



# Monterey Bay Aquarium Seafood Watch®

## Capelin

*Mallotus villosus*



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Gulf of St. Lawrence and North Atlantic  
Trap, Seine net

November 17 2014

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### Disclaimer

Seafood Watch® strives to ensure all our Seafood Reports and the recommendations contained therein are accurate and reflect the most up-to-date evidence available at time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation

## **About Seafood Watch®**

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from [www.seafoodwatch.org](http://www.seafoodwatch.org). The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

## **Guiding Principles**

Seafood Watch defines sustainable seafood as originating from sources, whether fished<sup>1</sup> or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch had developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

**Best Choice/Green:** Are well managed and caught in ways that cause little harm to habitats or other wildlife.

**Good Alternative/Yellow:** Buy, but be aware there are concerns with how they're caught.

**Avoid/Red:** Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

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<sup>1</sup> "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

## **Summary**

The following Seafood Watch report provides recommendations for two domestic fisheries of capelin (*Mallotus villosus*) caught in the Gulf of St. Lawrence and North Atlantic by Canadian fishing vessels.

Capelin is a small pelagic schooling finfish species with major populations occurring in the Northwest Atlantic, in waters around Iceland, in the Barents Sea, and in the Northern Pacific. Several reports by the Canadian Department of Fisheries and Oceans (DFO) and academics indicate that there exist five biologically distinct capelin stocks in the Northwest Atlantic Fisheries Organization (NAFO) areas: 2J3KL (Eastern Newfoundland and Labrador; which exists as a stock complex that frequently mix), 3Ps (St. Pierre Bank), 4RST (the Gulf of St. Lawrence), 4W (Scotia Shelf), and 3NO (Southeast Shoal; which is a straddling stock that is internationally managed). This report will focus on two domestic management units residing in the NAFO areas 4RST (Gulf) and 2J3KLPs (N. Atlantic), respectively. These two fisheries contribute to 100% of the Canadian domestic catch. Canadian fishers capture capelin using a variety of methods, including purse seine, other seine nets using vessels (aka “tuck” seine), and trapnets (aka weirs).

All capelin stocks, throughout this species’ range, have a low inherent vulnerability to fishing pressure because they are short-lived, have a high fecundity, and mature quickly. Capelin abundance indices are not available for each management area because DFO does not conduct directed trawl surveys on this species. However, total allowable catches (TACs) are applied through a calculated science and management review process. The TAC for the 4RST fishery was set at 14,300 MT for the 2013–2014 management cycle and the fixed gear fleet (which includes both the tuck seine and trapnet gear types) landed 2,927 MT (20% of the TAC) and the mobile fleet (purse seine) landed 5,921 MT (41% of the TAC) in 2013. There were no catches in NAFO areas 4ST. The TAC for the 2J3KLPs fishery was set at 24,396 MT for the 2013–2014 management cycle and the fixed gear fleet landed 8,590 MT (35% of the TAC) and the mobile fleet landed 13,718 MT (56% of the TAC). There were no catches in NAFO areas 2J and 3Ps. Although there were no catches in several areas, the report is still based on the DFO management units. Landings in both management areas have remained stable over the long term (10 years), which would indicate the sustainability of the resource.

Both capelin fisheries in 4RST and 2J3KLPs are only authorized to retain the directed species; all other bycatch species are discarded. Most bycatch species are of high concern because they are listed as threatened, endangered, or of special concern: Atlantic cod, Atlantic salmon, and marine mammals (especially cetaceans). Atlantic herring are also caught as bycatch in both fisheries, and the status of these stocks are of a high concern because biomass indices specify that they are below limit reference points. A bycatch report for all areas details that the purse seine fleets have a negligible impact on all bycatch species. However, there are no bycatch reports for the fixed gear (tuck seine and trapnet) fleets; therefore, a moderate score was used since a moderately effective management regime exists.

Except during rare occurrences, the purse seine and tuck seine types do not contact the substrate and consequently do not have a significant impact on benthic habitats and ecosystems. Trapnet gear does

come into contact with the substrate, but it has been scientifically studied that this gear type only affects habitats of low complexity with minimal impact. There are also moderate mitigation measures (e.g., mesh size restrictions, season closures, etc.) in place to further reduce impacts on ecosystems for this fishery type. Capelin are considered a forage species, which is defined in terms of its functional role in providing a critically important route for energy transfer from lower to higher trophic levels in marine ecosystems. DFO provides ecological and food web impact analysis for this exceptional species of importance. Based on these results, the criterion is ranked high (green); meaning that all gear types, in all areas, have a low impact on the ecosystem.

Both fisheries in 4RST and 2J3KLPs, within Canada's 200 nm jurisdiction, are managed by the DFO area offices—in St. John's, NL, and Mont-Joli, QC (respectively)—through scientific peer-review (fisheries-dependent and fisheries-independent surveys) and regional advisory (which includes all stakeholder groups) processes. DFO management then sets TACs, in both 4RST and 2J3KLPs, based on the advice gathered from the internal and external review processes. DFO management has a proven track record of following this advice. DFO reports on bycatch for only the purse seine fleets in both management areas through the use of at-sea observers. However, observer coverage is low (<5%). Since DFO does not employ observers in the fixed gear fisheries, this reflects poorly on the management regime. Contrary to these points, both fisheries in 4RST and 2J3KLPs are governed by a regulatory framework and are subjected to monitoring using vessel monitoring systems (VMS), logbooks, and fisheries (conservation and protection) officers. Consequently, the purse seine fisheries in both areas are well managed whereas the management regime needs to be improved for the fixed gear fleets in both 4RST and 2J3KLPs.

Capelin caught in Atlantic Canada is a “Good Alternative” because of concerns over bycatch of endangered, sensitive and overfished species, uncertainties over capelin abundance and management concerns (specifically for the tuck seine and trap net gear types). Recommendations in this report cover all capelin products, including whole fish as well as the roe (known as masago).

### Table of Conservation Concerns and Overall Recommendations

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Capelin: Gulf of St. Lawrence (4RST) Canada Gulf of St. Lawrence - Purse Seine	Yellow (2.64)	Yellow (2.24)	Green (3.46)	Green (3.57)	<b>Good Alternative (2.924)</b>
Capelin: Gulf of St. Lawrence (4RST) Canada Gulf of St. Lawrence - Trap net	Yellow (2.64)	Red (1.53)	Yellow (2.45)	Green (3.24)	<b>Good Alternative (2.379)</b>
Capelin: Gulf of St. Lawrence (4RST) Canada Gulf of St. Lawrence - Seine Net, Boat	Yellow (2.64)	Red (1.92)	Yellow (2.45)	Green (3.57)	<b>Good Alternative (2.580)</b>

Capelin: NAFO 2J3KLPs Canada North Atlantic - Purse Seine	Yellow (2.64)	Yellow (2.24)	Green (3.46)	Green (3.67)	<b>Good Alternative (2.945)</b>
Capelin: NAFO 2J3KLPs Canada North Atlantic - Seine Net, Boat	Yellow (2.64)	Red (1.92)	Yellow (2.45)	Green (3.67)	<b>Good Alternative (2.598)</b>
Capelin: NAFO 2J3KLPs Canada North Atlantic - Trap net	Yellow (2.64)	Red (1.53)	Yellow (2.45)	Green (3.24)	<b>Good Alternative (2.379)</b>

#### Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, **and** no Red Criteria, **and** no Critical scores
- **Good Alternative/Yellow** = Final score >2.2, **and** neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern,<sup>2</sup> **and** no more than one Red Criterion, **and** no Critical scores, **and** does not meet the criteria for Best Choice (above)
- **Avoid/Red** = Final Score ≤2.2, **or** either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern,<sup>2</sup> **or** two or more Red Criteria, **or** one or more Critical scores.

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<sup>2</sup> Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

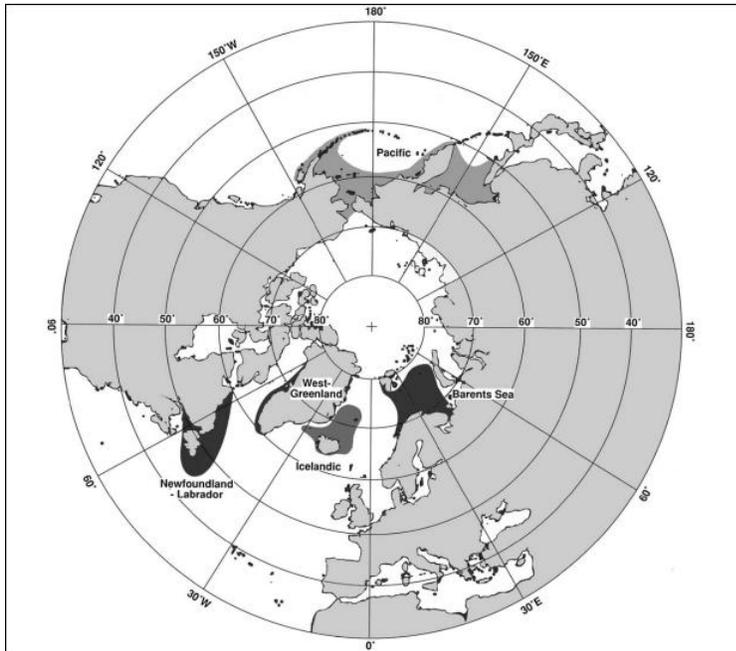
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## Introduction

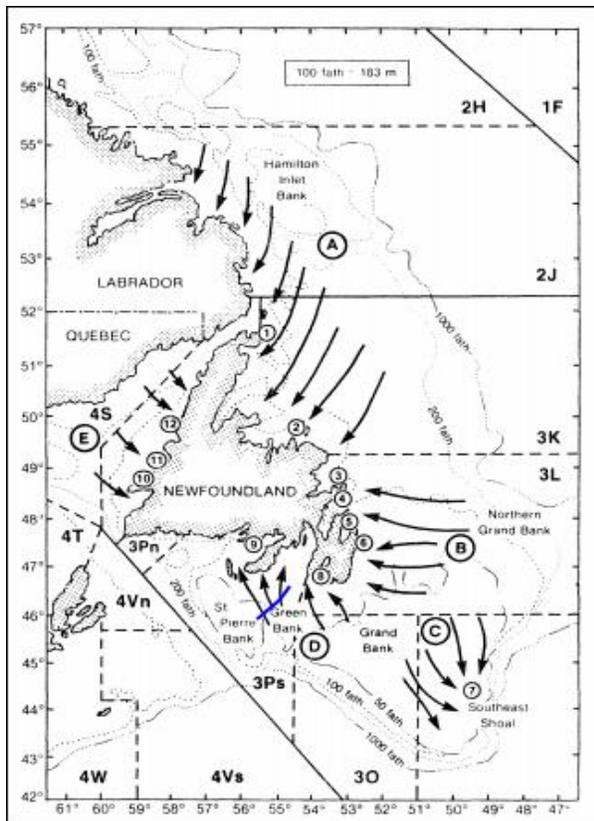
### Scope of the analysis and ensuing recommendation

The following Seafood Watch report provides recommendations for two domestic fisheries of capelin (*Mallotus villosus*) caught in the Gulf of St. Lawrence and North Atlantic by Canadian fishing vessels. Capelin is a small pelagic schooling finfish species with major populations occurring in the Northwest Atlantic, in waters around Iceland, in the Barents Sea, and in the Northern Pacific (Figure 1; Rose 2005; DFO 2013a).



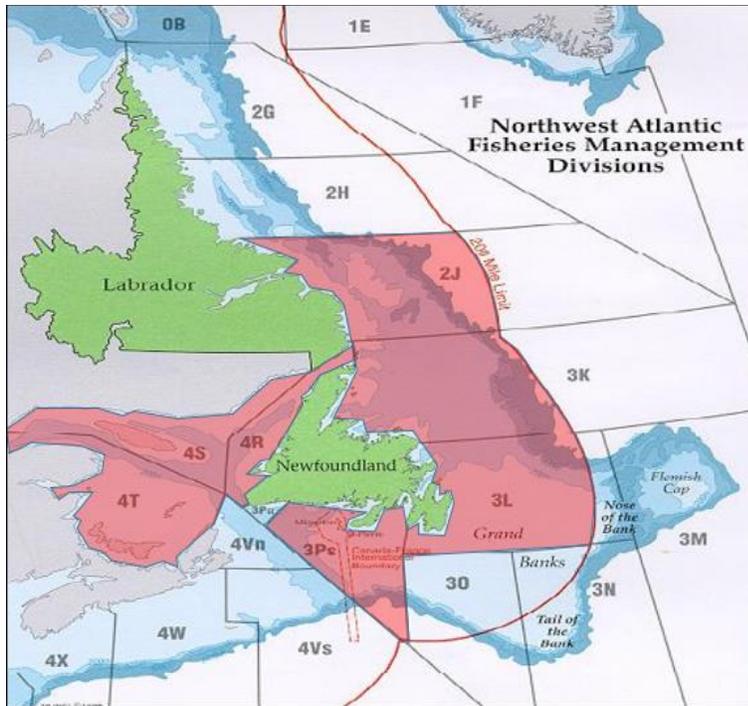
**Figure 1.** Map of global capelin (*Mallotus villosus*) distribution (Rose 2005).

Several reports by the Canadian Department of Fisheries and Oceans (DFO) and academics indicate that five biologically distinct capelin stocks exist in the Northwest Atlantic Fisheries Organization (NAFO) areas: 2J3KL (Eastern Newfoundland and Labrador; stock complex), 3Ps (St. Pierre Bank), 4RST (the Gulf of St. Lawrence), 4W (Scotia Shelf; not shown) and 3NO (Southeast Shoal; straddling stock that is internationally managed; Figure 2, Misra and Carscadden 1984; DFO 2013b).



**Figure 2.** Characteristics of Atlantic Canadian capelin stocks (Mirsa and Carcadden 1984)

This report will focus on two domestic management units residing in the NAFO areas 4RST (Gulf) and 2J3KLPs (N. Atlantic), respectively (see Figure 3). These two fisheries contribute to 100% of the Canadian domestic catch. Canadian fishers capture capelin using a variety of methods, including purse seine, other seine net using vessels (i.e., “tuck” seine) and trap (i.e., weirs; Hislop, K. 2013; Wilding 2013).



**Figure 3.** Northwest Atlantic Fisheries Organization (NAFO) areas map. 4RST and 2J3KLPs capelin fisheries management areas are highlighted in red (DFO 2011a).

### Overview of the species and management bodies

Capelin, part of the Osmeridae (sardine) family, are olive in color and have an elongated body (DFO 2013a). Capelin overwinter in offshore waters, move shoreward in early spring to spawn on coastal beaches in spring–summer, and return to offshore waters in autumn (DFO 2014a). Capelin are sexually dimorphic (males are larger than females) and range in size from 12–23 cm. Spawning essentially occurs at water temperatures of 6–10 °C and is more predominant at night. Capelin can spawn at 2 years of age and nearly 100% of males die following reproduction (DFO 2011a; DFO 2013a; DFO 2013b).

A 2013 DFO Canadian Science Advisory report states that there are five biologically distinct stock complexes residing in NAFO subdivisions 2J3KL (Eastern NL), 3Ps (St. Pierre Bank), 4RST (Gulf of St. Lawrence), 3NO (Southeast Shoal), and 4W (Scotian Shelf; DFO 2013a). Scientific evidence for these biologically distinct stocks can be found in the 1984 peer-reviewed report by Misra and Carscadden (Figure 2, Misra and Carscadden 1984). However, since there has been no commercial fishery in 4W and the 3NO international straddling stock is managed by NAFO, these stocks have been removed from the Canadian domestic commercial capelin assessments and integrated fisheries management plans (IFMPs). DFO consequently manages the domestic capelin fisheries in the North Atlantic via two separate management units: NAFO area 4RST (Gulf Region) and 2J3KLPs (Eastern Newfoundland Region).

The 4RST fishery is managed and assessed by DFO in Mont-Joli, QC, and the 2J3KLPs fishery is managed

and assessed by DFO in St. John's, NL based on the adjacency of the offices to the management units. These two offices manage and assess the units independent of one another. DFO offices in Moncton, NB, Quebec, QC, and Corner Brook, NL support science and management operations for these fisheries. The 4RST and 2J3KLPs fisheries represent 100% of the Canadian domestic catch. Both fisheries are managed using an IFMP process that evaluates multiple ecological (e.g., capelin biology, life history, limited population dynamics, landings and predator/prey relationships), socioeconomic (e.g., landings and ex-vessel value, local and export market trends, and economic dependency), and governance (e.g., monitoring, compliance, enforcement, regulatory framework and stakeholder consultation) parameters. The IFMP process also involves a regional advisory process (RAP) in which there is thorough scientific review and public consultations with key stakeholder groups (harvesters, processors, and aboriginal groups; please refer to Criterion 3 of the assessment for a full explanation of the IFMP process; DFO 2013d).

Capelin fishing seasons are generally short and correspond to the pre-spawning period for the seine fisheries (purse and tuck) and to the spawning period for the trapnet fisheries. The seine and trapnet fisheries mainly target mature females for the Japanese roe market. Historical records show that a small domestic fisheries (for both the 4RST and 2J3KLPs management units) existed for spawning capelin (on beaches) in the 1960s, which provided food, bait, and fertilizer for local residents. The emergence and prominence of the Japanese roe market, throughout the late 1970s and early 1980s, is responsible for sharp increases in landings within both fisheries. Since the expansion of the fisheries both inshore and offshore, the fisheries can be categorized as cyclical and highly dependent on global market and processor demand. As of 2011, the most recent IFMP states that there are 302 fixed gear (trapnet and/or weir) and 33 mobile gear (seine; both purse and tuck) licenses in 4RST. Within the same management year, the 2J3KLPs fishery had 1,418 fixed gear and 210 mobile gear licenses (DFO 2011a; DFO 2011b).

### **Production Statistics**

As shown in Figure 4, the landings for the 4RST capelin fishery (from 2000 to 2010) can be described as cyclical. The fishery experienced a ten year low in 2001 of 856 MT and a high of 12,080 MT in 2009. Also shown in the figure, the landings within the time period are consistently lower than the TAC set for each year. This can be attributed to the market value of capelin. As seen in Figure 5, the landed value of capelin in 4RST (over the same time period) mirrors the trends of the landings. As the value of capelin decreases or increases over time, the level of effort reflects these markets fluctuations (DFO 2011a).

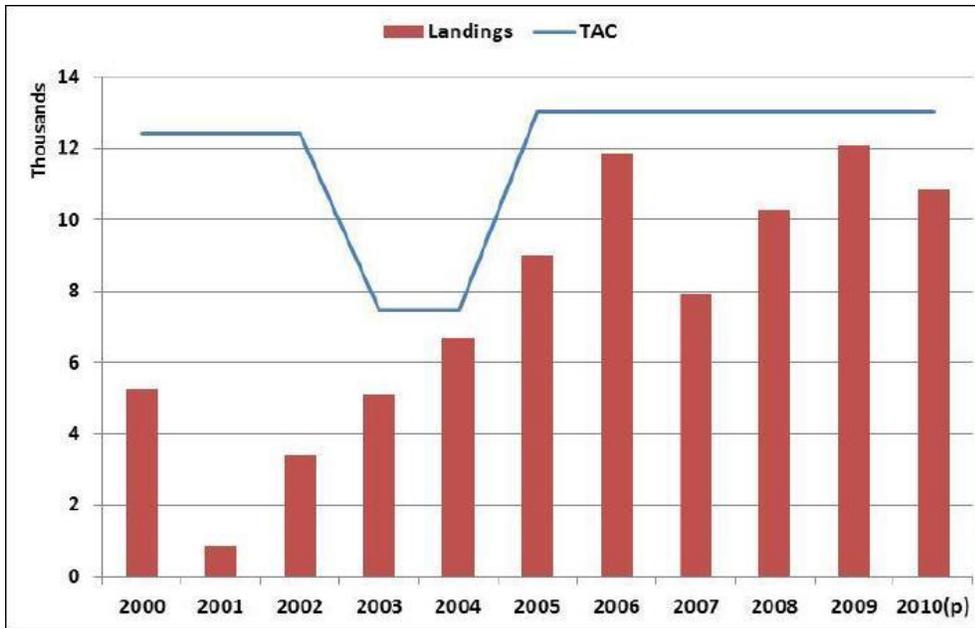


Figure 4. NAFO area 4RST capelin TAC and landings (000s MT) for the 2000-2010 period (DFO 2011a).

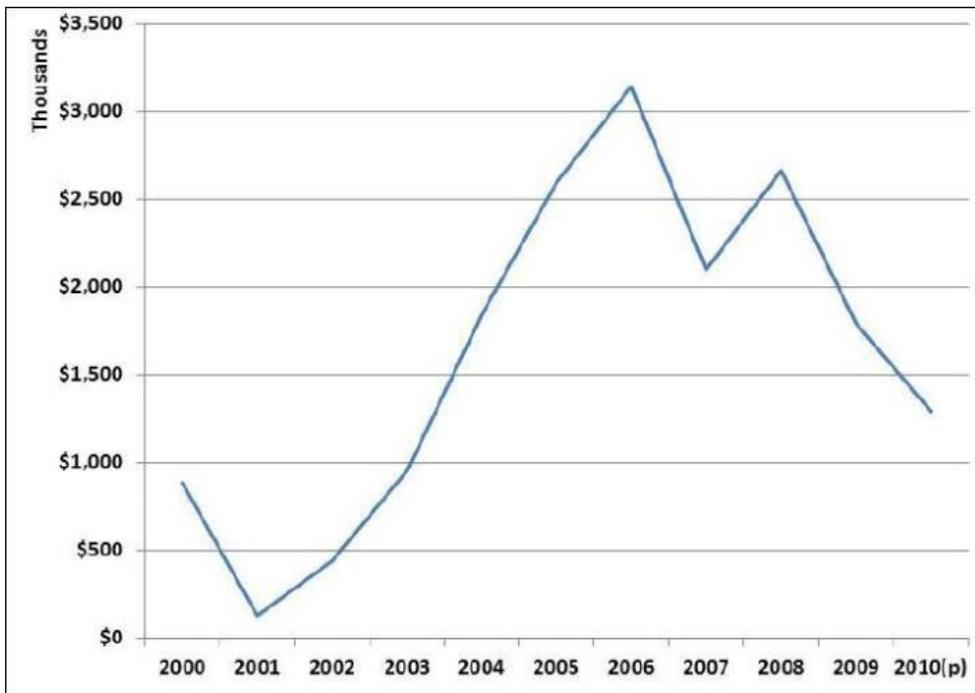


Figure 5. Landed value of the capelin fishery in NAFO area 4RST during the period from 2000-2010 (DFO 2011a).

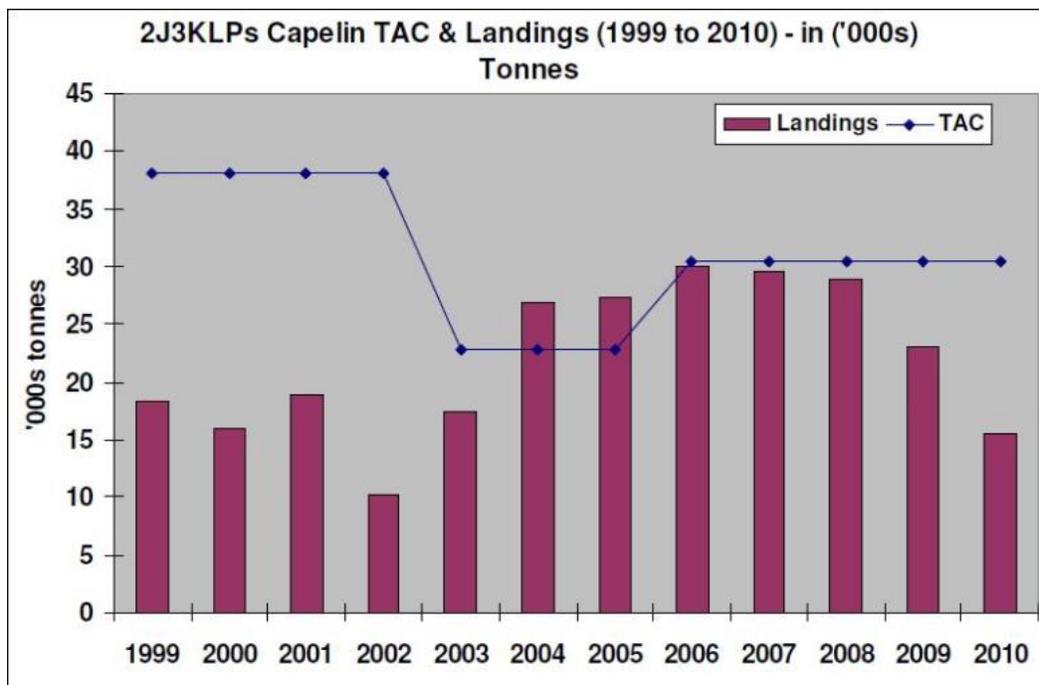
Table 1 shows the most recent 2013 landings data, divided by fleet sector (where fixed gear represents the trapnet sector and the mobile fleet encompasses both purse and tuck seine sectors), for the 4RST fishery. The total landings in this area for the period were 6,492 MT. The table also includes the TAC

(allocated by fleet sector), which has been set on a 2 year management cycle; meaning that the TAC is set by DFO's Fisheries and Aquaculture Management (FAM) Division (which is informed by scientific assessments and advice from industry) for 2 subsequent years. The TAC for the 2013 season was set at 14,300 MT (which was a 10% increase from the 2011–2012 management period) and remained the same for the 2014 season (DFO 2014a).

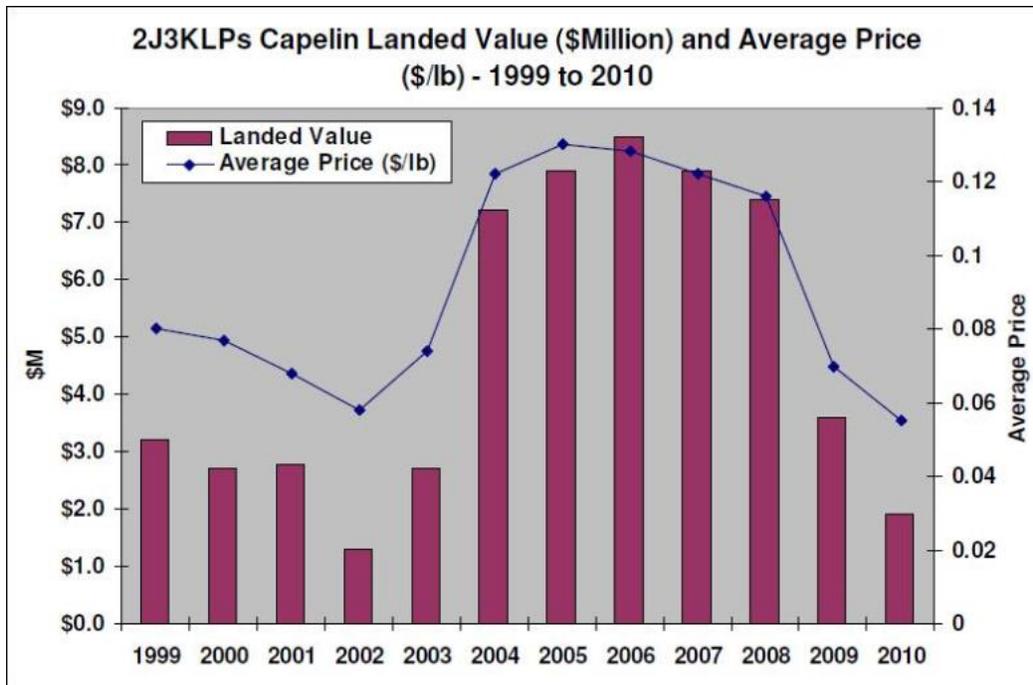
Area	Gear	Quota (t)	Landings (t)
4R	Fixed	5,408	1,861
4R	Mobile	6,907	4,394
4R	Total	12,315	6,255
4ST	Total (Fixed & Mobile)	1,985	237
4RST	Total	14,300	6,492

**Table 1.** 2013 4RST capelin fishery total allowable catch allocations and landings by gear sector (DFO 2014a).

Figure 6 shows the landings for the 2J3KLPs capelin fishery from 1999 to 2010. Again, the landings are cyclical and correspond to the market trends shown in Figure 7. The 2J3KLPs fishery experienced an 11 year low of 10,192 MT in 2002 and a high of 30,067 MT in 2006. For most years throughout the time series, the catch remains consistently below the TAC set. However, in 2004 and 2005 fishing seasons, the fishery experiences overages (DFO 2011b).



**Figure 6.** NAFO area 2J3KLPs capelin TAC and landings (000's MT) for the 1999-2010 period (DFO 2011b).



**Figure 7.** The landed value for the capelin fishery in NAFO area 2J3KLPs during the period between 1999-2010 (DFO 2011b),

Table 2 shows the most recent 2013 landings data, divided by fleet sector, for the 2J3KLPs fishery. The total landed weight in this area for 2013 was 23,755 MT. The table also includes the TAC (allocated by fleet sector), which has been set on a similar 2 year management cycle as the 4RST fishery. The TAC for the 2013 season was set at 24,396 MT (which has remained the same since the 2011–2012 management period) and remained the same for the 2014 season (DFO 2011b; DFO 2014a).

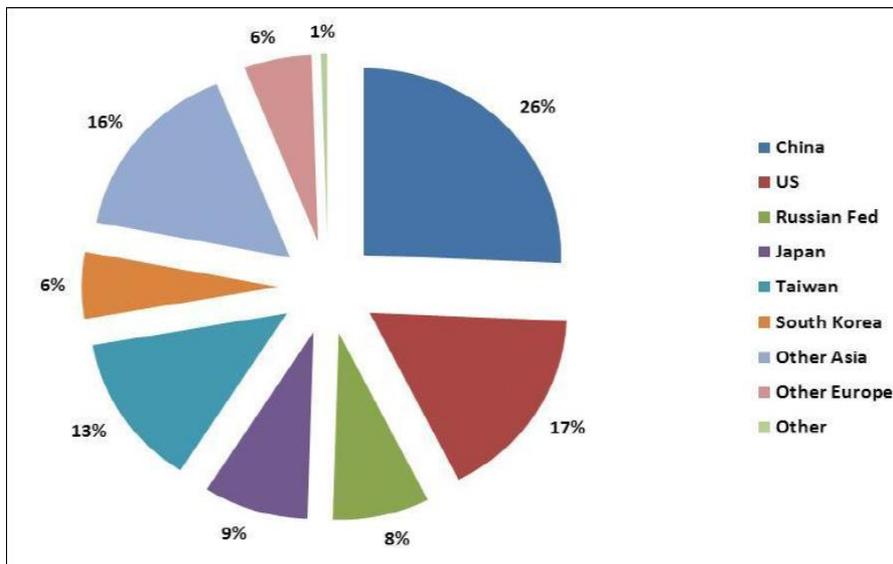
Area	Gear	Quota (t)	Landings (t)
2J	Fixed	96	0
2J	Mobile	0	0
2J	Total	96	0
3K	Fixed	6,656	8,005
3K	Mobile	1,920	4,419
3K	Total	8,576	12,424
3L	Fixed	8,637	7,656
3L	Mobile	5,462	3,675
3L	Total	14,099	11,331
3Ps	Fixed	1,440	0
3Ps	Mobile	185	0
3Ps	Total	1,625	0
<b>2J3KLPs</b>	<b>Total</b>	<b>24,396</b>	<b>23,755</b>

**Table 2.** 2013 capelin fishery fleet allocation and landings (by gear sector) in 2J3KLPs (DFO 2014b).

### Importance to the US/North American market

Export production statistics are provided by Statistics Canada (Stats Can) to DFO. The most recent report is from 2009. A request for 2014 export data was submitted to Stats Can, but such data was unable to be released at this time. The 2011 IFMP for 4RST states that total exports of capelin in all areas totaled approximately 23,400 MT; when compared against the total landings during the period (33,326 MT) exports equated to 70.2% of the total landings. It is assumed that the other 29.8% (9,926 MT) was sold (whole or frozen) domestically as either bait or fishmeal (e.g., animal feed or fertilizer). In 2009, the export value was \$26.6 million (DFO 2011a; DFO 2014b).

Figure 8 outlines the specific breakdown of the 2009 exports by country of destination. China, at 26%, is the largest purchaser of Canadian caught capelin. The United States (17%), Taiwan (13%), Japan (9%), the Russian Federation (8%), and South Korea (6%) comprise the rest of the top 6 importing countries of Canadian caught capelin. The “other Asia” category includes Thailand, Hong Kong, and Vietnam, while “other Europe” includes Denmark, Georgia, Lithuania, and Ukraine. The “other” category includes Mexico, Syria, Haiti, and the United Arab Emirates (DFO 2011a).



**Figure 8.** The total Canadian capelin exports for 2009: NAFO area 4RST and 2J3KLPs (DFO 2011a).

Catches in Iceland and Norway (countries that also export capelin) may influence Canadian capelin exports from year to year because their landings (which are much higher than Canada's) typically peak before the Canadian fishery in January to March (DFO 2011a).

### Common and market names

Common names: Capelin, caplin, capeling, roller, whitefish.

Market names: Capelin, tea fish, breakfast fish (FishBase 2014a).

**Primary product forms**

Canada primarily exports mature egg-bearing females to supply the Asian roe market. The capelin eggs are later transformed into “masago” and used in the sushi industry. The secondary products (male and female carcasses) are exported for use as fishmeal (i.e., fertilizer or animal feed) or whole (primarily males) for use as animal feeds, namely for zoos and aquariums in the United States and Canada. All Canadian products are exported whole and frozen. The domestic catch is sold whole and frozen for bait or fishmeal (DFO, personal communication, March 7, 2014; DFO 2011a; DFO 2011b).

## Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at <http://www.seafoodwatch.org>.

### Criterion 1: Stock for which you want a recommendation

*This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:*

- Score >3.2=Green or Low Concern
  - Score >2.2 and <=3.2=Yellow or Moderate Concern
  - Score <=2.2=Red or High Concern
- Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

#### Criterion 1 Summary

CAPELIN: GULF OF ST. LAWRENCE (4RST)				
Region / Method	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Canada Gulf of St. Lawrence Purse Seine	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
Canada Gulf of St. Lawrence Seine Net, Boat	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
Canada Gulf of St. Lawrence Trapnet	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>

CAPELIN: NAFO 2J3KLPS				
Region / Method	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
Canada North Atlantic Purse Seine	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
Canada North Atlantic Seine Net, Boat	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>
Canada North Atlantic Trapnet	3.00:Low	3.00:Moderate Concern	2.33:Moderate Concern	<b>Yellow (2.644)</b>

There are 5 biologically distinct stock complexes residing in NAFO subdivisions 2J3KL, 3Ps, 4RST, 4W, and 3NO. Both the 2J3KL and 3Ps stocks are managed and assessed by one regional office in St. John's, NL;

this explains the rationale for combining the stocks in this assessment. The 4RST stock complex is managed separately from the 2J3KLPs stocks and was consequently assessed separately in this report as well.

## Criterion 1 Assessment

### CAPELIN: GULF OF ST. LAWRENCE (4RST)

#### Factor 1.1 - Inherent Vulnerability

##### *Scoring Guidelines*

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing).*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make it particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*  
*Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

#### **Low**

Capelin has low inherent vulnerability, based on a FishBase score of 23 out of 100 (Cheung et al. 2005; FishBase 2014a).

#### **Rationale:**

Using the SFW Productivity and Susceptibility Analysis (PSA) capelin receive a score of 2.79 (low inherent vulnerability) because they are short-lived ( $T_{\max} = 5$  years; nearly 100% post-spawning mortality for males), mature relatively quickly (2-3 years of age), have a relatively high fecundity in comparison to

their size (6,000-12,000 egg per female; adults are between 12-23cm;  $L_m = 13.5\text{cm}$ ), are broadcast spawners, and are a lower tropic level forage species. Please refer to the SFW criteria scoring manual for more information on how the PSA was conducted (Seafood Watch 2013; DFO 2013a; DFO 2013b; FishBase 2014a).

## Factor 1.2 - Abundance

### Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield,  $B_{MSY}$ ) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished.*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

### Canada Gulf of St. Lawrence, Purse Seine

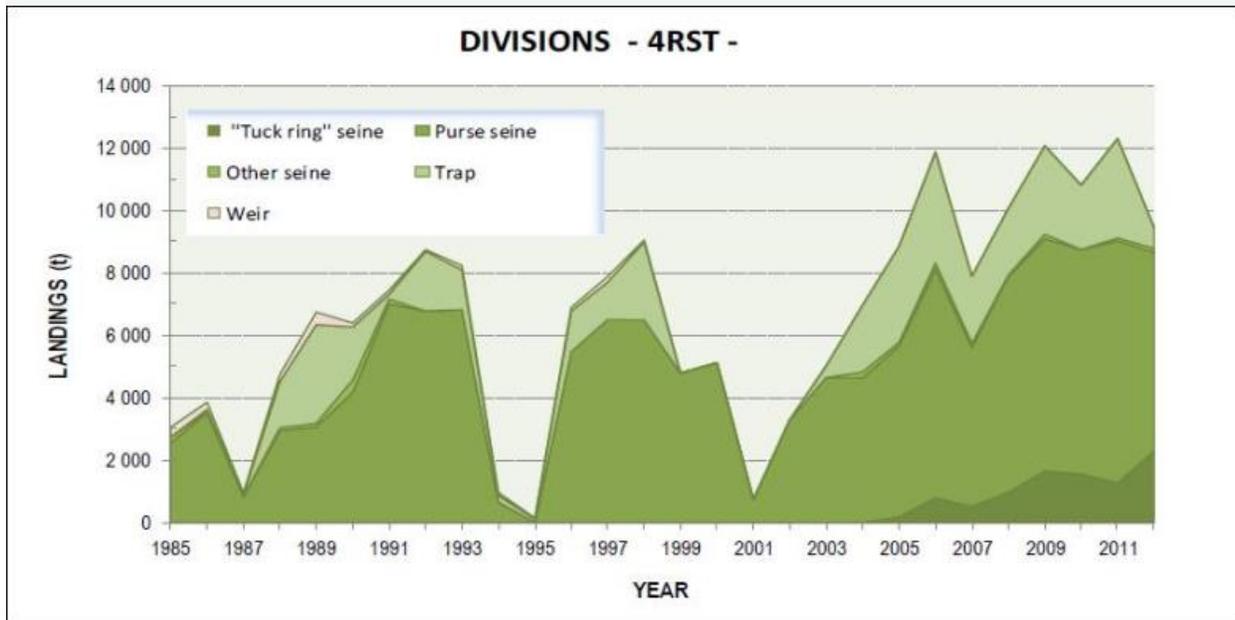
### Canada Gulf of St. Lawrence, Seine Net, Boat

### Canada Gulf of St. Lawrence, Trapnet

#### Moderate Concern

The most recent 4RST capelin species assessment (2013) collected fisheries-dependent data [landings by area, gear type and year (Figure 9), and mean lengths of males and females by year] and fisheries-independent data (multi-species trawl survey). However, since there is no directed abundance survey for capelin in this area, DFO is unable to calculate: biomass (B) or spawning stock biomass (SSB) indices, target reference points (e.g., biomass that is required for the maximum sustainable yield;  $B_{MSY}$ ). Consequently, DFO is unable to set a Total Allowable Catch (TAC) based on such indices. Capelin abundance in the area is also heavily influenced by environmental factors such as ocean temperatures, prey availability, the abundance of predators, and the abundance of other forage species (in particular northern shrimp). These stocks have not been classified as overfished, based on landings in relation to TAC, for a long-term duration of greater than 5 years (Figure 4; DFO 2011a; DFO 2013a).

Capelin abundance in NAFO area 4RST is assessed as moderate concern because inherent vulnerability is low and there is no evidence to suggest that the stock is above or below a sustainable biomass (because there are no biomass estimates or reference points; Seafood Watch 2013).

**Rationale:**

**Figure 9.** NAFO area 4RST capelin landings, specified by gear type, for the 1985–2012 period (DFO 2013a).

**Factor 1.3 - Fishing Mortality***Scoring Guidelines*

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable ( $>50\%$ ) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*

- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

#### Canada Gulf of St. Lawrence, Purse Seine

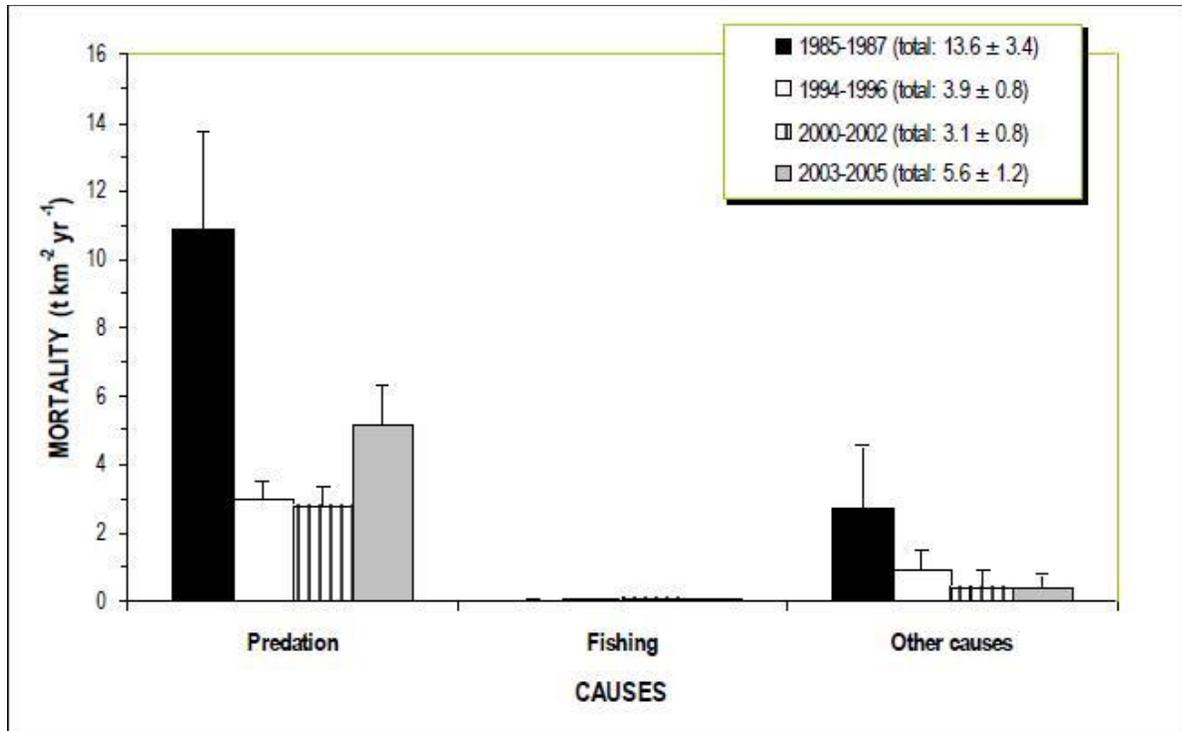
#### Canada Gulf of St. Lawrence, Seine Net, Boat

#### Canada Gulf of St. Lawrence, Trapnet

#### **Moderate Concern**

Capelin landings in 4RST have consistently remained below the TAC from 2000-2010 (Figure 4; DFO 2011a). The time series depicts that the fishery experiences prevalent fluctuations over the long term. The fluctuations in landings have been attributed to variability in global markets. The TAC, which has been held steady at 13,000 MT from 2005–2010 (Figure 4) and recently increased 10% to 14,300 MT during the 2013-2014 management cycle (Table 1), is set using a management mechanism which will be described in criterion 3. The 2013 landings (6,492 MT) by area and fleet sector (Table 1) are 45% less than the TAC for the period. In the 2013 capelin assessment, DFO stated that environmental factors may have contributed to early spawning forcing the capelin stock in 4RST into deeper depths offshore – away from conventional fishing gears (DFO 2011a; DFO 2013a; DFO 2014a). Capelin is also regularly caught as bycatch in the shrimp fishery in 4RST. Between 2000 and 2012, this fishery caught a range of 77 MT–322 MT of capelin. These catches represent only 1.23%-5.15% of the total 2013 landings; a minimal impact. All capelin caught in this fishery were discarded (DFO 2013a). Predation is the largest source of mortality to capelin stocks. Figure 10 details all sources of capelin mortality for area 4RS between 1985 and 2005. The fishery represents an almost negligible amount of mortality when compared to the other sources (DFO 2011a). Since capelin biomass in 4RST is unknown, it is impossible to know what fishing mortality rate will result in a maximum sustainable yield (i.e.,  $F_{MSY}$ ). However, there is a moderately effective management strategy in place: this is defined by the results of criterion 3 in this report (DFO 2011a; DFO 2013a; Seafood Watch 2013). Also, there is no evidence to support that the stock is depleted; the fishery has been persecuted without major signs of collapse for a 10 year period (DFO 2011a; DFO 2013a; DFO 2014a). Based on this information, the moderate concern score is appropriate.

#### **Rationale:**



**Figure 10.** Main causes of mortality ( $t\ km^{-2}\ yr^{-1}$ ) for the northern Gulf of St. Lawrence capelin (NAFO Divisions 4RS) from the mid-1980s to the mid-2000s (DFO 2011a).

## **CAPELIN: NAFO 2J3KLPS**

### **Factor 1.1 - Inherent Vulnerability**

#### *Scoring Guidelines*

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing).*
  - *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
  - *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make it particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*
- Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling,*

*aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.*

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### **Low**

Capelin has low inherent vulnerability, based on a FishBase score of 23 out of 100 (Cheung et al 2005; FishBase 2014a).

### **Rationale:**

Using the SFW Productivity and Susceptibility Analysis (PSA) capelin receive a score of 2.79 (low inherent vulnerability) because they are short-lived ( $T_{max} = 5$  years; nearly 100% post-spawning mortality for males), mature relatively quickly (2-3 years of age), have a relatively high fecundity in comparison to their size (6,000-12,000 egg per female; adults are between 12-23cm;  $L_m = 13.5$ cm), are broadcast spawners, and are a lower trophic level forage species. Please refer to the SFW criteria scoring manual for more information on how the PSA was conducted (Seafood Watch 2013; DFO 2013a; DFO 2013b; FishBase 2014a).

## **Factor 1.2 - Abundance**

### *Scoring Guidelines*

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished.*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### Moderate Concern

The most recent 2J3KL capelin species assessment (2013) collected fisheries-dependent data (landings by year, and mean lengths of males and females by year) and fisheries-independent data (multi-species trawl survey, localized acoustic monitoring of larval and spring spawning stock abundances, and monitoring area ocean temperature trends; DFO 2013b). This 2013 assessment found (for 2+3KL) that the capelin in this region continue to be small, continue to mature at a young age, are in poor condition, are late spawning and remain close to the bottom (DFO 2013b).

There is no directed abundance survey for capelin in this area, so DFO is unable to calculate: biomass (B) or spawning stock biomass (SSB) indices, target reference points (e.g., biomass that is required for the maximum sustainable yield;  $B_{MSY}$ ). Consequently, DFO is unable set a Total Allowable Catch (TAC) based on such indices. A bottom-up population regulation mechanism (where environmental conditions affect algal blooms which, in turn, affect zooplankton and capelin populations) has been independently observed in the management area and will aid in the ecosystem-based fisheries management of capelin in 2J3KL (Buren et al 2014). These stocks have also not been classified as overfished, based on landings in relation to TAC, for a long-term duration of greater than 5 years (Figure 6; DFO 2011b).

Capelin abundance in NAFO area 2J3KL is assessed as moderate concern (based on the Seafood Watch scoring guidelines provided) because inherent vulnerability is low and there is no evidence to suggest that the stock is above or below a sustainable biomass (as there are no biomass estimates or reference points; Seafood Watch 2013).

### Factor 1.3 - Fishing Mortality

#### Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible ( $\leq 5\%$  of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*

- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

#### Canada North Atlantic, Purse Seine

#### Canada North Atlantic, Seine Net, Boat

#### Canada North Atlantic, Trapnet

##### **Moderate Concern**

Capelin landings in 2J3KLPs have consistently remained below the TAC in all but 2 years from 1999–2010 (Figure 6). The time series depicts that the fishery experiences prevalent fluctuations over the long term. The fluctuations in landings have been attributed to variability in global markets. The TAC, which has been held steady at 30,000 MT from 2006-2010 (Figure 6) and recently decreased to 24,396 MT during the 2013-2014 management cycle (Table 2), is set using the management mechanism mentioned in criterion 3. The 2013-2014 landings (23,755 MT) by area and fleet sector are also shown in Table 2 and are below the TAC for the period (DFO 2011b; DFO 2013b; DFO 2014a). There is no catch per unit effort (CPUE) data available in the DFO assessments or primary literature. The 2013 Canadian Science Advisory Secretariat (CSAS) stock assessment has not been used for this subcriterion as it does not include NAFO area 3Ps. While there is also no data regarding other sources of mortality to this particular stock in DFO reports, it is assumed that due to capelin's role as a forage species, predation is a large source of mortality to this stock.

Since capelin biomass in 2J3KLPs is unknown, it is impossible to know what fishing mortality rate will result in a maximum sustainable yield (i.e.,  $F_{MSY}$ ). However, there is a moderately effective management strategy in place: this is defined by the results of criterion 3 in this report (DFO 2013a; Seafood Watch 2013). Also, there is no evidence to support that the stock is depleted; the fishery has been persecuted without major signs of collapse for an 8 year period (DFO 2011b; DFO 2013b; DFO 2014a). Based on this information, the moderate concern score is appropriate.

## **Criterion 2: Impacts on other species**

All main retained and bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch. The Criterion 2 rating is determined as follows:

- Score >3.2=Green or Low Concern
  - Score >2.2 and <=3.2=Yellow or Moderate Concern
  - Score <=2.2=Red or High Concern
- Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical.

### **Criterion 2 Summary**

#### **Capelin: Gulf of St. Lawrence (4RST): Canada Gulf of St. Lawrence, Purse Seine**

**Subscore: 2.236      Discard Rate: 1.00      C2 Rate: 2.236**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
ATLANTIC COD	High	1.00: Very High Concern	5.00: Very Low Concern	<b>2.236</b>
ATLANTIC SALMON	High	1.00: Very High Concern	5.00: Very Low Concern	<b>2.236</b>
CAPELIN: GULF OF ST. LAWRENCE (4RST)	Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
ATLANTIC HERRING	Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

#### **Capelin: Gulf of St. Lawrence (4RST): Canada Gulf of St. Lawrence, Seine Net, Boat**

**Subscore: 1.916      Discard Rate: 1.00      C2 Rate: 1.916**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
ATLANTIC COD	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
ATLANTIC SALMON	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
MAMMALS	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>

		High Concern	Concern	
<b>CAPELIN: GULF OF ST. LAWRENCE (4RST)</b>	Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>ATLANTIC HERRING</b>	Medium	3.00: Moderate Concern	3.67: Low Concern	<b>3.318</b>

**Capelin: Gulf of St. Lawrence (4RST): Canada Gulf of St. Lawrence, Trapnet**

**Subscore: 1.526      Discard Rate: 1.00      C2 Rate: 1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
<b>ATLANTIC COD</b>	High	1.00: Very High Concern	2.33: Moderate Concern	<b>1.526</b>
<b>ATLANTIC SALMON</b>	High	1.00: Very High Concern	2.33: Moderate Concern	<b>1.526</b>
<b>MAMMALS</b>	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
<b>ATLANTIC HERRING</b>	Medium	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>CAPELIN: GULF OF ST. LAWRENCE (4RST)</b>	Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>

**Capelin: NAFO 2J3KLPs: Canada North Atlantic, Purse Seine**

**Subscore: 2.236      Discard Rate: 1.00      C2 Rate: 2.236**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
<b>ATLANTIC COD</b>	High	1.00: Very High Concern	5.00: Very Low Concern	<b>2.236</b>
<b>CAPELIN: NAFO 2J3KLPS</b>	Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
<b>ATLANTIC HERRING</b>	Medium	2.00: High Concern	5.00: Very Low Concern	<b>3.162</b>

**Capelin: NAFO 2J3KLPs: Canada North Atlantic, Seine Net, Boat****Subscore: 1.916      Discard Rate: 1.00      C2 Rate: 1.916**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
ATLANTIC COD	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
MAMMALS	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
CAPELIN: NAFO 2J3KLPs	Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>
ATLANTIC HERRING	Medium	2.00: High Concern	3.67: Low Concern	<b>2.709</b>
ATLANTIC SALMON	High	2.00: High Concern	3.67: Low Concern	<b>2.709</b>

**Capelin: NAFO 2J3KLPs: Canada North Atlantic, Trapnet****Subscore: 1.526      Discard Rate: 1.00      C2 Rate: 1.526**

Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
ATLANTIC COD	High	1.00: Very High Concern	2.33: Moderate Concern	<b>1.526</b>
MAMMALS	High	1.00: Very High Concern	3.67: Low Concern	<b>1.916</b>
ATLANTIC HERRING	Medium	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
ATLANTIC SALMON	High	2.00: High Concern	2.33: Moderate Concern	<b>2.159</b>
CAPELIN: NAFO 2J3KLPs	Low	3.00: Moderate Concern	2.33: Moderate Concern	<b>2.644</b>

The selected species—Atlantic herring, Atlantic cod, Atlantic salmon and marine mammals (non-specified)—have been identified (by members of DFO management and science branches) as the main bycatch species caught by all gear types in both Canadian capelin fisheries in 4RST and 2J3KLPs. Other bycatch species (winter flounder, non-specified redfish and American plaice) have not been included in the assessment because they represent less than 0.01% of the total catches in both fisheries (DFO 2014c). Based on their life histories and being listed as endangered species or species of special concern Atlantic cod, Atlantic salmon and marine mammals have all been ranked as having a high vulnerability to fishing. Atlantic herring have been assessed as having a medium vulnerability to fishing because they possess positive life histories traits (e.g., high fecundity) but have been susceptible to population

declines in the past. A report released by DFO shows that the purse seine fisheries in both 4RST and 2J3KLPs have minimal impacts on all bycatch species and thus receive a 'very low concern' score. However, since there have been no catch composition reports released for the “tuck” seine (i.e., seine net, boat) and trapnet fisheries they receive a 'moderate concern' score because there exists moderately effective management strategies for all fisheries in both areas. Atlantic salmon and marine mammals have not been evaluated in the 2J3KLPs purse seine fishery since the catch composition report of 2011 does not list these species as being caught in this fishery. Similarly, marine mammals have been removed from the assessment of the 4RST purse seine fishery since the 2011 report does not list these species as being caught in this fishery (DFO 2014c).

## **Criterion 2 Assessment**

### **ATLANTIC COD**

#### **Factor 2.1 - Inherent Vulnerability**

*Scoring Guidelines (same as Factor 1.1 above)*

**Canada Gulf of St. Lawrence, Purse Seine**

**Canada Gulf of St. Lawrence, Seine Net, Boat**

**Canada Gulf of St. Lawrence, Trapnet**

**Canada North Atlantic, Purse Seine**

**Canada North Atlantic, Seine Net, Boat**

**Canada North Atlantic, Trapnet**

#### **High**

Atlantic cod has high inherent vulnerability, based on a FishBase score of 67 out of 100 (Cheung et al 2005; FishBase 2014b).

#### **Rationale:**

Using the SFW Productivity and Susceptibility Analysis (PSA) Atlantic cod receives a vulnerability score of 2.17 (moderate) based on the following parameters: age at maturity (4-6 years), max age (25 years; long lived), fecundity (400,000-600,000+ eggs; highly fecund), max size (200cm), length at maturity (LM = 45-55cm), reproductive strategy (broadcast spawner), and trophic level (4.4; FishBase 2014a). Please refer to the SFW criteria scoring manual for more information on how the PSA was conducted (Seafood Watch 2013). For the purpose of this report, SFW is using the FishBase score for Atlantic cod, which corresponds to high inherent vulnerability.

## Factor 2.2 - Abundance

*Scoring Guidelines (same as Factor 1.2 above)*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

### Very High Concern

The Committee on the Status of Endangered Wildlife in Canada has listed the Laurentian Atlantic cod stock in 4RST as endangered (Committee on the Status of Endangered Wildlife in Canada 2014).

#### Rationale:

The limit reference point (LRP or  $B_{lim}$ ) for Atlantic cod in the assessment areas (NAFO 3Pn and 4RS) has been estimated to be 116,000 MT (2011). However, according to the most recent stock assessment that estimates biomass, the estimated spawning stock biomass (SSB) has been below the LRP since 1990 and was estimated to be 16,000 MT in 2010 (DFO 2011c).

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### Very High Concern

The Committee on the Status of Endangered Wildlife in Canada has listed the Northern Atlantic cod stocks in 2J3KLPs as endangered (Committee on the Status of Endangered Wildlife in Canada 2014).

#### Rationale:

There are two Atlantic cod stocks in the North Atlantic management area 2J3KLPs: Northern cod (2J3KL) and Southern Newfoundland cod (3Ps). This subcriterion will provide information for both stocks. In the 2014 Northern cod (2J3KL) stock assessment, DFO reported (Figure 11) that the spawning stock biomass (SSB) for this stock was 85% below the limit reference point (LRP or  $B_{lim}$ ); 45,000 MT in relation to 300,000 MT (respectively) - which is of high concern (DFO 2010a; DFO 2014d).

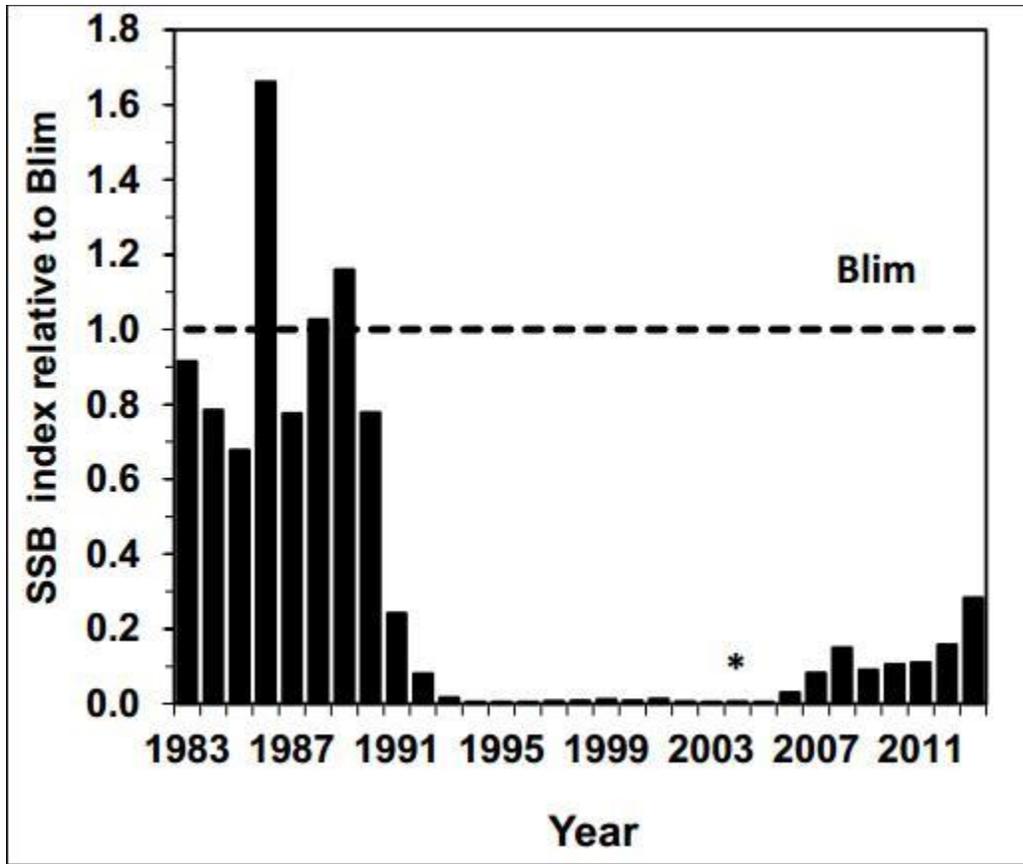
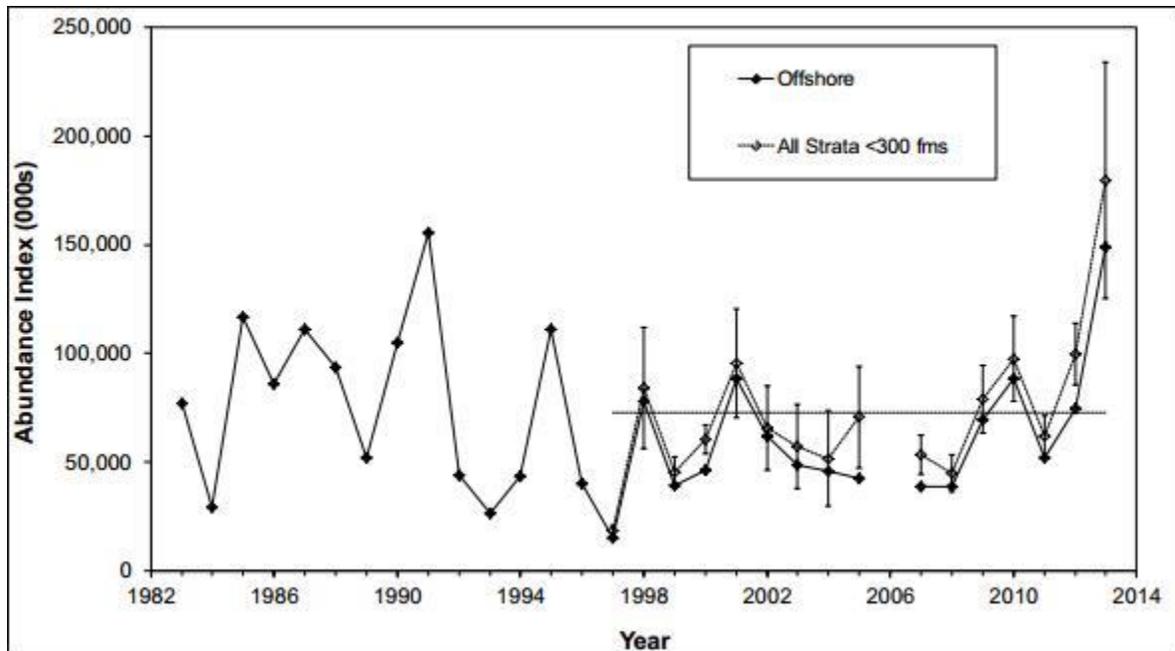


Figure 11. 2013 Atlantic cod spawning stock biomass (SSB) index from the autumn RV surveys in 2J3KL (DFO 2014d).

In the 2014 Southern Newfoundland (3Ps) stock assessment, DFO reported that the SSB for this stock was approximately double the LRP; which is of low concern since it is uncertain if the biomass is above or below a target reference point of  $B_{MSY}$ . Quantitative values were not provided in the assessment; however, Figure 12 was provided and is attached (DFO 2014e).



**Figure 12.** 2013 Fisheries-independent survey: abundance indices for NAFO subdivision 3Ps Atlantic Cod (DFO 2014e).

Both stocks are experiencing completely different abundance patterns; the 2J3KL stock's recruitment is impaired while the 3Ps stock appears to be rebuilding. However, as of 2014, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) maintains a listing of endangered for both stocks. This assessment will err on the side of caution and accept the COSEWIC listing which will score this subcriterion as a very high concern.

### Factor 2.3 - Fishing Mortality

*Scoring Guidelines (same as Factor 1.3 above)*

#### Canada Gulf of St. Lawrence, Purse Seine

##### Very Low Concern

DFO released, in a requested catch composition report (2011), that Atlantic Cod bycatch caught in the 4R purse seine fishery constitutes 0.45% of the total extrapolated catch (11,262 MT; DFO 2014c). These bycatch landings only contribute 4.4% to the overall fishing mortality of cod in 4RST (51 MT/1152 MT); a negligible effect on cod fishing mortality (DFO 2014c; DFO 2014f).

##### Rationale:

Appendix A shows the extrapolation of the DFO catch composition report. Cod bycatch in 4ST was not sampled as the directed capelin fishery in the area only represents 1.25% of the total extrapolated catch

of the entire 4RST fishery for 2011.

#### Canada Gulf of St. Lawrence, Seine Net, Boat

##### **Low Concern**

As of 2014, there are no bycatch estimates for the capelin tuck seine fishery in 4RST. However, it can be estimated that tuck seines will have similar bycatch compositions and ratios as purse seines since their methods of capture are almost identical (one purses the lead line while the other does not). Therefore, it is probable that the fishing mortality of cod caught as bycatch in the 4RST capelin tuck seine fishery will have a negligible effect on the total fishing mortality for cod in 4RST (less than 5% of 1152 MT; DFO 2014f). As a result, the score of low concern is appropriate.

#### Canada Gulf of St. Lawrence, Trapnet

##### **Moderate Concern**

To date, there are no public bycatch records available for the trapnet fisheries in 4RST. Therefore, the fisheries mortality (F) for all bycatch species is unknown at this time. However, moderately effective management is in place for all fisheries so a moderate score is appropriate.

#### Canada North Atlantic, Purse Seine

##### **Very Low Concern**

DFO released, in a requested catch composition report (2011), that Atlantic cod caught in the 2J3KLPs purse seine fishery constitutes less than 0.1% of the total extrapolated catch (DFO 2014c).

##### **Rationale:**

The following table (Table 3) shows the extrapolation of the DFO catch composition report. 2J and 3Ps were not sampled because there were no purse seine catches in these subareas.

#### Canada North Atlantic, Seine Net, Boat

##### **Low Concern**

As of 2014, there are no bycatch estimates for the capelin tuck seine fishery in 2J3KLPs. However, it can be estimated that tuck seines will have similar bycatch ratios as purse seines since their methods of capture are almost identical (one purses the lead line while the other does not). Therefore, it is probable

that the fishing mortality of cod caught as bycatch in the 2J3KLPs capelin tuck seine fishery will have a negligible effect on the total fishing mortality for cod in 2J3KLPs (less than 5% of 7851 MT; DFO 2014f). As a result, the score of low concern is appropriate.

#### Canada North Atlantic, Trapnet

##### **Moderate Concern**

To date, there are no public bycatch records available for the trapnet fisheries in 2J3KLPs. Therefore, the fisheries mortality (F) for all bycatch species is unknown at this time. However, moderately effective management is in place for all fisheries so a moderate score is appropriate.

#### **Factor 2.4 - Discard Rate**

#### Canada Gulf of St. Lawrence, Purse Seine

##### **< 20%**

In the catch composition report (2011) and extrapolation table (Table 3), all bycatch species caught in NAFO subarea 4R represent 10.86% of the total extrapolated catch of the capelin purse seine fishery. Using the 2011 catch data from DFO, it has been extrapolated that 1173 MT (rounded) of Atlantic herring was kept. All other bycatch species were discarded. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Fortunately, it was extrapolated that a low quantity (4 MT) of capelin was discarded; this only represents 0.04% of the total extrapolated catch composition for 2011. Since no data exists regarding post-release survivorship, a 100% mortality rate is assumed for all discarded species. The landings in 4ST are not shown in the table because they only represent 1.25% of the total extrapolated catch (141 MT/11,262 MT) within the 4RST management area for 2011 (DFO 2011a; DFO 2014a; DFO 2014c).

#### Canada Gulf of St. Lawrence, Seine Net, Boat

##### **< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 4RST. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 10.86% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.04% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard

ban for the directed capelin fishery (DFO 2011a; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, have increased the utilization of male capelin.(DFO 2013b).

#### Canada Gulf of St. Lawrence, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 4RST. High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a).

#### Canada North Atlantic, Purse Seine

**< 20%**

In the catch composition report (2011) and extrapolation table (Table 3), all bycatch species caught in NAFO subareas 3KL represent 0.15% of the total extrapolated catch of the capelin purse seine fishery (30.5 MT/20,205 MT). All bycatch species were discarded. The regulation measures in the 2011 2J3KLP IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Fortunately, it was extrapolated that a relatively low quantity (69 MT) of capelin was discarded; this only represents 0.34% of the total extrapolated catch composition for 2011. Since no data exists regarding post-release survivorship a 100% mortality rate is assumed for all discarded species. The landings of 3Ps have not been included because they only

represent 0.14% of the total extrapolated catch (29 MT/20,205 MT) within the 2J3KLPs management area. In 2011, there were no landings for this fishery in 2J (DFO 2011b; DFO 2014a; DFO 2014c).

#### Canada North Atlantic, Seine Net, Boat

**< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 2J3KLPs. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 0.15% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.34% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

#### Canada North Atlantic, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 2J3KLPs. High discard rates were characteristic of the capelin fishery in the past, the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries. (Alverson et al. 1996). In recent years, several management Canadian wide measures and access to other markets have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fisheries (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring full utilization of capelin has been in effect since 2006. This requirement along with new markets for male capelin have increased the utilization of male capelin.(DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b).

## **ATLANTIC HERRING**

### **Factor 2.1 - Inherent Vulnerability**

*Scoring Guidelines (same as Factor 1.1 above)*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

#### **Medium**

Atlantic herring has medium inherent vulnerability, based on a Fishbase score of 39 out of 100 (Cheung et al. 2005; FishBase 2014c).

#### **Rationale:**

Using the SFW Productivity and Susceptibility Analysis (PSA) Atlantic herring receives a vulnerability score of 2.5 (low) based on the following parameters: age at maturity (4 years), max age (25 years; long lived), fecundity (<360,000 eggs; highly fecund), max size (45cm), length at maturity (LM = 23.5cm), reproductive strategy (demersal egg layer), and trophic level (3.2). Please refer to the SFW criteria scoring manual for more information on how the PSA was conducted (Seafood Watch 2013). Both the SFW and FishBase analyses list Atlantic herring in Canada as either on the cusp of the low inherent vulnerability scale or on the cusp medium inherent vulnerability scale. For the purpose of being precautionary, this assessment will rank Atlantic herring in Canada as having a medium inherent vulnerability to fishing (FishBase 2014c).

### **Factor 2.2 - Abundance**

*Scoring Guidelines (same as Factor 1.2 above)*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

### Moderate Concern

There are three Atlantic herring stocks in the Gulf of St. Lawrence: Northern Gulf (4S), Southern Gulf (4T) and Western Newfoundland (4R). This subcriterion will evaluate all three stocks and average the totals. For the Northern Gulf (4S), a 2011 herring assessment stated that there is no abundance survey for the total area; DFO is unable to distinguish if the stock is above or below reference points (DFO 2011d). However, the species has an inherent vulnerability of medium and consequently receives a score of moderate concern (3). In 2013, DFO completed an assessment for the Atlantic herring stock in the Southern Gulf of St. Lawrence (4T). For the spring spawner component, the assessment describes that the age 4+ spawning stock biomass (SSB2013; 22,280 MT) is just above the limit reference point (LRP or  $B_{lim}$ ; 22,000 MT) but below the targeted upper stock reference point (BUSR; 54,000 MT). For the fall spawner component, the assessment describes that the age 4+ spawning stock biomass (SSB2013; 98,000 MT - 182,800 MT), which was calculated using two models, is above the limit reference point (LRP or  $B_{lim}$ ; 51,000 MT) but it is uncertain whether the fall spawner SSB is above the targeted upper stock reference point (BUSR; 172,000 MT; DFO 2014g). Because of this information, both the spring and fall spawner components of the herring stock in 4T receive a score of low concern (4) for this subcriterion. For the Western Newfoundland Stock (4R), DFO stated (in their 2012 assessment) that the spring-spawning biomass increased from 5,801 MT to 14,624 MT between 2009 and 2011; however, this biomass is below the 10 year historical average of 50,000 MT (1991-2002). The fall-spawning biomass fluctuated between 66,216 MT and 121,885 MT between 2009 and 2011; this biomass was above the 10 year historical average of 60,000 MT (1991-2002). The regulated commercial catch primarily consists of the fall-spawning herring, while the unmonitored gillnet bait fishery is believed to be comprised primarily of the spring-spawning (as this fishery coincides with the spring lobster fishery in the area). DFO has stated that they: expect declines of the dominant 2000 year class, have observed signs of weak stock recruitment. Because of this information, the herring stock in 4R receives a score of high concern (2; DFO 2012a). Based on the average score of 3, all Atlantic herring stocks in NAFO area 4RST receive a Abundance score of moderate concern.

### Canada North Atlantic, Purse Seine

### Canada North Atlantic, Seine Net, Boat

### Canada North Atlantic, Trapnet

### High Concern

Instead of using traditional abundance indices, stocks were assessed using a multi-method approach by combining data from: research and commercial gill net surveys, logbook landings data and qualitative harvester surveys. All stocks were assessed using three criteria: a comparison of the most recent (2011) stock abundances to historical abundance (1970s–1990), a comparison of the most recent abundances (2011) to slightly dated abundances (2000–2010), and short term (2006–2011) recruitment projections. Quantitative values were not shown. Instead, a stop light assessment approach (termed the

standardized performance index) was used to evaluate each criterion. All stocks were below historical abundance levels; this represents a red or poor condition. All but one stock (St. Mary's Bay-Placentia Bay) were below the slightly dated abundance levels; this represents a red or poor condition. The St. Mary's Bay-Placentia Bay current stock abundance is stable in comparison to the slightly dated abundance levels; this represents a yellow or moderate condition. All but one stock (Fortune Bay) received a moderate (yellow) score for their short term recruitment projections. Fortune Bay received a below average (red) score for its short term recruitment projections (DFO 2011e).

### Factor 2.3 - Fishing Mortality

*Scoring Guidelines (same as Factor 1.3 above)*

#### Canada Gulf of St. Lawrence, Purse Seine

##### Low Concern

DFO released, in a requested catch composition report (2011), that Atlantic herring caught in the NAFO subarea 4R capelin purse seine fishery comprises 10.41% (1,173 MT) of the total extrapolated catch (11,262 MT). However, this same amount of herring catch constitutes approximately 5.7% of the total herring landings (20,436 MT) in 4R in 2011. This is slightly above a negligible amount; consequently, the low concern score is appropriate (DFO 2011d; DFO 2012a; DFO 2014c; DFO 2014h).

##### Rationale:

Table 3 shows the extrapolation of the DFO catch composition report. Herring bycatch in 4ST was not sampled as the directed capelin fishery in the area only represents 1.25% of the total extrapolated catch of the entire 4RST fishery for 2011 (141 MT/11,262 MT; DFO 2014a; DFO 2014c).

#### Canada Gulf of St. Lawrence, Seine Net, Boat

##### Low Concern

As of 2014, there are no bycatch estimates for the capelin tuck seine fishery in 4RST. However, it can be estimated that tuck seines will have similar bycatch ratios as purse seines since their methods of capture are almost identical (one purses the lead line while the other does not). Therefore, it is probable that the fishing mortality of herring caught as bycatch in the 4RST capelin tuck seine fishery will have a slightly above negligible effect on the total fishing mortality for herring in 4RST (approximately 5.7% of 20,436 MT; DFO 2011d; DFO 2012a; DFO 2014h). As a result, the score of low concern is appropriate.

#### Canada Gulf of St. Lawrence, Trapnet

### **Moderate Concern**

To date, there are no public bycatch records available for the trapnet fisheries in 4RST. Therefore, the fisheries mortality (F) for all bycatch species is unknown at this time. However, moderately effective management is in place for all fisheries so a moderate score is appropriate.

### **Canada North Atlantic, Purse Seine**

#### **Very Low Concern**

DFO released, in a requested catch composition report (2011), that Atlantic herring caught in the NAFO 3KL capelin purse seine fishery represents 0.13% (27 MT) of the total extrapolated catch. This exploitation rate is negligible (0.73%) when compared to the overall herring fishing mortality (3,702 MT) for the area (DFO 2014c; DFO 2014i).

#### **Rationale:**

Table 3 shows the extrapolation of the DFO catch composition report for 2011. NAFO subareas 2J and 3Ps were not sampled as there was no purse seine catches in these areas (DFO 2014c).

### **Canada North Atlantic, Seine Net, Boat**

#### **Low Concern**

As of 2014, there are no bycatch estimates for the capelin tuck seine fishery in 2J3KLPs. However, it can be estimated that tuck seines will have similar bycatch ratios as purse seines since their methods of capture are almost identical (one purses the lead line while the other does not). Therefore, it is probable that the fishing mortality of herring caught as bycatch in the 2J3KLPs capelin tuck seine fishery will have a negligible effect on the total fishing mortality for herring in 2J3KLPs (less than 5% of 3,702 MT; DFO 2011e; DFO 2014h). As a result, the score of low concern is appropriate.

### **Canada North Atlantic, Trapnet**

#### **Moderate Concern**

To date, there are no public bycatch records available for the trapnet fisheries in 2J3KLPs. Therefore, the fisheries mortality (F) for all bycatch species is unknown at this time. However, moderately effective management is in place for all fisheries so a moderate score is appropriate.

## Factor 2.4 - Discard Rate

### Canada Gulf of St. Lawrence, Purse Seine

**< 20%**

In the catch composition report (2011) and extrapolation table (table 3), all bycatch species caught in NAFO subarea 4R represent 10.86% of the total extrapolated catch of the capelin purse seine fishery. Using the 2011 catch data from DFO, it has been extrapolated that 1173 MT (rounded) of Atlantic herring was kept. All other bycatch species were discarded. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Fortunately, it was extrapolated that a low quantity (4 MT) of capelin was discarded; this only represents 0.04% of the total extrapolated catch composition for 2011. Since no data exists regarding post-release survivorship, a 100% mortality rate is assumed for all discarded species. The landings in 4ST are not shown in the table as they only represent 1.25% of the total extrapolated catch (141 MT/11,262 MT) within the 4RST management area for 2011 (DFO 2011a; DFO 2014a; DFO 2014c).

### Canada Gulf of St. Lawrence, Seine Net, Boat

**< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 4RST. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 10.86% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.04% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

### Canada Gulf of St. Lawrence, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 4RST. High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) has significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin, has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a).

**Canada North Atlantic, Purse Seine****< 20%**

In the catch composition report (2011) and extrapolation table (table 3), all bycatch species caught in NAFO subareas 3KL represent 0.15% of the total extrapolated catch of the capelin purse seine fishery (30.5 MT/20,205 MT). All bycatch species were discarded. The regulation measures in the 2011 2J3KLP IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Fortunately, it was extrapolated that a relatively low quantity (69 MT) of capelin was discarded; this only represents 0.34% of the total extrapolated catch composition for 2011. Since no data exists regarding post-release survivorship a 100% mortality rate is assumed for all discarded species. The landings of 3Ps have not been included as the only represent 0.14% of the total extrapolated catch (29 MT/20,205 MT) within the 2J3KLPs management area. In 2011, there were no landings for this fishery in 2J (DFO 2011b; DFO 2014a; DFO 2014c).

**Canada North Atlantic, Seine Net, Boat****< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 2J3KLPs. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 0.15% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.34% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

#### Canada North Atlantic, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 2J3KLPs. High discard rates were characteristic of the capelin fishery in the past, the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries. (Alverson et al. 1996). In recent years, several management Canadian wide measures and access to other markets have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fisheries (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring full utilization of capelin has been in effect since 2006. This requirement along with new markets for male capelin have increased the utilization of male capelin.(DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b).

## **ATLANTIC SALMON**

### **Factor 2.1 - Inherent Vulnerability**

*Scoring Guidelines (same as Factor 1.1 above)*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Seine Net, Boat

### Canada North Atlantic, Trapnet

#### High

Atlantic salmon has high inherent vulnerability, based on a FishBase score of 62 out of 100 (Cheung et al 2005; FishBase 2014d).

#### Rationale:

Using the SFW Productivity and Susceptibility Analysis (PSA) Atlantic salmon receives a vulnerability score of 2 (moderate) based on the following Seafood Watch parameters: age at maturity (4-5 years), max age (13 years), fecundity (1000+ eggs; highly fecund), max size (150cm), length at maturity ( $L_M = 73.1\text{cm}$ ), reproductive strategy (demersal egg layer), and trophic level (4.4). Atlantic salmon are anadromous (spending portions of their life cycle in both fresh and salt water), populations in all regions of Canada are highly vulnerable to: climate change, ecosystem degradation and overfishing. (COSEWIC 2010b; FishBase 2014a). For the purpose of this report, SFW is using the FishBase score for Atlantic salmon, which corresponds to high inherent vulnerability.

## Factor 2.2 - Abundance

*Scoring Guidelines (same as Factor 1.2 above)*

### Canada Gulf of St. Lawrence, Purse Seine

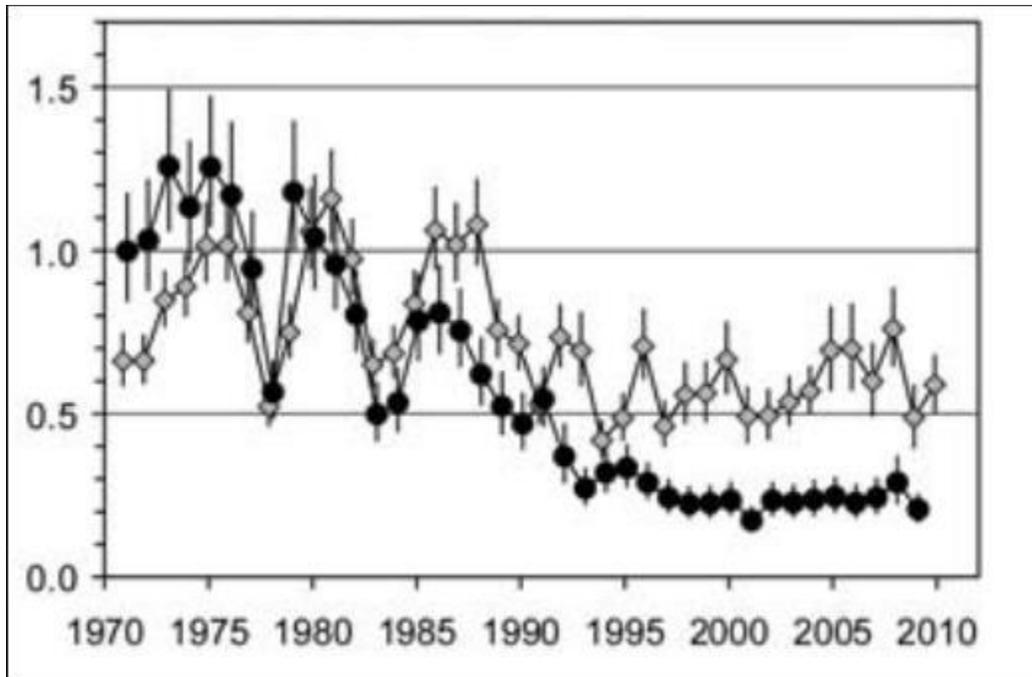
### Canada Gulf of St. Lawrence, Seine Net, Boat

### Canada Gulf of St. Lawrence, Trapnet

#### Very High Concern

The Committee on the Status of Endangered Wildlife in Canada listed Atlantic salmon stocks in the Gulf of St. Lawrence (4RST) as special concern (Committee on the Status of Endangered Wildlife in Canada 2014). However, current abundances (approximately 1,500,000 individuals), for large and small Atlantic salmon in 4RST and 2J3KLPs, are far below historic levels (approximately 2,300,000 individuals; Figure 13; Chaput 2012). Due to these factors this criterion scores as very high concern.

#### Rationale:



**Figure 13.** Historic Atlantic salmon abundance in the Northwest Atlantic. The y-axis represents millions of one-year-at-sea (1SW) and multi-sea-winter (MSW) individuals (Chaput 2012).

#### Canada North Atlantic, Seine Net, Boat

#### Canada North Atlantic, Trapnet

#### High Concern

The Committee on the Status of Endangered Wildlife in Canada has listed Atlantic salmon stocks in and around Newfoundland and Labrador (2J3KLPs) as: not at risk (Committee on the Status of Endangered Wildlife in Canada 2014). However, current abundances (approximately 1,500,000 individuals), for large and small Atlantic salmon in 4RST and 2J3KLPs, are far below historic levels (approximately 2,300,000 individuals; Figure 13; Chaput 2012). Due to these factors this criterion scores as a high concern.

### Factor 2.3 - Fishing Mortality

*Scoring Guidelines (same as Factor 1.3 above)*

#### Canada Gulf of St. Lawrence, Purse Seine

#### Very Low Concern

DFO released, in a requested catch composition report (2011), that Atlantic Salmon caught in the NAFO subarea 4R capelin purse seine fishery represents a negligible amount (0.201 MT) of the total

extrapolated catch (11,262 MT). This incidental catch also represents a negligible amount when compared to the total approximated Atlantic salmon catch in the Gulf of St. Lawrence (approximately 80,884 individuals), resulting in the score of very low concern. A report conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2010 makes no mention that any capelin fishery in Canada has a detrimental effect on Atlantic salmon populations (COSEWIC 2010b). There has also been no commercial catch for Atlantic salmon in 4RST since 1985 (DFO 2012b; DFO 2014c).

**Rationale:**

Table 3 shows the extrapolation of the DFO catch composition report. Atlantic salmon bycatch in 4ST was not sampled as the directed capelin fishery in the area only represents 1.25% of the total extrapolated catch of the entire 4RST fishery for 2011 (DFO 2014c).

**Canada Gulf of St. Lawrence, Seine Net, Boat**

**Low Concern**

As of 2014, there are no bycatch estimates for the capelin tuck seine fishery in 4RST. However, it can be estimated that tuck seines will have similar bycatch ratios as purse seines since their methods of capture are almost identical (one purses the lead line while the other does not). Therefore, it is probable that the fishing mortality of salmon caught as bycatch in the 4RST capelin tuck seine fishery will have a negligible effect on the total fishing mortality for salmon in 4RST (less than 5% of approximately 80,884 individuals). A report conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2010 makes no mention that any capelin fishery in Canada has a detrimental effect on Atlantic salmon populations. As a result, the score of low concern is appropriate. There has also been no commercial catch for Atlantic salmon in 4RST since 1985 (COSEWIC 2010b; DFO 2012b; DFO 2014c).

**Canada Gulf of St. Lawrence, Trapnet**

**Moderate Concern**

To date, there are no public bycatch records available for the trapnet fisheries in 4RST. Therefore, the fisheries mortality (F) for all bycatch species is unknown at this time. However, moderately effective management is in place for all fisheries so a moderate score is appropriate. There has also been no commercial catch for Atlantic salmon in 4RST since 1985 (COSEWIC 2010b; DFO 2012b; DFO 2014c).

**Canada North Atlantic, Seine Net, Boat**

**Low Concern**

As of 2014, there are no bycatch estimates for the capelin tuck seine fishery in 2J3KLPs. However, it can

be estimated that tuck seines will have similar bycatch ratios as purse seines since their methods of capture are almost identical (one purses the lead line while the other does not). Since salmon were not caught in the purse seine fishery of 2J3KLPs (in the 2011 bycatch report) it is probable that the fishing mortality of salmon caught as bycatch in the 2J3KLPs capelin tuck seine fishery will have a negligible effect on the total fishing mortality for salmon in 2J3KLPs (less than 5% of approximately 72,000 individuals). As a result, the score of low concern is appropriate. All commercial Atlantic salmon fisheries were incrementally closed in the 2J3KLPs area between 1992 and 1998, and have since remained closed (COSEWIC 2010b; DFO 2011h; DFO 2014c).

#### Canada North Atlantic, Trapnet

##### **Moderate Concern**

To date, there are no public bycatch records available for the trapnet fishery in 2J3KLPs. Therefore, the fisheries mortality (F) for all bycatch species is unknown at this time. However, moderately effective management is in place for all fisheries so a moderate score is appropriate. All commercial Atlantic salmon fisheries were incrementally closed in the 2J3KLPs area between 1992 and 1998, and have since remained closed. (COSEWIC 2010b; DFO 2012h; DFO 2014c).

#### **Factor 2.4 - Discard Rate**

#### Canada Gulf of St. Lawrence, Purse Seine

##### **< 20%**

In the catch composition report (2011) and extrapolation table (table 3), all bycatch species caught in NAFO subarea 4R represent 10.86% of the total extrapolated catch of the capelin purse seine fishery. Using the 2011 catch data from DFO, it has been extrapolated that 1173 MT (rounded) of Atlantic herring was kept. All other bycatch species were discarded. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Fortunately, it was extrapolated that a low quantity (4 MT) of capelin was discarded; this only represents 0.04% of the total extrapolated catch composition for 2011. Since no data exists regarding post-release survivorship, a 100% mortality rate is assumed for all discarded species. The landings in 4ST are not shown in the table as they only represent 1.25% of the total extrapolated catch (141 MT/11,262 MT) within the 4RST management area for 2011 (DFO 2011a; DFO 2014a; DFO 2014c).

#### Canada Gulf of St. Lawrence, Seine Net, Boat

**< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 4RST. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 10.86% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.04% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

**Canada Gulf of St. Lawrence, Trapnet****< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 4RST. High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) has significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a).

**Canada North Atlantic, Seine Net, Boat****< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 2J3KLPs. However, since the

tuck seine operates similarly to the purse seine, the 2011 discard rate of 0.15% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.34% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

#### Canada North Atlantic, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 2J3KLPs. High discard rates were characteristic of the capelin fishery in the past, the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries. (Alverson et al. 1996). In recent years, several management Canadian wide measures and access to other markets have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fisheries (two to three days) has significantly reduced at-sea discarding. A condition of provincial processing licenses requiring full utilization of capelin has been in effect since 2006. This requirement along with new markets for male capelin have increased the utilization of male capelin (DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b).

### **MAMMALS**

#### **Factor 2.1 - Inherent Vulnerability**

*Scoring Guidelines (same as Factor 1.1 above)*

#### Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### High

Based on the Seafood Watch scoring criteria, all marine mammals receive a score of high inherent vulnerability to fishing (Seafood Watch 2013).

## Factor 2.2 - Abundance

*Scoring Guidelines (same as Factor 1.2 above)*

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### Very High Concern

The Committee on the Status of Endangered Wildlife in Canada has listed all species of cetaceans in all areas of Atlantic Canada as either threatened, endangered or of special concern (Committee on the Status of Endangered Wildlife in Canada 2014). It is unknown at this time which species of marine mammals are affected. If any cetacean species are affected the score of very high concern is appropriate due to the COSEWIC designations above.

## Factor 2.3 - Fishing Mortality

*Scoring Guidelines (same as Factor 1.3 above)*

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### Low Concern

To date, there are no public records for bycatch species in both the seine net (purse and tuck seines) and trapnet fisheries in 4RST and 2J3KLPs, but DFO fishery managers stated that interactions with marine mammals might occur in capelin fisheries. The Seafood Watch Criteria for Fisheries includes fishing mortality scoring criteria for unknown species; pelagic seine nets and trap gears score as low concerns (3.5 and 4; respectively) for marine mammal mortality (Seafood Watch 2013).

## Factor 2.4 - Discard Rate

### Canada Gulf of St. Lawrence, Seine Net, Boat

**< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 4RST. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 10.86% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.04% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) has significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

### Canada Gulf of St. Lawrence, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 4RST. High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) has significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the

utilization of male capelin (DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011a).

#### Canada North Atlantic, Seine Net, Boat

**< 20%**

Currently, no data regarding discard rates exists for the tuck seine fishery in 2J3KLPs. However, since the tuck seine operates similarly to the purse seine, the 2011 discard rate of 0.15% (which has been extrapolated, for all bycatch species, from the 2011 catch composition and species quota reports) has been adopted for this tuck seine fishery. The 2011 capelin discard rate of 0.34% has also been adopted for the tuck seine sector in this fishery. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b; DFO 2014a; DFO 2014c).

High discard rates were characteristic of the capelin fishery in the past—the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries (Alverson et al. 1996). In recent years, several Canadian-wide management measures (and access to other markets) have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fishing seasons (two to three days) have significantly reduced at-sea discarding. A condition of provincial processing licenses requiring the full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b).

#### Canada North Atlantic, Trapnet

**< 20%**

Currently, no data regarding discard rates exists for the trapnet fishery in 2J3KLPs. High discard rates were characteristic of the capelin fishery in the past, the 1996 Food and Agriculture Organization of the United Nation's (FAO) global assessment of bycatch provided an 80% discard rate for Canadian capelin fisheries. (Alverson et al. 1996). In recent years, several management Canadian wide measures and access to other markets have mitigated these concerns. Monitoring capelin quality prior to opening the fishery and relatively short fisheries (two to three days) has significantly reduced at-sea discarding. A condition of provincial processing licenses requiring full utilization of capelin has been in effect since 2006. This requirement, along with new markets for male capelin, has increased the utilization of male capelin (DFO 2013b). Based on these new requirements, SFW estimates a discard ratio of <20%. The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery;

however, it does not explicitly state that there is a discard ban for the directed capelin fishery (DFO 2011b).

## **Criterion 3: Management effectiveness**

*Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).*

*The final score for this criterion is the geometric mean of the two scores. The Criterion 3 rating is determined as follows:*

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern*  
*Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.*

### **Criterion 3 Summary**

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
Canada Gulf of St. Lawrence Purse Seine	3.000	4.000	Green(3.464)
Canada Gulf of St. Lawrence Seine Net, Boat	3.000	2.000	Yellow(2.449)
Canada Gulf of St. Lawrence Trapnet	3.000	2.000	Yellow(2.449)
Canada North Atlantic Purse Seine	3.000	4.000	Green(3.464)
Canada North Atlantic Seine Net, Boat	3.000	2.000	Yellow(2.449)
Canada North Atlantic Trapnet	3.000	2.000	Yellow(2.449)

### **Factor 3.1: Harvest Strategy**

#### Scoring Guidelines

*Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.'*

- *5 (Very Low Concern)—Rated as 'highly effective' for all seven subfactors considered.*

- 4 (Low Concern)—Management Strategy and Recovery of Species of Concern rated ‘highly effective’ and all other subfactors rated at least ‘moderately effective.’
- 3 (Moderate Concern)—All subfactors rated at least ‘moderately effective.’
- 2 (High Concern)—At minimum, meets standards for ‘moderately effective’ for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated ‘ineffective.’
- 1 (Very High Concern)—Management exists, but Management Strategy and/or Recovery of Species of Concern rated ‘ineffective.’
- 0 (Critical)—No management exists when there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of illegal, unregulated, and unreported fishing occurring.

### Factor 3.1 Summary

Factor 3.1: Management of fishing impacts on retained species							
Region / Method	Strategy	Recovery	Research	Advice	Enforce	Track	Inclusion
Canada Gulf of St. Lawrence Purse Seine	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Canada Gulf of St. Lawrence Seine Net, Boat	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Canada Gulf of St. Lawrence Trapnet	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Canada North Atlantic Purse Seine	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Canada North Atlantic Seine Net, Boat	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective
Canada North Atlantic Trapnet	Moderately Effective	N/A	Moderately Effective	Highly Effective	Highly Effective	Moderately Effective	Highly Effective

#### Subfactor 3.1.1 – Management Strategy and Implementation

*Considerations: What types of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? To achieve a highly effective rating, there must be appropriate management goals, and evidence that the measures in place have been successful at maintaining/rebuilding species.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

### Canada North Atlantic, Purse Seine

### Canada North Atlantic, Seine Net, Boat

### Canada North Atlantic, Trapnet

#### **Moderately Effective**

Currently, in 2014, there are no directed abundance surveys for capelin in NAFO area 4RST and 2J3KLPs; therefore, DFO is unable to set target reference points such as  $B_{MSY}$ ,  $B_{lim}$ , etc. However, both fisheries are managed by separate Integrated Fisheries Management Plans (IFMPs) which evaluate—biennially (every two years)—multiple aspects of the fisheries’ dynamics including ecological (e.g., capelin biology, life history, predator-prey relationships, and other ecosystem factors), socioeconomic (e.g., landings and ex-vessel value, local and export market trends, and economic dependency) and institutional (e.g., monitoring, compliance, enforcement, regulatory framework and stakeholder consultation) components (DFO 2011a; DFO 2011b). Within the 2 year management cycle for the IFMPs, management measures (such as the implementation of individual quotas, licenses, season and area closures, as well a comprehensive compliance strategy) are mapped against the DFO management objectives. This governance evaluation apparatus (which is known as a management performance review and is conducted separately for each fishery) is used to monitor the effectiveness of the management strategies (which are independently chosen for each fishery). For example, the performance reviews provide fisheries managers with tools that allow them to make in-season adjustments for each fishery (i.e., they allow for adaptive management). In particular, specific tools used within the performance reviews are the species quota reports—which allow for the in-season monitoring of catch levels and “provide guidance as to when a season should close for a particular gear type and area (based on when the fisheries’ approach their corresponding TAC)” (DFO 2011a; DFO 2011b; DFO 2013c; DFO 2013d; DFO 2014a; DFO 2014b). Capelin TACs are not based on biomass and/or spawning stock biomass indices, as there are no directed abundance surveys for these fisheries. TACs are instead set via a series of internal and external DFO review processes (which occur within the 2 year management cycle). First, DFO Science Branches (in the Gulf, and Newfoundland and Labrador regions; 4RST and 2J3KLPs – respectively) collect all relevant fisheries-dependent (e.g., landings relative to current TAC, CPUE data, capelin length frequencies, etc.) and fisheries-independent (e.g., indirect multispecies trawl survey) data for each fishery. The scientific studies for both fisheries are then independently internally peer-reviewed by DFO’s Canadian Science Advisory Secretariat (CSAS) within the fisheries’ respective regions. The peer-reviewed reports are then externally presented (within the fisheries’ respective regions) through Regional Advisory Processes (RAPs) where industry, academic and public stakeholders are able to provide feedback on both scientific assessments. The results of these respective meetings are compiled into two separate Science Advisory Reports (SARs). The SARs are then presented at the corresponding industry advisory meetings—which are held by the respective DFO Fisheries and Aquaculture Management (FAM) Regional Branches—where the regional DFO scientists can provide clarification regarding the SARs to members of the respective FAM branches. The respective FAM branches finally set the TACs (for 2 consecutive years to allow time for the following IFMP cycle) for the 4RST and 2J3KLPs fisheries in consultation with industry representatives from each fishery (personal

communication, DFO representative, October 8 2014; DFO 2011a; DFO 2011b; DFO 2013c; DFO 2013d; DFO 2014a).

**Rationale:**

The management strategy does not receive the ineffective score as the strategy has been implemented and adaptively managed with measurable success: the fishery has been prosecuted consistently below the TAC over the long-term (DFO 2011a). However, the management strategy does not warrant a highly effective score because there are no abundance indices available, so it is unknown whether TACs are set appropriately. Consequently, the management strategy score of moderately effective is adequate.

**Subfactor 3.1.2 – Recovery of Species of Concern**

*Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/endangered species or to limit fishery's impact on these species and what is their likelihood of success? To achieve a rating of Highly Effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

**N/A**

Capelin is not listed as threatened, endangered, or a species of special concern.

**Subfactor 3.1.3 – Scientific Research and Monitoring**

*Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species? To achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.*

**Canada Gulf of St. Lawrence, Purse Seine****Canada Gulf of St. Lawrence, Seine Net, Boat****Canada Gulf of St. Lawrence, Trapnet****Moderately Effective**

DFO conducts the following research and monitoring in 4RST throughout the two year management cycle:

1. 100% of the landings are monitored via the use of a dockside observer network. Male and female length frequency and body condition data is collected by these observers and analyzed by DFO scientists. Trends in mean lengths and body condition are summarized in biennial assessments.
2. Catch composition and vessel operations are monitored at an extremely low 3.78% during the fishing season, via the use of at-sea fisheries observers, for only the purse seine fishery in 4R (West coast of Newfoundland).
3. Catch per unit effort (CPUE) data—represented as MT per day—is monitored throughout the season for the purse seine fishery in 4R.
4. Capelin are regularly caught in the shrimp fishery in the area and these catches are monitored, via at-sea fisheries observers, at a low coverage of 5% throughout the shrimp fishing season.
5. Capelin are regularly caught in the multidisciplinary groundfish and shrimp bottom trawl surveys which are conducted periodically throughout the management cycle. The dispersion of capelin is estimated for the area using this method. There is no direct abundance survey for capelin in 4RST. Therefore, research and monitoring methods receive a moderately effective score because there is some data collection related to stock health, but data is insufficient/too uncertain to help maintain the stock in 4RST(DFO 2013a; Seafood Watch 2013).

**Canada North Atlantic, Purse Seine****Canada North Atlantic, Seine Net, Boat****Canada North Atlantic, Trapnet****Moderately Effective**

DFO conducts the following research and monitoring in 2J3KLPs throughout the two year management cycle:

1. 100% of the landings are monitored in 3KL via the use of a dockside observer network. In 2013, there were no capelin landings in 2J and 3Ps. Male and female length frequency, body condition and age data

was collected by observers and analyzed by DFO scientists. Trends in mean lengths and body condition are summarized in biennial assessments.

2. Catch composition and vessel operations are monitored at an extremely low 0.97-3.22% (3K and 3L; respectively) during the fishing season via the use of at-sea fisheries observers for only the purse seine fishery in these areas.
3. A spring offshore acoustic survey has been periodically (1988-1992, 1996, 1999-2005 2007-2012) conducted over a long term period. The resurvey results are used to simulate capelin stock abundance in the survey area. It does not estimate overall capelin stock abundance in 2J3KLPs.
4. Capelin are regularly caught in the fall multi-species bottom trawl survey which is conducted periodically throughout the management cycle. It measures relative biomass of species groups (e.g., planktivores of which capelin is associated). It does not estimate overall capelin stock abundance in 2J3KLPs.
5. Local (Trinity Bay, NL) spring spawning larval studies have been conducted between 1990 and 2012.
6. Independent academic studies (performed by faculty from Memorial University of Newfoundland in collaboration with DFO) have been conducted. One study conducted an acoustic survey in 3KLPs in 2012 (referred to in 2013 assessment but reference not found) and the other study was conducted in 2014 to understand capelin population regulation (Buren et al. 2014).
7. Local spawning times were recorded by harvesters for two beaches: Bryants Cove, Conception Bay (1978-2012) and Bellevue Beach, Trinity Bay (1990-2010).
8. Data regarding the Cold Intermediate Layer (CIL)—which is revered as a robust index of ocean climate conditions—has been monitored since 1950 for Southern Labrador and Eastern Newfoundland (2J3KL). As of 2014, there is no direct abundance survey for capelin in 2J3KLPs. Therefore, research and monitoring methods receive a moderately effective score because there is some data collection related to stock health, but data is insufficient/too uncertain to help maintain the stock in 2J3KLPs (DFO 2011b; DFO 2013b; Seafood Watch 2013; DFO 2014a).

#### **Subfactor 3.1.4 – Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.*

**Canada Gulf of St. Lawrence, Purse Seine**

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### Highly Effective

In these particular fisheries—capelin in both management NAFO area 4RST and 2J3KLPs—the Department of Fisheries and Oceans (DFO) Canada has a proven track record of always following the scientific advice from its internally peer-reviewed scientific assessment arm the Canadian Science Advisory Secretariat (CSAS). This track record can be seen in Tables 1 and 2, and Figures 4 and 6: the Fisheries and Aquaculture Management (FAM) Branch of DFO sets TACs based on the advice received during the internal and external science Regional Advisory Process (RAP; DFO 2011a; DFO 2011b; DFO 2013a; DFO 2013b; DFO 2013c; DFO 2013d; DFO 2014a).

### Subfactor 3.1.5 – Enforcement of Management Regulations

*Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

### Highly Effective

In both capelin fisheries, in NAFO areas 4RST and 2J3KLPs, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), at-sea and dockside monitoring, logbooks, and through the use of fisheries

(conservation and protection) officers (DFO 2011a; DFO 2011b).

### **Subfactor 3.1.6 – Management Track Record**

*Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels? A Highly Effective rating is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

#### **Moderately Effective**

DFO has tracked capelin exploitation rates since 1970. It appears that DFO management measures have resulted in the relative maintenance of both capelin fisheries (in NAFO area 4RST and 2J3KLPs) over the long term (10+ years). It may not be said with 100% certainty because abundance indices are not known (DFO 2011a; DFO 2011b; DFO 2013a; DFO 2013b).

### **Subfactor 3.1.7 – Stakeholder Inclusion**

*Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent and includes stakeholder input.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

### Canada North Atlantic, Purse Seine

### Canada North Atlantic, Seine Net, Boat

### Canada North Atlantic, Trapnet

#### Highly Effective

The stakeholder inclusion process is well documented in the proceedings of the Regional Advisory Process (RAP) for both the Gulf (4RST), and Newfoundland and Labrador (2J3KLPs) regions. The two-day RAP for both regions consists of DFO scientists (who conduct capelin research and report their findings in the stock assessments) presenting their findings and recommendations to a representative stakeholder and peer group (which includes DFO science and management peers, invited harvesters, provincial department of fisheries representatives, fisheries union representatives, and academics). After each presentation, representatives from each stakeholder and peer group are welcomed to comment for a limited period of time. All scientific peer-review advice and a summation of stakeholder comments are written in a Science Advisory Report (SAR) which is used in the decision-making process. Please refer to the citations and links provided for a list of all the participants in the RAPs for each fishery (DFO 2013c; DFO 2013d).

## Bycatch Strategy

Factor 3.2: Management of fishing impacts on bycatch species						
Region / Method	All Kept	Critical	Strategy	Research	Advice	Enforce
Canada Gulf of St. Lawrence Purse Seine	No	No	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
Canada Gulf of St. Lawrence Seine Net, Boat	No	No	Moderately Effective	Ineffective	Moderately Effective	Highly Effective
Canada Gulf of St. Lawrence Trapnet	No	No	Moderately Effective	Ineffective	Moderately Effective	Highly Effective
Canada North Atlantic Purse Seine	No	No	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
Canada North Atlantic Seine Net, Boat	No	No	Moderately Effective	Ineffective	Moderately Effective	Moderately Effective
Canada North Atlantic Trapnet	No	No	Moderately Effective	Ineffective	Moderately Effective	Highly Effective

### Subfactor 3.2.1 – Management Strategy and Implementation

*Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures? To achieve a Highly Effective rating, the primary bycatch species must be known and there must*

*be clear goals and measures in place to minimize the impacts on bycatch species (e.g., catch limits, use of proven mitigation measures, etc.).*

#### Canada Gulf of St. Lawrence, Purse Seine

##### **Highly Effective**

DFO only enforces one bycatch management measure for the 4RST purse seine fishery: all vessels in this fishery must release all bycatch species in a manner that causes the least harm (Government of Canada, 1993). DFO implements this bycatch management measure for this fishery through routine checks by at-sea observers and fisheries officers (DFO 2011a). Although there are no bycatch limits set during the TAC setting process, Table 3 details that bycatch is minimized to the greatest extent possible (DFO 2014c). Because of this result, bycatch management in the 4RST purse seine is highly effective.

#### Canada Gulf of St. Lawrence, Seine Net, Boat

##### **Moderately Effective**

DFO has specific management measures in place within its Fisheries (General) Regulations to mitigate the capture of bycatch species in the 4RST tuck seine (i.e., boat seine net or bar seine) capelin fishery. The following is a list of the specific management measures currently enforced for this fishery: 1. All incidental catch (bycatch) must be release in a manner that causes the least harm. 2. Bar seines fitted with rings that allow the bottom and sides of the seine to be hauled or brought together shall not exceed a length of 80 fathoms (Government of Canada, 1993). DFO implements these bycatch management measures for this fishery through routine checks by at-sea fisheries observers and fisheries officers (DFO 2011a).

##### **Rationale:**

Although management measures to reduce bycatch are implemented, there are currently no bycatch reports or statistics to verify their effectiveness. Consequently, the moderately effective score for the bycatch management strategy is adequate.

#### Canada Gulf of St. Lawrence, Trapnet

##### **Moderately Effective**

DFO has specific management measures in place within its Fisheries (General) Regulations to mitigate the capture of bycatch species in the 4RST trapnet capelin fishery. The following is a list of the specific management measures currently enforced for this fishery: 1. All incidental catch (bycatch) must be release in a manner that causes the least harm. 2. Trap (net) leaders will be regulated by condition of license to prohibit the use of leader mesh size between 2 and 7 inches, and monofilament netting

material (Government of Canada, 1993). This is a conservation measure aimed at reducing the capture of wild Atlantic salmon. DFO implements these bycatch management measures for this fishery through routine checks by at-sea fisheries observers and fisheries officers (DFO 2011a).

**Rationale:**

Although management measures to reduce bycatch are implemented, there are currently no bycatch reports or statistics to verify their effectiveness. Consequently, the moderately effective score for the bycatch management strategy is adequate.

**Canada North Atlantic, Purse Seine**

**Highly Effective**

DFO only enforces one bycatch management measure for the 2J3KLPs purse seine fishery: all vessels in this fishery must release all bycatch species in a manner that causes the least harm (Government of Canada, 1993). DFO implements this bycatch management measure for this fishery through routine checks by at-sea observers and fisheries officers (DFO 2011b). Although there are no bycatch limits set during the TAC setting process, table 3 details that bycatch is minimized to the greatest extent possible (DFO 2014c). Because of this result, bycatch management in the 2J3KLPs purse seine is highly effective.

**Canada North Atlantic, Seine Net, Boat**

**Moderately Effective**

DFO has specific management measures in place within its Fisheries (General) Regulations to mitigate the capture of bycatch species in the 2J3KLPs tuck seine (i.e., boat seine net or bar seine) capelin fishery. The following is a list of the specific management measures currently enforced for this fishery: 1. All incidental catch (bycatch) must be release in a manner that causes the least harm. 2. Bar seines fitted with rings that allow the bottom and sides of the seine to be hauled or brought together shall not exceed a length of 80 fathoms (Government of Canada, 1993). 3. Bar seines must also have a minimum length of 25 fathoms and a minimum depth of 5 fathoms (with the exception of individual quota Capelin fisheries in both Green Bay and White Bay, which may have a minimum depth of 4 fathoms). This bar seine must also be comprised of mesh seventy-five percent of which is three-quarters of an inch in size. DFO implements these bycatch management measures for this fishery through routine checks by at-sea fisheries observers and fisheries officers (DFO 2011b).

**Rationale:**

Although management measures to reduce bycatch are implemented, there are currently no bycatch reports or statistics to verify their effectiveness. Consequently, the moderately effective score for the bycatch management strategy is adequate.

### Canada North Atlantic, Trapnet

#### **Moderately Effective**

DFO has specific management measures in place within its Fisheries (General) Regulations to mitigate the capture of bycatch species in the 2J3KLPs trapnet capelin fishery. The following is a list of the specific management measures currently enforced for this fishery: 1. All incidental catch (bycatch) must be released in a manner that causes the least harm. 2. Trap (net) leaders will be regulated by condition of license to prohibit the use of leader mesh size between 2 and 7 inches, and monofilament netting material (Government of Canada, 1993). DFO implements these bycatch management measures for this fishery through routine checks by at-sea fisheries observers and fisheries officers (DFO 2011b).

#### **Rationale:**

Although management measures to reduce bycatch are implemented, there are currently no bycatch reports or statistics to verify their effectiveness. Consequently, the moderately effective score for the bycatch management strategy is adequate.

### **Subfactor 3.2.2 – Scientific Research and Monitoring**

*Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to measure fishery's impact on bycatch species? To achieve a Highly Effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are being met.*

### Canada Gulf of St. Lawrence, Purse Seine

#### **Moderately Effective**

The catch composition report and corresponding extrapolation table (Table 3) details that there is 3.78% observer coverage in the NAFO subarea 4R purse seine fishery. The 4ST NAFO subareas are not observed because the landings only represent 1.25% of the total catch (141 MT/11,262 MT) within the 4RST management area (DFO 2014c).

This subcriterion receives a score of moderately effective; 3.78% observer coverage only provides a limited amount of data regarding bycatch species caught in this purse seine fishery.

### Canada Gulf of St. Lawrence, Seine Net, Boat

### Canada Gulf of St. Lawrence, Trapnet

#### Ineffective

There is no observer coverage for the tuck seine (seine net, boat) and trapnet fisheries. Bycatch and discarding in these fisheries is likely low; however, there is no monitoring or research on bycatch from these gear types to confirm this. Overfished species are likely caught by these gears, and potential interactions with marine mammals exist (see Criteria 2). The regulation measures in the 2011 4RST IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Therefore, observer coverage is likely necessary to confirm the discard rate for this fishery. Due to the lack of observer coverage and lack of research on bycatch for these gear types, scientific research/monitoring for bycatch scores as "ineffective."

### Canada North Atlantic, Purse Seine

#### Moderately Effective

The catch composition report and corresponding extrapolation table detail that there is 0.97% and 3.22% observer coverage in the NAFO subareas 3K and 3L (respectively) purse seine fisheries (DFO 2014c). There is no observer coverage in NAFO subarea 3Ps because the landings only represent 0.14% of the total landings (29 MT/20,205 MT) within the 2J3KLPs management area. In 2011, there were no landings for this fishery in 2J (DFO 2014c).

#### Rationale:

This subcriterion receive of moderately effective; 0.97% and 3.22% observer coverage only provides a limited amount of data regarding bycatch species caught in these purse seine fisheries.

### Canada North Atlantic, Seine Net, Boat

### Canada North Atlantic, Trapnet

#### Ineffective

There is no observer coverage for the tuck seine (seine net, boat) and trapnet fisheries. Bycatch and discarding in these fisheries is likely low; however, there is no monitoring or research on bycatch from these gear types to confirm this. Overfished species are likely caught by these gears, and potential interactions with marine mammals exist (see Criteria 2). The regulation measures in the 2011 2J3KLPs IFMP stipulate that only capelin can be retained in this fishery; however, it does not explicitly state that there is a discard ban for the directed capelin fishery. Therefore, observer coverage is likely necessary to confirm the discard rate for this fishery. Due to the lack of observer coverage and lack of research on bycatch for these gear types, scientific research/monitoring for bycatch scores as "ineffective."

### **Subfactor 3.2.3 – Management Record of Following Scientific Advice**

*Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.*

Canada Gulf of St. Lawrence, Purse Seine

Canada Gulf of St. Lawrence, Seine Net, Boat

Canada Gulf of St. Lawrence, Trapnet

Canada North Atlantic, Purse Seine

Canada North Atlantic, Seine Net, Boat

Canada North Atlantic, Trapnet

#### **Moderately Effective**

The Fisheries and Aquaculture Management (FAM) Branch of DFO—the body that sets fisheries targets—is documented as always following the bycatch mitigation advice garnered from the DFO Science Branch and industry groups (harvesters and union representatives). Bycatch mitigation measures have been proposed by DFO and the industry, and the FAM Branches for both the 4RST and 2J3KLPs fisheries (for all gear types) have implemented the measures proposed (see section 3.2.1; DFO 2011a; DFO 2011b). However, there is no documentation regarding the setting of bycatch targets. Therefore, this subcriterion receives a score of moderately effective.

### **Subfactor 3.2.4 – Enforcement of Management Regulations**

*Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen’s compliance with regulations? To achieve a Highly Effective rating, there must be consistent enforcement of regulations and verification of compliance.*

Canada Gulf of St. Lawrence, Purse Seine

#### **Highly Effective**

In both capelin purse seine fisheries, in NAFO areas 4RST and 2J3KLPs, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), at-sea and dockside monitoring, logbooks, and fisheries (conservation and protection) officers. There are concerns of noncompliant (illegal and unreported) fishing activities

occurring; fortunately, DFO conservation and protection (C&P) branches have detailed protocols, enforcement mechanisms and personnel (outlined in each fisheries' IFMP) to prevent against these occurrences (Government of Canada, 1986; Government of Canada, 1993; DFO 2011a; DFO 2011b). The score of highly effective enforcement has been selected based on the SFW criteria for fisheries (Seafood Watch 2013).

#### **Canada Gulf of St. Lawrence, Seine Net, Boat**

##### **Highly Effective**

For the capelin tuck seine fishery in NAFO areas 4RST, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), dockside monitoring, logbooks, and fisheries (conservation and protection) officers. These fisheries lack at-sea observer coverage. However, since all other enforcement methods remain consistent across the gear types in both fisheries the score of highly effective is appropriate (Government of Canada, 1986; Government of Canada, 1993; DFO 2011a; DFO 2011b).

#### **Canada Gulf of St. Lawrence, Trapnet**

##### **Highly Effective**

For the capelin trapnet fisheries, in NAFO areas 4RST and 2J3KLPs, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), dockside monitoring, logbooks, and fisheries (conservation and protection) officers. These fisheries lack at-sea observer coverage. However, since all other enforcement methods remain consistent across the gear types in both fisheries the score of highly effective is appropriate (Government of Canada, 1986; Government of Canada, 1993; DFO 2011a; DFO 2011b).

#### **Canada North Atlantic, Purse Seine**

##### **Highly Effective**

In both capelin purse seine fisheries, in NAFO areas 4RST and 2J3KLPs, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), at-sea and dockside monitoring, logbooks, and fisheries (conservation and protection) officers. There are concerns of noncompliant (illegal and unreported) fishing activities occurring; fortunately, DFO conservation and protection (C&P) branches have detailed protocols,

enforcement mechanisms and personnel (outlined in each fisheries' IFMP) to prevent against these occurrences (Government of Canada, 1986; Government of Canada, 1993; DFO 2011a; DFO 2011b). The score of highly effective enforcement has been selected based on the SFW criteria for fisheries (Seafood Watch 2013).

#### **Canada North Atlantic, Seine Net, Boat**

##### **Moderately Effective**

For the capelin tuck seine and trapnet fisheries, in NAFO areas 4RST and 2J3KLPs, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), dockside monitoring, logbooks, and fisheries (conservation and protection) officers. These fisheries lack at-sea observer coverage. The 2J3KLPs 2011 IMFP specifically mentions the need to address illegal tuck seines in this region (DFO 2011b).

Due to the issue of illegal tuck seines in this region, in combination with the enforcement methods described above, a score of "moderately effective" is appropriate (Government of Canada, 1986; Government of Canada, 1993; DFO 2011a; DFO 2011b).

#### **Canada North Atlantic, Trapnet**

##### **Highly Effective**

For the capelin trapnet fisheries, in NAFO areas 4RST and 2J3KLPs, all regulatory arrangements [that are specified by license conditions, Atlantic Fishery Regulations and Fishery (General) Regulations of the Canadian Fisheries Act] are regularly enforced and independently verified through use of vessel monitoring systems (VMS), dockside monitoring, logbooks, and fisheries (conservation and protection) officers. These fisheries lack at-sea observer coverage. However, since all other enforcement methods remain consistent across the gear types in both fisheries the score of highly effective is appropriate (Government of Canada, 1986; Government of Canada, 1993; DFO 2011a; DFO 2011b).

## **Criterion 4: Impacts on the habitat and ecosystem**

*This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.*

*The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management score. The Criterion 2 rating is determined as follows:*

- *Score >3.2=Green or Low Concern*
  - *Score >2.2 and <=3.2=Yellow or Moderate Concern*
  - *Score <=2.2=Red or High Concern*
- Rating cannot be Critical for Criterion 4.*

### **Criterion 4 Summary**

<b>Region / Method</b>	<b>Gear Type and Substrate</b>	<b>Mitigation of Gear Impacts</b>	<b>EBFM</b>	<b>Overall Recomm.</b>
Canada Gulf of St. Lawrence Purse Seine	4.00:Very Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Green (3.571)</b>
Canada Gulf of St. Lawrence Seine Net, Boat	4.00:Very Low Concern	0.25:Minimal Mitigation	3.00:Moderate Concern	<b>Green (3.571)</b>
Canada Gulf of St. Lawrence Trapnet	3.00:Low Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	<b>Green (3.240)</b>
Canada North Atlantic Purse Seine	4.00:Very Low Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	<b>Green (3.674)</b>
Canada North Atlantic Seine Net, Boat	4.00:Very Low Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	<b>Green (3.674)</b>
Canada North Atlantic Trapnet	3.00:Low Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	<b>Green (3.240)</b>

### **Justification of Ranking**

#### **Factor 4.1 – Impact of Fishing Gear on the Habitat/Substrate**

##### *Scoring Guidelines*

- *5 (None)—Fishing gear does not contact the bottom*
- *4 (Very Low)—Vertical line gear*

- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g., gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*
- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass, and maerl)*

*Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

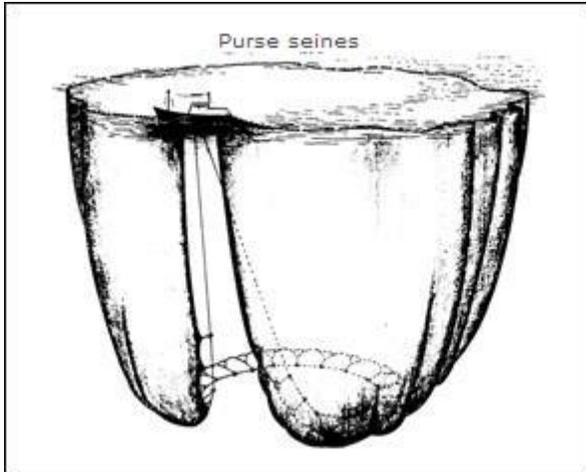
#### Canada Gulf of St. Lawrence, Purse Seine

#### Canada North Atlantic, Purse Seine

##### **Very Low Concern**

A purse seine (Figure 14) consists of a long vertical meshed net which is fashioned atop with: small buoys to float the headline and weights attached to the bottom of the net to sink the leadline. Also attached to the leadline are purse rings, through which a purse line enables the bottom of the net to be closed or "pursed" to entrap the fish. The setting of the net is usually accomplished with two vessels: a larger (approximately 15m+) vessel (known as a seiner) that is capable of holding fish and all equipment needed (including the skiff), and a smaller vessel (commonly known as a skiff). The skiff pulls one end of the net away from the seiner, encircles the school of fish, and pulls the net back around to the seiner. The purse line is pursed, and the fish are typically pumped or dip netted aboard the seiner. This gear primarily does not contact the substrate (except when the water depth is less than the height of the seine during the fishing operations and that the lower edge of the gear wipes the sea bottom; FAO 2014). Contact with the substrate is rare because gear damage is likely to occur (DFO 2010b).

##### **Rationale:**



**Figure 14.** Visual description of a purse seine (FAO 2014).

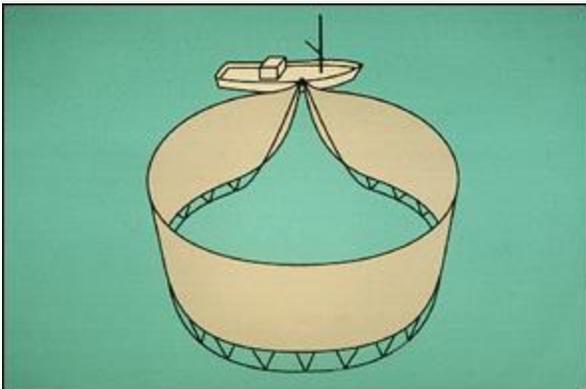
Canada Gulf of St. Lawrence, Seine Net, Boat

Canada North Atlantic, Seine Net, Boat

### Very Low Concern

There is an alternative seine gear that is used in this fishery: the bar seine—which is also known as a tuck seine (Figure 15). The tuck seine operates as a modified purse seine: a school of fish is surrounded by the netting (typically using a larger vessel and small 'skiff' boat) and the leadline (opposite to the float line) is drawn but not completely “pursed.” This gear primarily does not contact the substrate (except when the water depth is less than the height of the seine during the fishing operations and that the lower edge of the gear wipes the sea bottom).

### Rationale:



**Figure 15.** Modified purse seine: also known as a bar seine or “tuck” seine (FAO 2014).

## Canada Gulf of St. Lawrence, Trapnet

### Canada North Atlantic, Trapnet

#### Low Concern

Trapnet (i.e., fishing weir; Figure 16) is a method that uses a configuration of fixed posts lined with netting to entrap schools of migrating fish (CCCHFA 2014). The fixed posts are the only part of the structure that contacts the substrate; the impact of this contact is minimal (DFO 2010b).

#### Rationale:



Figure 16. Picture of s fishing weir (CCCHFA 2014).

## Factor 4.2 – Mitigation of Gear Impacts

### Scoring Guidelines

- *+1 (Strong Mitigation)—Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of ‘moderate’ mitigation measures.*

- *+0.5 (Moderate Mitigation)—20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation)—A few measures are in place (e.g., vulnerable habitats protected but other habitats not protected); there are some limits on fishing effort/intensity, but not actively being reduced.*
- *0 (No Mitigation)—No effective measures are in place to limit gear impacts on habitats.*

#### Canada Gulf of St. Lawrence, Purse Seine

##### Minimal Mitigation

The DFO effectively controls fishing effort and intensity in the 4RST purse fisheries through the use of catch limits, season closures, and area closures. However, the TAC has increased by 10%—which has ultimately increased effort. DFO does not have explicit management plans to mitigate the benthic impacts of this gear type for this fishery (DFO 2011a; DFO 2013a).

#### Canada/Gulf of St. Lawrence, Seine Net, Boat

##### Minimal Mitigation

The DFO effectively controls fishing effort and intensity in the 4RST tuck seine fishery through the use of catch limits, season closures, and area closures. However, the TAC has increased by 10%—which has ultimately increased effort. DFO does not have explicit management plans to mitigate the benthic impacts of this gear type for this fishery (DFO 2011a; DFO 2013a).

#### Canada Gulf of St. Lawrence, Trapnet

##### Moderate Mitigation

A report on the impacts of fishing gears on benthic environment was published by the Canadian Department of Fisheries and Oceans Canada (DFO). "When set on the bottom, traps [refers to netted traps or weirs] are usually set on substrate of low complexity. Thus impacts are localized to the footprint of the trap and generally restricted to a reduction in available habitat. Little physical habitat modification occurs except for the anchoring mechanisms and driving of stakes in the sediment" (DFO 2010b). Also, within the capelin fisheries regulations, fixed gear (specifically pertaining to trapnet) harvesters are: only allowed to fish a maximum of two traps, the traps cannot contain mesh size between 2 and 7 inches and may not be made of monofilament. Since gear modifications have been implemented (which are reasonably expected to be effective) and trapnets have been assessed to have minimum impacts on the substrate, this gear type appears to have moderate mitigations measures in place for both fisheries in 4RST and 2J3KLPs (DFO 2011a; DFO 2011b).

### Canada North Atlantic, Purse Seine

#### **Moderate Mitigation**

The DFO effectively controls fishing effort and intensity in the 2J3KLPs purse seine fishery through the use of catch limits, season closures, and area closures. Additionally, the TAC has decreased by 18.6%—which has ultimately decreased effort. DFO does not have explicit management plans to further mitigate the benthic impacts of this gear type for this fishery (DFO 2011b; DFO 2013b).

### Canada North Atlantic, Seine Net, Boat

#### **Moderate Mitigation**

The DFO effectively controls fishing effort and intensity in the 2J3KLPs tuck seine fishery through the use of catch limits, season closures, and area closures. Additionally, the TAC has decreased by 18.6%—which has ultimately decreased effort. DFO does not have explicit management plans to further mitigate the benthic impacts of this gear type for this fishery (DFO 2011b; DFO 2013b).

### Canada North Atlantic, Trapnet

#### **Moderate Mitigation**

A report on the impacts of fishing gears on benthic environment was published by the Canadian Department of Fisheries and Oceans Canada (DFO). "When set on the bottom, traps [refers to netted traps or weirs] are usually set on substrate of low complexity. Thus impacts are localized to the footprint of the trap and generally restricted to a reduction in available habitat. Little physical habitat modification occurs except for the anchoring mechanisms and driving of stakes in the sediment" (DFO 2010b). Also, within the capelin fisheries regulations, fixed gear (specifically pertaining to trapnet) harvesters are: only allowed to fish a maximum of two traps, the traps cannot contain mesh size between 2 and 7 inches and may not be made of monofilament. Since gear modifications have been implemented (which are reasonably expected to be effective) and trapnets have been assessed to have minimum impacts on the substrate, this gear type appears to have moderate mitigations measures in place for both fisheries in 4RST and 2J3KLPs (DFO 2011a; DFO 2011b).

### Factor 4.3 – Ecosystem-Based Fisheries Management

#### Scoring Guidelines

- *5 (Very Low Concern)—Substantial efforts have been made to protect species’ ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators).*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*
- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and management is not in place to mitigate these impacts.*
- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

#### Canada Gulf of St. Lawrence, Purse Seine

##### **Moderate Concern**

All main species caught within the 4RST capelin fishery are considered to be exceptional species. Both capelin and Atlantic herring are small pelagic forage species and play an integral role in the transfer of energy from lower to higher trophic levels. Both Atlantic cod and Atlantic salmon are secondary consumers and have shown that reductions in their biomass have led to trophic cascade effects. Marine mammals are top predators (tertiary consumers) and also play an integral role in the ecosystem by balancing/managing populations in the food web (Hislop, K. 2013; Odum 1971). Within the 2013 4RST capelin fishery assessment, predatory impacts (including humans) have been considered. Figure 17 depicts that fishing mortality contributes to the lowest impact on capelin mortality and does not appear to have a noticeable effect on the population (DFO 2013a).

There appears to be no clear policy to protect the ecosystem role of these species: DFO does have a Sustainable Fisheries Framework that describes its commitment to implement the principles of ecosystem-based fisheries management (EBFM), but these are merely high level government policy

objectives. However, multiple branches of DFO (e.g., Canadian Science Advisory Secretariat, Science, Economics and Policy, Fisheries and Aquaculture Management, and the Centre of Expertise in Marine Mammology) have combined their efforts to provide scientific assessments of the ecosystem function of each species caught in these fisheries (COSEWIC 2010a; COSEWIC 2010b; DFO 2011a; DFO 2011f; DFO 2011x; DFO 2012a; DFO 2013a).

This subcriterion scores as moderate concern because the fishery catches “exceptional species,” lacks policies to protect the ecosystem role of these species, but scientific assessment to account for these species’ ecological roles is underway (Seafood Watch 2013)

#### Canada Gulf of St. Lawrence, Seine Net, Boat

#### Canada Gulf of St. Lawrence, Trapnet

##### **Moderate Concern**

All main species caught within the 4RST capelin fishery are considered to be exceptional species. Both capelin and Atlantic herring are small pelagic forage species and play an integral role in the transfer of energy from lower to higher trophic levels. Both Atlantic cod and Atlantic salmon are secondary consumers and have shown that reductions in their biomass have led to trophic cascade effects. Marine mammals are top predators (tertiary consumers) and also play an integral role in the ecosystem by balancing/managing populations in the food web (Hislop, K. 2013; Odum 1971). Within the 2013 4RST capelin fishery assessment, predatory impacts (including humans) have been considered. Figure 17 depicts that fishing mortality contributes to the lowest impact on capelin mortality and does not appear to have a noticeable effect on the population (DFO 2013a).

There appears to be no clear policy to protect the ecosystem role of these species: DFO does have a Sustainable Fisheries Framework that describes its commitment to implement the principles of ecosystem-based fisheries management (EBFM), but these are merely high level government policy objectives. However, multiple branches of DFO (e.g., Canadian Science Advisory Secretariat, Science, Economics and Policy, Fisheries and Aquaculture Management, and the Centre of Expertise in Marine Mammology) have combined their efforts to provide scientific assessments of the ecosystem function of each species caught in these fisheries (COSEWIC 2010a; COSEWIC 2010b; DFO 2011a; DFO 2011f; DFO 2011x; DFO 2012a; DFO 2013a).

This subcriterion scores as moderate concern because the fishery catches “exceptional species,” lacks policies to protect the ecosystem role of these species, but scientific assessment to account for these species’ ecological roles is underway (Seafood Watch 2013)

**Canada North Atlantic, Purse Seine****Canada North Atlantic, Seine Net, Boat****Canada North Atlantic, Trapnet****Moderate Concern**

All main species caught within the 2J3KLPs capelin fishery are considered to be exceptional species. Both capelin and Atlantic herring are small pelagic forage species and play an integral role in the transfer of energy from lower to higher trophic levels. Both Atlantic cod and Atlantic salmon are secondary consumers and have shown that reductions in their biomass have led to trophic cascade effects. Marine mammals are top predators (tertiary consumers) and also play an integral role in the ecosystem by balancing/managing populations in the food web (Odum 1971; Hislop, K. 2013). A bottom-up population regulation mechanism (where environmental conditions affect algal blooms which, in turn, affect zooplankton and capelin populations) has been independently scientifically observed in situ in the management area. This mechanism has just recently been observed (2014) but will aid in the ecosystem-based fisheries management of capelin in the area (Buren et al 2014). There appears to be no clear policy to protect the ecosystem role of these species: DFO does have a Sustainable Fisheries Framework that describes its commitment to implement the principles of ecosystem-based fisheries management (EBFM), but these are merely high level government policy objectives. However, multiple branches of DFO (e.g., Canadian Science Advisory Secretariat, Science, Economics and Policy, Fisheries and Aquaculture Management, and the Centre of Expertise in Marine Mammology) and Memorial University of Newfoundland have combined their efforts to provide scientific assessments of the ecosystem function of each species caught in these fisheries. Therefore, a score of moderate concern is warranted for this subcriterion (COSEWIC 2010a; COSEWIC 2010b; DFO 2011b; DFO 2011e; DFO 2011f; DFO 2011g; DFO 2013b).

This subcriterion scores as moderate concern because the fishery catches “exceptional species,” lacks policies to protect the ecosystem role of these species, but scientific assessment to account for these species’ ecological roles is underway (Seafood Watch 2013)

## **Acknowledgements**

*Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.*

Seafood Watch® would like to thank Rachel Wang of WWF and an anonymous reviewer for graciously reviewing this report for scientific accuracy.

Seafood Watch® would also like to thank the staff at the Department of Fisheries and Canada, Maritime Region, for providing verification of the data found within this report.

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## Appendix A

Year	Area	Gear	Species	Obs Kept Weight (kg)	Obs Discard Weight (kg)	Obs Total Caught (kg)	% of Kept Capelin	Recorded Landings (mt)	% Obs	Extrapolation (mt)	Extrap. Catch Comp (%)
2011	4R	Purse Seine	Capelin (Kept only)	233,145	n/a	233,145	100	10,033	3.78	10,033	89.09
2011	4R	Purse Seine	Capelin (Discards only)	n/a	100	100	0.04	Not Recorded	3.78	4,013	0.04
2011	4R	Purse Seine	Herring (Kept only)	27,265	n/a	27,265	11.69	Not Recorded	3.78	1172.858	10.41
2011	4R	Purse Seine	Herring (Discards only)	n/a	10	10	0.004	Not Recorded	3.78	0.401	Negligible
2011	4R	Purse Seine	Cod	0	1,180	1,180	0.51	Not Recorded	3.78	51.167	0.45
2011	4R	Purse Seine	Salmon	0	5	5	0.002	Not Recorded	3.78	0.203	Negligible
Total										11,262	100
2011	3K	Purse Seine	Capelin (Kept only)	35,588	n/a	35,588	100.00	8,139	0.97	8,139	99.57
2011	3K	Purse Seine	Capelin (Discards only)	n/a	115	115	0.32	Not Recorded	0.97	26,045	0.32
2011	3K	Purse Seine	Herring	0	37	37	0.10	Not Recorded	0.97	8,139	0.10
2011	3K	Purse Seine	Cod	0	5	5	0.01	Not Recorded	0.97	0.854	0.01
Total										8,174	100
2011	3L	Purse Seine	Capelin	119,283	n/a	119,283	100.00	11,988	3.22	11,988	99.46
2011	3L	Purse Seine	Capelin (Discards only)	n/a	426	426	0.36	Not Recorded	3.22	43.08	0.36
2011	3L	Purse Seine	Herring	0	189	189	0.16	Not Recorded	3.22	19,146	0.16
2011	3L	Purse Seine	Cod	0	27	27	0.02	Not Recorded	3.22	2,393	0.02
Total										12,031	100