) meeting on species-at-risk is scheduled for December 2002. Marine fish species, for which contracts for the preparation of draft status reports are expected, are scheduled for review at this meeting. The meeting will also consider case scenarios for analytical approaches and data requirements for IHPs.

## B. General objectives

The DFO NAP Species at Risk meeting will be held to review information relevant to status designation, protection, and recovery of marine species at risk in Canada.

The meeting has two general objectives:

1. To review information held by DFO that could be used by COSEWIC in assessing status and extinction risk of several marine/diadromous fish species, including:

- Acadian redfish (*Sebastes fasciatus*)
- Golden redfish (*Sebastes marinus)*
- Porbeagle (*Lamna nasus*)
- Winter skate (*Leucoraja ocellata*)
- Blue hake (*Antimora rostrata*)
- Striped bass (*Morone saxatilis*)
- American shad (*Alosa sapidissima*)

No scientific advice on the above species' status will be produced. For the information that is reviewed for use by COSEWIC, non-DFO information will not be considered. The intent of this part of the meeting is simply to review and provide information from DFO to COSEWIC.

2. To consider analytical approaches and data requirements for providing scientific advice on criteria for issuance of, and terms and conditions of IHPs as provided for in SARA. Case scenarios will be developed for the following species expected to be on Schedule 1 upon proclamation of SARA:

- Leatherback turtle (*Dermochelys coriacea*)— relative to pelagic longline fisheries in Atlantic Canada
- Northern wolffish (*Anarhichas denticulatus*) and spotted wolffish (*Anarhichas minor*), relative to bottom fisheries on the Grand Banks and elsewhere in Atlantic Canada
- Interior Fraser River coho salmon (*Oncorhynchus kisutch*), relative to salmon fisheries on the Pacific coast

Advice on whether to issue such permits will be produced and non-DFO information may be considered.

## C. Specific objectives

<u>Species information</u>

The purpose of the first part of the meeting is to ensure that information on these species that is held by DFO is made available to COSEWIC, including the authors of the respective status reports, and the Chairs of the COSEWIC Marine Fish Species Specialist Group.

The meeting will review information on distribution, abundance, and life history characteristics of these species, which could be used by COSEWIC to determine, following its assessment guidelines and criteria, the appropriate risk category. Discussion on each species will also consider the available information on population differentiation, which could support a COSEWIC decision of which populations would be suitable for assessment and designation.

Documentation produced by this part of the meeting will include Research Documents summarising the available information on these species and Proceedings documenting discussions at the meeting.

A detailed description of the information to be produced for each species follows. In addition, information that can be made available on life history and ecological characteristics will be reviewed for each species to allow a general assessment of the resilience or general vulnerability of the species. Therefore, the following information will be reviewed to the extent that it is available:

**Life history characteristics—**

- Growth parameters : age and/or length at maturity, maximum age and/or length
- Fecundity
- Early life history pattern (e.g. duration of planktonic larval life, and major egg, larval, and juvenile transport mechanisms)
- Specialised niche or habitat requirements

*For all species:*

1. **Review the population structure—** (with redfish, if not possible to disaggregate data sources by species, all redfish in Atlantic Canada) in the context of "evolutionarily significant units"[2]

2. **COSEWIC Criterion—** **Declining Total Population**: by stock, for species in Canada as a whole and for ESUs identified in 1 (if on a scale finer than stocks), and using information in the most recent assessments:

    a. Summarize overall trends in population size (both number of mature individuals and total numbers in the population) over as long a period as possible and in particular for the past three generations (taken as mean age of spawners). Additionally present data on a log scale to clarify the rate of decline.
    b. Where declines have occurred over the past three generations, summarize the degree to which the causes of the declines are understood, and the evidence that the declines are a result of natural variability, habitat loss, fishing, or other human activity
    c. Where declines have occurred over the past three generations, summarize the evidence that the declines have ceased, are reversible, and likely time scales for reversibility.

3. **COSEWIC Criterion—** **Small Distribution and Decline or Fluctuation**: by stock, for species in Canada as a whole and for ESUs identified in 1 (if on a scale finer than stocks) and using information in the most recent assessments:

    a. Summarise current area of occupancy (in $km^2$)

[2] (*sensu* Waples 1995: Evolutionarily significant units and the conservation of biological diversity under the endangered species act. pp 8-27 in Nielsen, J. L., Ed. Evolution and the aquatic ecosystem: defining unique units in population conservation. Symposium 17, Am. Fish. Soc., Bethesda, Md.) Provide conclusions regarding the degree to which population units at and below the scale of stocks (as used in current management) are evolutionarily independent and the scientific evidence for those conclusions.

b. Summarise changes in area of occupancy over as long a time as possible, and in particular, over the past three generations.
c. Summarise any evidence that there have been changes in the degree of fragmentation of the overall population, or a reduction in the number of meta-population units.

4. **COSEWIC criteria— Small Total Population Size and Decline and Very Small and Restricted**: by stock, for species in Canada as a whole and for ESUs identified in 1 (if on a scale finer than stocks), and using information in the most recent assessments:

   a. Tabulate the best scientific estimates of the number of mature individuals;
   b. If there are likely to be fewer than 10,000 mature individuals, summarize trends in numbers of mature individuals over the past 10 years or three generations, and, to the extent possible, causes for the trends.

As time allows, review status and trends in other indicators of the status of each of the species that would be relevant to evaluating the risk of extinction of the species. This includes the likelihood of imminent or continuing decline in the abundance or distribution of the species, or that would otherwise be of value in preparation of COSEWIC Status Reports.

Incidental harm permits

Under SARA, once a species is placed on the legal list of protected species it becomes illegal to kill or harm the species or its residence. SARA allows that a competent Minister may make an agreement or issue a permit to allow for "incidental harm" to a listed species. If such a permit was not issued, and a person was found to have caused harm to the species, the person would be subject to prosecution. Fisheries bycatch is a potential source of "incidental harm".

Before the competent Minister can issue such a permit, the following must be shown—

*(a)* all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best alternative has been adopted. In the case of bycatch, this would imply considering alternative gear types or management approaches to the target species

*(b)* all feasible measures will be taken to minimise the impact of the activity on the species or its critical habitat or the residences of its individuals. In the case of fishery bycatch this might imply such things as areal, seasonal, or inseason closures in response to expected or observed bycatch

*(c)* the activity will not jeopardise the survival or recovery of the species.

This meeting has two objectives in relation to IHPs:

1. The meeting will review methods for determining allowable mortality for endangered or threatened species, as a basis for assessing whether IHPs could be issued. Working papers on methods for assessing allowable mortality, including simulations or case studies, are solicited. Reference can be made to Proceedings of the SARA NAP meeting in March 2002 (CSAS Proceedings Series 2002/007) for background information relative to this item.

2. The meeting will assess whether IHPs could be allowed, and under what conditions, for the following species:

- Atlantic leatherback turtle
- Spotted wolffish
- Northern wolffish
- Interior Fraser coho salmon

In order to conduct these assessments, the following information and analyses will be assembled and reviewed for each species:

a. **Description of the species—** including general biology, distribution, abundance, whether "residence" can be identified
b. **Description of the threat(s)—** from incidental harm, including distribution and intensity of incidental harm (e.g. bycatch) to species and residence (if identified), and available data and information on magnitude of incidental harm (e.g. mortality estimates)
c. **Alternative measures—** which might reduce the magnitude of incidental harm such as alternative fishing gears, sectoral closures or restrictions
d. **Mitigating measures—** which might reduce the magnitude of incidental harm, such as spatial or temporal restrictions on the activity (e.g. closed areas or seasons), modifications to the activity (e.g. fishing gear modifications), management of incidental harm by quota (e.g. quota on allowable bycatch after which the fishery is closed)
e. **Analysis of magnitude of incidental harm—** in relation to survival or recovery of the species, including analyses of mortality from incidental harm relative to a level which would ensure survival or recovery, incorporating any alternative or mitigating measures from above

To the extent possible, final conclusions will be summarised indicating whether and under what condition incidental harm could be permitted, taking into account that this must not jeopardise survival or recovery of the species.

## D. Documentation

The meeting will produce the following documentation:

1. At least one Research Document for each of the species to be considered, summarising the overall status of the species and the data and information held by DFO which could be used by COSEWIC in making status designations. These Research Documents will cover the information called for in the Terms of Reference above.

2. Proceedings summarising the decisions, recommendations, and major points of discussion at the meeting, including a reflection of the diversity of opinion present in the discussions.

3. Documentation of the incidental harm permit issue will be determined at the meeting. One or more specific Research Documents on methods and approaches may be produced if available information merits this, or discussions may simply be summarised in the Proceedings. Once SARA is enacted and the Minister is required to issue IHPs, formal advice on the meeting's conclusions and recommendations will have to be issued. The proper vehicle for such advice is under discussion, and will also be discussed at the NAP.

## Appendix 2— Canadian fisheries impact on leatherback turtle

Rough calculations:

1982— 115,000 females (Pritchard 1982)

1996— 34,500 females (Spotila et al. 1996)

This translates to a 70% decline in 15 years = 4.7% decline/year.

Therefore, extrapolating the 4.7% decline/year to 2002:

2002— 25,845 females, =~ 51,690 (males and females)

Assuming 20% in Pacific Ocean = 10,385, 80% in Atlantic = 41,352 (total population)

For fisheries impacts in Canadian Atlantic waters:

Assume 50% of Atlantic population enters Canada = ~ 20,676

Canadian fishery impacts—

- Longline = 150 hooked/year

Assume 18% killed (50% mouth-hooked x 0.35 mortality (mean of US data of 27% + 42%)

Assume 15% harmed and fitness reduced.

This totals 33% lost from the longline fishery.

150 x 0.33= 50 leatherbacks lost /year from the longline fishery.

- Fisheries impact extrapolated from longline

Assume the impact from all fisheries is 3 x longline (3 x 50 = 150/year).

Therefore, annual impact on leatherback mortality from Canadian fisheries is:

150/41,352 = 0.36% of the Atlantic population (and 0.29% of the global population).

**Note: These are highly speculative estimates for evaluation purposes. They are not to be used for any type of communication regarding the impact of Canadian fisheries on leatherback turtles.*

## Appendix 3— List of Presentations

Species status assessments

1. **Redfish spp. (SARA-NAP-02b-01a-f)—** working papers by redfish working group led by Bernard Morin in Quebec region; Don Power (NFLD); Bob Branton (Maritimes); Jean-Marie Sevigny (Quebec)

2. **Porbeagle (SARA-NAP-02b-02)—** working paper by Steve Campana — Maritimes Region

3. **Winter skate (SARA-NAP-02b-03)—** working paper by Lei Harris, Jim Simon — Maritimes Region

4. **Blue hake (SARA-NAP-02b-04)—** working paper by Dave Kulka — Newfoundland Region

5. **Striped bass (SARA-NAP-02b-05)—** working paper by Scott Douglas — Gulf Region

6. **Striped bass (Quebec Province Info) —** Jean Robitaille has been asked by Quebec to present these data for discussion

7. **American shad (SARA-NAP-02b-06)—** working paper by Gerald Chaput — Gulf Region

8. **American shad (Quebec Province Info)—** Jean Robitaille has been asked by Quebec to present these data for discussion

Incidental Harm Permit case scenarios

1. **Leatherback turtle (SARA-NAP-02b-07)—** case scenario by Jim McMillan — Maritimes Region

2. **Northern and spotted wolffish (SARA-NAP-02b-08)—** case scenario by Dave Kulka — Newfoundland Region

3. **Interior Fraser River coho salmon (SARA-NAP-02b-09)—** case scenario by Blair Holtby — Pacific Region

# Appendix 4— Participants List

**DFO Science**

Amiro, Peter— Maritimes, BIO
Berube, Marthe— Quebec
Bradford, Rod— Maritimes, BIO (American shad/ striped bass)
Branton, Bob— Maritimes, BIO (redfish)
Bowen, Don— Maritimes, BIO (leatherback turtle)
Campana, Steve— Maritimes, BIO (porbeagle)
Chaput, Gerald— Gulf (American shad)
Conway, Jerry— Maritimes, BIO (leatherback turtle)
Cooper, Lara— NCR, Biodiversity Science
Douglas, Scott— Gulf (striped bass)
Forest, Isabelle— Gulf SAR Coordinator
Gibson, Jamie— Maritimes, BIO
Harris, Lei— Maritimes, St. Andrews (winter skate)
Hnytka, Fred— Central and Arctic
Holtby, Blair— Pacific (coho salmon)
Hood, Catherine— Newfoundland and Labrador SAR coordinator
Jewett, Tara— Maritimes, BIO (redfish)
Johnston, Terry— Maritimes, St. Andrews (winter skate)
Kulka, Dave — Newfoundland and Labrador (blue hake, wolffish)
Mann, Julie— Maritimes, BIO
Marshall, Larry— Maritimes, BIO
McMillan, Jim— Maritimes, BIO (leatherback turtle)
Mcpherson, Arran— Maritimes, BIO
Méthot, Red— Quebec (redfish)
Morin, Bernard— Quebec (redfish)
O'Boyle, Bob— Maritimes, BIO - RAP coordinator
Perrault, Julie— NCR, Biodiversity Science
Power, Don— Newfoundland and Labrador (redfish)
Powles, Howard— NCR, Meeting Chair
Rice, Jake— NCR, Canadian Science Advisory Secretariat
Sevigny, Jean-Marie— Quebec (redfish)
Simon, Jim— Maritimes, BIO (winter skate)
Simpson, Mark— Newfoundland (blue hake, wolffish)
Smedbol, Kent— Maritimes, St. Andrews
Wood, Chris— Pacific

**DFO Resource Management**

Brocklehurst, Gary— Newfoundland and Labrador
Chatt, Mira — NCR
Hebert, Rejean— Gulf
Huson, Bob — NCR
McMaster, Andrew— Maritimes
Murphy, Odette— Maritimes
Tremblay, Denis— Quebec
Vermette, Michel— NCR

Vezina, Bernard— NCR
Weber, Gary— Maritimes
Wright, Steven— Pacific

**DFO Habitat Management**

Phelps, Anne— NCR

**COSEWIC Members**

Gross, Mart— University of Toronto, COSEWIC Marine Fishes Co-chair
Renaud, Claude— Canadian Museum of Nature, COSEWIC Freshwater Fishes Co-chair

**COSEWIC Status Report Authors**

Baum, Julia— Dalhousie University (porbeagle)
Cunningham, Tarah— Memorial University, (blue hake)
Howlett, Jerome— Memorial University, (winter skate)
Laurel, Ben— Memorial University, (redfish)
Robitaille, Jean— Levis, Quebec, (American shad/Striped bass)

**Universities**

Bentzen, Paul – Dalhousie University
James, Mike – Dalhousie University
Myers, Ransom – Dalhousie University

**NMFS**

McDaniel, Carrie— Leatherback turtle IHP