



OPPORTUNITY FOR ATLANTIC SILVERSIDE AND ATLANTIC SAURY FISHERIES IN THE NOVA SCOTIA PORTION OF THE SOUTHERN GULF OF ST. LAWRENCE

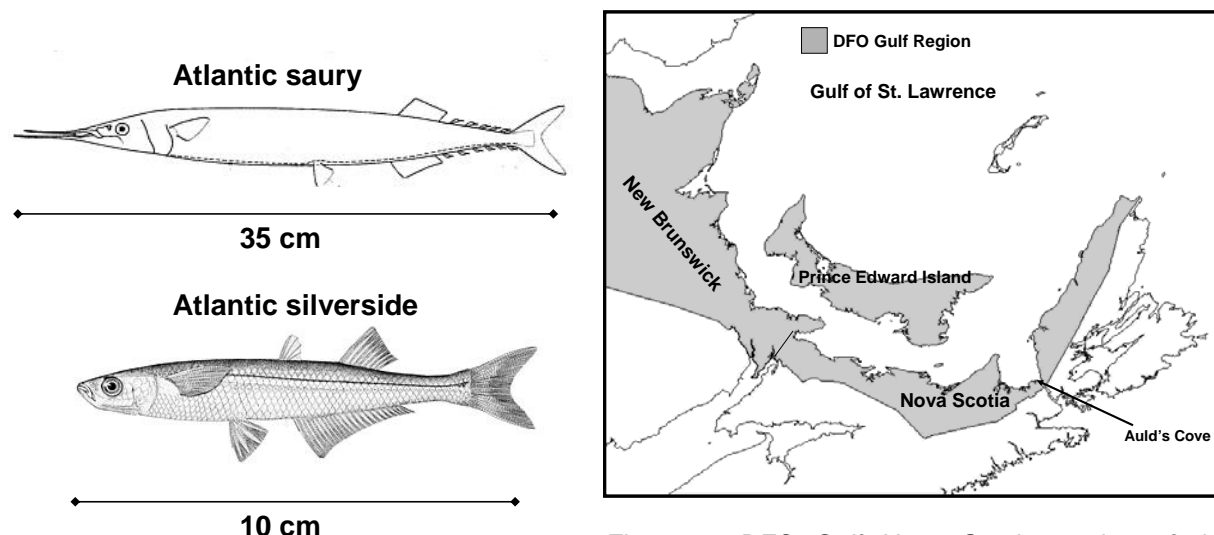


Figure 1. DFO Gulf Nova Scotia portion of the southern Gulf of St. Lawrence.

Context

The increasing value of crustacean fisheries (lobster and snow crab) and the corresponding decline in a number of fish species which traditionally provided bait in the southern Gulf of St. Lawrence have motivated an interest for alternate sources of bait including Atlantic silverside and Atlantic saury. Both of these species are lower trophic level species and could be considered as forage species of importance to several components of the aquatic ecosystem.

DFO Fisheries and Aquaculture Management (FAM) has asked whether there are opportunities for an Atlantic silverside (*Menidia menidia*) fishery and for a directed Atlantic saury (*Scomberesox saurus*) fishery in Gulf Nova Scotia. Two commercial fishery licences for silverside and an exploratory licence for Atlantic saury have been issued in Gulf Region Nova Scotia. There is a well established Atlantic silverside fishery in Gulf Region Prince Edward Island which dates to the 1970's. A science review of the Atlantic silverside fishery in PEI was last conducted in 1997. No assessments of Atlantic saury have been conducted in eastern Canada. A workshop on ecosystem considerations for krill and other forage fisheries was conducted in 1997 and recommendations for evaluating forage species fishery requests were provided. Fisheries and Oceans Canada developed a policy to guide the development of fisheries on forage species (*Policy on New Fisheries for Forage Species*; DFO 2009).

A regional meeting of the Science Advisory Process was held during 15–16 of December, 2009 in Moncton, N.B. The objectives of the meeting were to review the biology and ecology of Atlantic saury and Atlantic silverside, to assess whether these species met the definition of forage species, and to assess if there were opportunities for commercial fisheries on these species in the Gulf Nova Scotia portion of the southern Gulf of St. Lawrence, consistent with the *Policy on New Fisheries for Forage Species*. Participants included DFO scientists and fishery managers, representatives of the industry, provincial governments and First Nations.

SUMMARY

- The North Atlantic saury is a small (max. length about 50 cm), short-lived pelagic fish broadly distributed in the temperate waters of the Atlantic Ocean. It spawns in the southern portion of its range in the Atlantic Ocean and it is assumed to consist of one stock. Off eastern North America, it is found from Newfoundland to North Carolina and into the southern Gulf of St. Lawrence.
- Atlantic silverside is a small-bodied (less than 15 cm), short-lived fish which is widely distributed in brackish and salt waters from the Gulf of St. Lawrence to Florida. It spawns in the intertidal zone in estuaries throughout the southern Gulf of St. Lawrence.
- Based on their biological and ecological characteristics, Atlantic saury and Atlantic silverside are forage species.
- At present, there is no directed commercial fishery for Atlantic saury in Canadian waters and attempts to exploit this species in the past were hampered by its sporadic abundance in this area.
- In Canada, the silverside fishery is concentrated in Prince Edward Island. Total Canadian reported landings between 2000 and 2008 ranged from 200 to 650 t, representing 98% of the total commercial fishery landings for the species in eastern North America.
- Based on the prerequisites in the Policy on New Fisheries for Forage Species, commercial fisheries on Atlantic saury and Atlantic silverside would not presently meet the conservation objectives. The main reasons are the lack of scientific information to inform on reference points, abundance and ecosystem interactions.
- There is such a paucity of information on Atlantic saury in the western Atlantic and the southern Gulf of St. Lawrence that information which can be obtained during exploratory fisheries, specifically off Western Cape Breton, would benefit the development of a long-term management plan.
- Based on the low number (2) of existing licences in Gulf NS, and information on the general distribution of silversides in the southern Gulf, there are opportunities for additional commercial effort on this species in this area.

BACKGROUND

In 1995, a science review of a request for a 1,000 t experimental fishery for krill on the Scotian Shelf and in the Bay of Fundy concluded that the fishery would have negligible effects on the overall marine ecosystem, however, concerns were raised that there may be expectations for an expanded harvest of this resource, and what the consequences this expanded harvest may have for the ecosystem (DFO 1997). The science review also concluded that proposed fisheries on forage species should be considered as scientific monitoring exercises, with the emphasis being on data collection and with harvest levels remaining low relative to the size of the resource (DFO 1997). That review provided guidance on the conservation objectives and the conditions under which fisheries on forage species would fulfill the conservation objectives. These subsequently were used in the development of the DFO Policy on New Fisheries for Forage Species.

Fisheries and Oceans Canada (DFO) developed a policy to guide the development of fisheries on forage species (DFO 2009). The policy defines a forage species as:

“...a species which is below the top of an aquatic food chain, is an important source of food for at least some predators, and experiences high predation mortality.” (DFO 2009; p. 1)

A dependent predator is defined in the DFO policy as:

“a species higher in the food web, which obtains a significant part of its annual food ration from the forage species, at least at times when the forage species is abundant. When the forage species declines markedly in abundance ... the dependent predator is likely to show biological responses.” (DFO 2009)

Examples of historical fisheries on forage species include sardine, Atlantic herring, capelin, shrimp and krill fisheries (DFO 2009).

The Policy states that fisheries on forage species should be designed to ensure a high likelihood that five objectives are simultaneously achieved:

1. maintenance of target, bycatch, and ecologically dependent species within the bounds of natural fluctuations in abundance;
2. maintenance of ecological relationships (e.g predator-prey and competition) among species affected directly or indirectly by the fishery within the bounds of natural fluctuations in these relationships;
3. minimization of the risk of changes to species' abundances or relationships which are difficult or impossible to reverse;
4. maintenance of full reproductive potential of the forage species, including genetic diversity and geographic population structure;
5. allowance of opportunities to conduct commercially viable fisheries.

The request from DFO FAM for science advice on whether there are opportunities for fisheries on Atlantic saury and Atlantic silverside in the Gulf Nova Scotia portion of the southern Gulf of St. Lawrence was reviewed relative to the conservation objectives defined in the above stated policy.

ASSESSMENT

Species Biology

Atlantic saury

The North Atlantic saury (*Scomberesox saurus saurus* Walbaum 1792) is a small (max. length about 50 cm), schooling pelagic fish broadly distributed in the temperate waters of the Atlantic Ocean. It is found on both sides of the Atlantic and in the northwest Atlantic it is distributed from Newfoundland to North Carolina and into the southern Gulf of St. Lawrence. It is assumed to consist of one stock although supporting information is lacking. Atlantic saury prefer water temperatures between 8° C and 25° C and undertake an annual migration northward in the late spring and summer and southward in the autumn associated with the warming and cooling of the ocean surface waters. Incidental catches of Atlantic saury in DFO monitoring programs and seabird diet studies suggest that the fish occurs seasonally on the Scotian Shelf, in the Gulf of St. Lawrence and north of Newfoundland in the Labrador Sea.

Spawning occurs primarily during the winter and spring in the southern portion of its range, off eastern United States. Atlantic saury are fast growing and short-lived (maximum age not exceeding 4 years), being approximately 23 cm long at 2 years of age and 31 cm long at 3

years of age. Atlantic saury reach sexual maturity at a minimum size of 25 cm when most fish are between 2 and 3 years of age.

Atlantic saury feed almost exclusively on plankton and are preyed upon by a wide variety of predators including squid, swordfish, marlins, sharks, tunas, cod, hake, pollock, mackerel, dolphins, porpoises, whales and seabirds (Scott and Scott 1988; Sergeant and Fisher 1957; Collette and Klein-MacPhee 2002). Large variations in the importance of Atlantic saury in the diet of gannets have been observed, related to surface temperatures which when warm favour a more northerly distribution of saury (Montevecchi 2007).

Collette and Klein-MacPhee (2002) contend that Atlantic saury are an important link in the epipelagic food chain of the ocean as they enable the transfer of energy from lower to higher trophic levels.

Atlantic Silverside

The Atlantic silverside (*Menidia menidia* Linnaeus 1766), is a small-bodied (length < 12 cm), short-lived fish which is widely distributed in brackish and salt waters from the Gulf of St. Lawrence to Florida. In its distribution, some Atlantic silversides overwinter in offshore waters but in the Gulf of St. Lawrence, at least some also overwinter under the ice in bays and estuaries. Silversides are commonly reported to form a substantial portion of the fish community in the coastal habitats they occupy including the bays and estuaries of the southern Gulf of St. Lawrence.

Silversides reproduce in spring with eggs deposited in the intertidal zone, attached to vegetation or to the substrate. From sampling of fall fisheries in PEI, age 0 fish had a mean length of 85.5 mm and a mean weight of 4.6 g, while age 1 fish had a mean length of 113.9 mm and a mean weight of 11.2 g, with generally little size overlap between the age groups. Most (97%) of the silversides sampled were age 0, with the remainder being age 1. Age-2 silversides have not been reported from the few samples collected from the fisheries in the southern Gulf of St. Lawrence.

Silversides feed on small planktonic and benthic organisms. Fish-eating birds and fish in estuaries and coastal waters prey on silversides.

Within the southern Gulf there is no information on stock structure. Migrations are known to occur between coastal and offshore waters. The extent of exchange among bays and estuaries within the southern Gulf is not known. Migrations of silverside between the southern Gulf and the Atlantic coast are not documented and not expected.

Silverside and Atlantic saury as forage species

The fit of Atlantic saury and Atlantic silverside characteristics to those described in the DFO Policy on New Fisheries for Forage Species is summarized in the following table.

	Atlantic saury	Atlantic silverside
1. below the top of an aquatic food chain	Yes	Yes
2. an important source of food for at least some predators	Yes	Yes
3. experiences high predation mortality	Yes	Yes
4. fully recruits to the fishery at ages which still experience high mortality due to predation	Yes	Yes

	Atlantic saury	Atlantic silverside
5. often undergoes large, natural fluctuations in abundance in response to environmental factors, on time scales comparable to or shorter than a generation	Yes For the Gulf of St. Lawrence.	Yes
6. usually form dense schools for at least a part of the annual cycle	Yes	Yes
7. relatively short lived	Yes	Yes
8. have a coastal distribution for at least a part of the year	Yes	Yes
9. often support dependent predators (which are species that obtain a significant part of their annual food ration from the forage species)	Unknown Dependent predators have not been identified	Unknown Dependent predators have not been identified

Based on these characteristics, Atlantic saury and Atlantic silverside are forage species.

Fishery

Atlantic saury

Atlantic saury represent a negligible part (less than 5%) of the total catch of saury species (Atlantic and Pacific) which has ranged from about 200 thousand to 600 thousand tons annually (Maguire et al. 2006). Fisheries for Atlantic saury off the eastern United States are not large and annual landings are sporadic; reported landings ranged from just over 4 t to about 18 t annually since 1986.

At present, there is no directed commercial fishery for Atlantic saury in Canadian Atlantic waters. Scott and Scott (1988) suggested that the many numerous attempts to exploit this species in the past were hampered by the sporadic abundance of Atlantic saury in Canadian waters. From 1969 to 1974, experimental fishing was conducted by the U.S.S.R. in the northwest Atlantic and reported annual landings by foreign vessels (mainly Russian) for the years 1970 to 1975 ranged between 490 and 3,429 t (Scott and Scott 1988).

Since 1985, the reported landings for the southern Gulf of St. Lawrence totaled less than 300 t over all years and they were very erratic (occurred in less than one quarter of the years). All of the reported landings were registered from Auld's Cove, NS, of which the majority (88%) were made during the month of November. There have not been any reported landings since 2001 for a number of reasons: delays in permitting, insufficient quantities during the period when fishing was permitted, and lack of market.

Since the mid-1980's, there have been several efforts to develop a fishery for this species in Auld's Cove off the north side of the Canso Causeway, in St. George's Bay. The best information comes from the exploratory fishery of 1995. From the 86 sets completed with a midwater pelagic trawl modified to fish at the surface, 39 t were reported landed and 23 sets produced catch rates of > 500 kg per 15 minute tow. Atlantic saury were most often caught after dark but the maximum catch rate occurred during a daylight tow. Catch rates were highest at the start of the fishing experiment (mid-November) and decreased into the end of November. The reported bycatch was minimal, not exceeding 10 kg, recorded from 6 of 86 sets, and was composed of threespine sticklebacks, rainbow smelt, capelin and a few alewife. Subsequent years landings from this exploratory fishery were 4 t in 1996, 57 t in 1997 and 176 t in 2001. Information on the size composition of Atlantic saury from the fishery in Auld's Cove indicated that there were two modes in length, one at about 30 cm and the other at about 35 cm probably corresponding to 2 and 3 year-olds.

Atlantic silverside

In Canada, the silverside fishery is concentrated in Prince Edward Island with low and occasional landings reported from Quebec. The Canadian reported landings between 2000 and 2008 varied between 200 and 650 t, and represented 98% of the total commercial fishery landings for the species in eastern North America.

The PEI silverside fishery showed peak reported landings in the late 1970s, was low in the 1980s and the early 1990s, and began a sharply rising trend in the mid-1990s (Figure 2). The increase in landings coincides with an increased number of licences and the elimination of individual licence quotas. Silverside fisheries are concentrated in Kings County in eastern PEI with 86.6% of total landings since 1973. At the present time, an unknown but likely major part of silverside harvest may be kept for the fisher's own use, or sold to other fishers. In either case, the harvest may be unregistered in the statistics system.

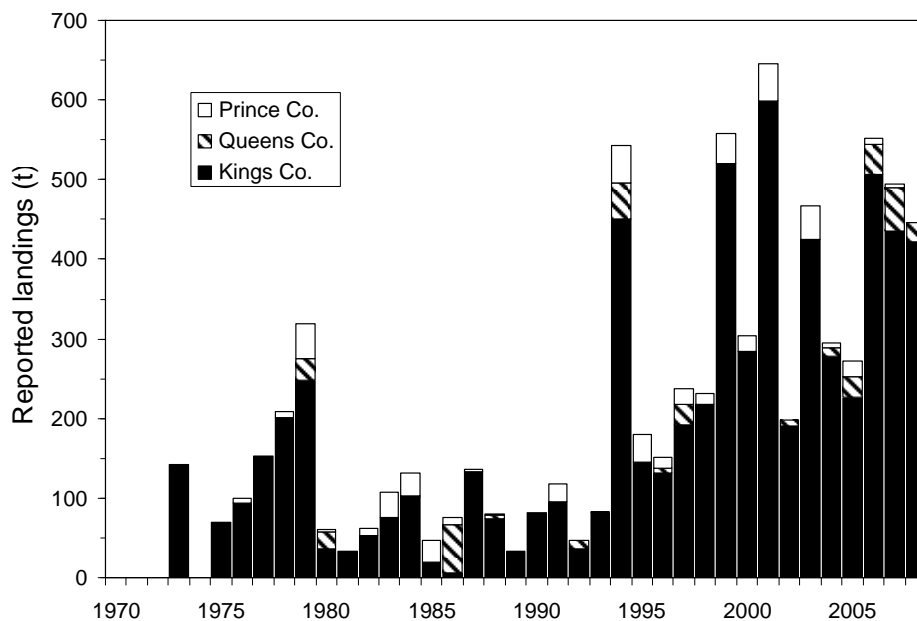


Figure 2. Reported landings (t) of Atlantic silversides on Prince Edward Island.

The modern silverside fishery began in PEI in 1973, first with seines, and in the following year, with traps. This fishery primarily supplied a Japanese food market, but sales subsequently shifted to the U.S., where fish were used as food for birds in zoos, and as angling bait. In the mid 1990s, the PEI silverside market largely shifted to supplying bait in the local lobster fishery. Prior to this change, the market was intolerant of sticklebacks mixed as bycatch with silversides, so trap catches were often released because the catch could not be sold. With the increased demand for the bait market, tolerance of stickleback bycatch increased, so trap releases due to excessive stickleback bycatch became less frequent.

Silverside traps also capture other species as bycatch, including tomcod, trout, hake, smelts, sand lance, striped bass, and mackerel, with a regulatory requirement that they be released alive. The extent of the bycatch and the survival of fish released has not been measured.

The PEI silverside fishery is open from October 1 to December 31, but gear is removed from water before freeze-up. Prior to 1994, there were individual quotas per licence. The individual quotas per licence were eliminated in 1994. The number of silverside licences on PEI increased

from 11 in 1984, to 44 in 1993, and to 103 in 1995 (Cairns 1996). A freeze on the issuance of new licences was imposed in 1995. There were 81 licences on PEI in 2008. The reduction in licences between 1995 and 2008 was due to consolidation of some licences which were authorized to fish one trap, to licences which are authorized to fish two traps. The PEI silverside fishery has always operated under a system where particular sites, termed berths, are allocated to particular fishers. In response to increasing demand for silverside fishing sites on PEI, DFO established in 2003 a silverside berth committee to review applications and to allocate fishing sites based on historic effort and geographic distribution of effort.

Two licences have been issued to fish silversides in Gulf Nova Scotia for over a decade. These fisheries are active, but no landings have been registered in the DFO statistical system.

Assessment

The Policy on New Fisheries for Forage Species identified several biological and management system prerequisites.

Biological prerequisites

1. "It should be possible to estimate some metrics of the status of the forage species on a regular basis, and there must be some values of those metrics against which achievement of conservation can be judged. In all cases fisheries should not cause populations (or biological characteristics) of forage species or their predators to fluctuate outside the normal range of variability of the populations." (DFO 2009).

Atlantic saury

There is no information on which to assess the biomass of the species in the western Atlantic nor the proportion of that biomass which enters the Gulf of St. Lawrence and would be available to the fisheries. There are no indicators of Atlantic saury abundance for the Gulf of St. Lawrence.

Atlantic silverside

There is no information on which to assess the biomass of the species in individual bays or overall in the southern Gulf of St. Lawrence. There are no validated fishery-dependent or fishery-independent indicators of Atlantic silverside abundance for the Gulf of St. Lawrence.

- 2 "It should be possible to identify some species of predators which would be appropriate for evaluating the sustainability of the fishery in the context of ecologically related species. The underlying assumption is that if a fishery on a forage species is being managed such that conservation of ecologically related species of high sensitivity are being conserved, conservation of less sensitive species is even less likely to be put at risk by the fishery." (DFO 2009).

Atlantic saury

As a small-bodied, pelagic fish which spends a substantial amount of time in the upper portion of the water column, it is likely preyed upon by a broad variety of predators, including fish, seabirds, and marine mammals. In many years and conditional on surface temperatures, Atlantic saury have comprised a high proportion of the diet of gannets off the northeast coast of Newfoundland (Montevecchi 2007). It is

Atlantic silverside

Silversides reside primarily in shallow bays and estuaries during the open water season. Given the geographic gaps in diet studies and sometimes modest sample sizes, it is likely that all fish, marine mammal, and bird predators whose range overlaps with the silverside consume it. However, there are no indications from the available information that silverside is an important food source for any of these predators and no corresponding

Gulf Region

Opportunities for fisheries on forage species

unknown whether commercial fishing for Atlantic saury could negatively affect northern gannets. In this context, there may be benefits to monitoring diets and demographic characteristics of gannets in relation to the fishery exploitation.

predator species could be monitored in relation to the fishery exploitation.

3. "It should be possible to estimate the risk that the proposed level of harvest poses to the forage species and ecologically dependent species." (DFO 2009).

Atlantic saury

There is assumed to be one stock of Atlantic saury in the northwest Atlantic. There is no information on the abundance of Atlantic saury in the northwest Atlantic and specifically the portion which enters the southern Gulf to conduct a risk assessment even in a qualitative sense.

Atlantic silverside

There is no information on stock structure of Atlantic silverside in the southern Gulf. In the absence of evidence, the precautionary approach would consider each bay as a stock unit and manage each accordingly. However, there is no information on the abundance of Atlantic silverside in individual bays and overall in the southern Gulf to conduct a risk assessment even in a qualitative sense.

4. "There should be sufficient knowledge of the forage species and its relationships to major marine predators to guide the proper prosecution of the fishery in space and time." (DFO 2009).

Atlantic saury

There is insufficient knowledge of Atlantic saury in the western Atlantic and in the Gulf of St. Lawrence with which to assess the fishery potential and its consequences on the ecosystem. Any fishery which develops should have a well defined sampling and monitoring protocol to gather baseline information such as catch and effort, biological characteristics (size, age sex composition), prey of saury, bycatch and interactions with other species in the same area.

Atlantic silverside

There is limited knowledge of Atlantic silverside abundance and no information on stock structure. Silversides are short-lived and survivors of the first year are the spawners for the following spring. Fisheries have occurred in PEI for over three decades. Annual variations in landings are presumed to reflect variations in abundance in the last decade of this short-lived species but there are also challenges with reporting of catches. Consequences of these fisheries to predators are not known. Therefore existing and new fisheries should have well defined sampling protocols to gather baseline information such as catch, effort, biological characteristics (size, age sex composition), prey, bycatch and interactions with other species in the same area.

Management prerequisites

1. "Consistent with the precautionary approach, there should be clearly identified conservation (limit) reference points and associated harvest control rules, for measurable properties of both the forage species and some dependent marine predators." (DFO 2009).

Atlantic saury

The present knowledge is insufficient to develop biomass or fishing rate reference points for Atlantic saury.

1. "For the reference points and harvest control rules to be able to ensure conservation is achieved, monitoring and enforcement must be adequate to ensure high compliance with the management plan occurs, and is seen to occur." (DFO 2009).

Atlantic saury

There are no reference points which can presently be defined. Although a proxy fishing rate reference point could be developed, there are no measures of abundance against which catches can be assessed.

2. "Because of the need for visible and high compliance of commercial fisheries with all provisions of the management plans, and for extensive and reliable monitoring of both the forage species and often selected predators, management costs for these fisheries are expected to be high. Industry proponents and participants have a responsibility to carry a fair share of the incremental costs of management." (DFO 2009).

3.

Atlantic saury

The current knowledge of Atlantic saury in the western Atlantic and the Gulf of St. Lawrence is so scant that any information on biology, distribution, and relative abundance which would be obtained during the development of Atlantic saury fisheries would benefit the development of management processes consistent with the conservation objectives on forage species.

3. "Management plans for fisheries on forage species should include explicit provisions to ensure that fisheries do not unduly lead to local depletions of the forage species for time scales long enough to have consequences for predators." (DFO 2009).

Atlantic saury

The present knowledge is insufficient to determine the causes of the variation in abundance of Atlantic saury in the southern Gulf. The presence and relative abundance of Atlantic saury in the eastern side of the

Atlantic silverside

The present knowledge is insufficient to develop biomass or fishing rate reference points for Atlantic silverside.

Atlantic silverside

There are no reference points which can presently be defined. There are no measures of abundance against which catches can be assessed. Some catches are unrecorded in official statistics making monitoring of the fishery difficult.

Atlantic silverside

As a forage species which is used primarily as bait, harvest data in these fisheries is incomplete. The total removal (tons) of silverside in southern Gulf fisheries is not known. Basic biological information on silversides is available but indices of abundance, and knowledge of stock structure are not available. Fishing plans need to include management tools to gather fisheries indicators such as harvests and effort by location.

Atlantic silverside

The most important consideration is the assumption of the stock structure of Atlantic silverside in the southern Gulf. The precautionary assumption should be that there is stock structure, that it occurs by bay

Gulf Region

southern Gulf of St. Lawrence is likely associated with the warm surface temperatures in that part of the Gulf as well as the abundance of the overall stock of Atlantic saury. Local knowledge indicates that Atlantic saury are variably abundant depending on the year. These variations in perceived abundance are observed in the absence of any directed fisheries of any consequence on Atlantic saury in the western Atlantic.

4. "Limitation of bycatch and impacts on habitats often should be important components of Management Plans for forage species." (DFO 2009).

Atlantic saury

The experience of the fishermen who conducted exploratory fishing for Atlantic saury in St. Georges Bay in November 1995 indicates that the mid-water trawl modified for fishing at the surface resulted in minimal bycatch of other species. The level of bycatch would depend upon when fishing occurred. If pelagic trawling was to occur earlier, bycatch of herring, mackerel, jellyfish, and leatherback turtles could be expected. Leatherback turtles are a listed species at risk and are known to be present in St. George's Bay in the fall. Impact on habitat would be negligible as the pelagic gear does not touch the bottom. Atlantic saury have also been reported from mackerel trapnets in the Auld's Cove area but the mesh size of the mackerel trapnets is such that it results in meshing of saury which causes grief to the fishermen. Trapnets would have a greater potential for bycatch and habitat impacts than the pelagic surface trawl which has been used previously.

5. "Management of commercial fisheries on forage species should include Long-term Plans which delineate the expected sizes of the fleet and harvests over several years, specify the long-term strategic objectives for the fishery, as well as the annual (or short-term) operational objectives within which the fishery will operate, and the harvest control rules which will guide and constrain operations." (DFO 2009).

Opportunities for fisheries on forage species

and fisheries should be managed accordingly. Such measures would reduce the risk to silverside stocks and to dependent ecosystem components.

Atlantic silverside

The most important bycatch species in silverside trapnet fisheries are sticklebacks followed by other estuarine species. Sticklebacks are landed in PEI and the impact of this bycatch fishery on stickleback is not known. Other species including potential species of concern (white hake and striped bass) have also been reported and these must be released back to the water. There has not been a detailed study of bycatch in silverside fisheries. A harvesting plan should have measures that would minimize the impact on non-target species. The impact of trapnets on the habitat in estuaries has not been examined. Interactions with seals have been noted in existing fisheries and some of these have resulted in death of the marine mammal.

Atlantic sauryAtlantic silverside

Prudent development of these fisheries during the initial years when scientific and fisheries data can be collected would be consistent with this condition. Monitoring is required in developing and existing fisheries.

Sources of Uncertainty

There is a very large knowledge gap for Atlantic saury, including basic information on biology, distribution and abundance in the southern Gulf of St. Lawrence. The long-term, marine fish monitoring programs at DFO are mostly directed at demersal fish stocks and have not used gears appropriate for sampling pelagic fish like Atlantic saury which are primarily distributed in the upper part of the water column. Little is known of the role of Atlantic saury in the ecosystem and in particular the importance of Atlantic saury as prey for marine organisms. Observations of the presence and activities of tuna, porpoises, whales, turtles and seabirds in the vicinity of fishing operations directed at Atlantic saury would begin to address this knowledge gap.

Stock structure of Atlantic silverside is not known. Little is known of the role of Atlantic silverside in the ecosystem and in particular the importance of Atlantic silverside as prey for marine organisms. In the absence of such information, prudent management for Atlantic silverside would distribute effort and catches across bays rather than having intensive exploitation in a few locations.

There has not been a detailed study of bycatch in silverside fisheries.

There are no validated indices of abundance for either silverside or saury in the southern Gulf of St. Lawrence.

As a forage species which is used primarily as bait, harvest data for silverside fisheries in DFO statistics are incomplete.

CONCLUSIONS AND ADVICE

Based on their biological and ecological characteristics, Atlantic saury and Atlantic silverside qualify as forage species.

Based on the biological and management prerequisites, commercial fisheries on Atlantic saury and Atlantic silverside would not presently meet the conservation objectives described in the Policy on New Fisheries on Forage Species. The main reason is the lack of scientific information to inform on reference points, abundance and ecosystem interactions.

There is such a paucity of information on Atlantic saury in the western Atlantic and the southern Gulf of St. Lawrence that information which can be obtained during exploratory fisheries would benefit the development of a long-term management plan. With the possible exception of gannets, there is no information at present to identify a predator species which is highly dependent on Atlantic saury and which could be harmed by a cautiously developing Atlantic saury fishery.

Silversides are short-lived and survivors of the first year are the spawners for the following spring. Fisheries have occurred in PEI for over three decades. Annual variations in landings are presumed to partly reflect variations in abundance of this short-lived species, particularly in the

last decade. Based on the low number (2) of existing licences in Gulf NS, and information on the broad distribution of silversides in the southern Gulf, there are opportunities for additional commercial effort on this species in the Gulf Nova Scotia area.

Any additional information which can be obtained as new fisheries develop would benefit the development of a long-term management plan.

Catch data from silverside fisheries, including the ones in Nova Scotia, are not completely recorded in the statistics of DFO. This is a common problem with bait species fisheries.

The most important consideration in the management of silverside fisheries is stock structure. The precautionary assumption should be that there is stock structure, that it occurs by bay, and fisheries should be managed accordingly. Such measures would reduce the risk to silverside stocks and to dependent ecosystem components. Any development of such fisheries requires a process for recording harvests at a spatial scale appropriate to this species; for silversides this would be harvest by bay. Fishing plans need to include management tools to gather fisheries indicators such as harvests, including bycatch and effort by location. Consequences to predators of these fisheries are not known.

OTHER CONSIDERATIONS

Estuarine habitat for silversides can increase or decrease as a result of storm events which modify the coastline. This could have implications on the productive capacity for silversides, on the availability of fish to fisheries, on annual indicators of abundance and on allocation of fishing sites using a designated berth system.

There is a general concern regarding exploitation of forage species such as silverside and saury. Alternative sources of bait from existing fisheries and potential from species / stocks which are better known, and for which a substantial biomass is available, should be considered to satisfy these requirements before beginning or expanding fisheries on forage species.

Bycatch of sticklebacks may be unavoidable and difficult to manage in the silverside fishery. In that case, an assessment of sticklebacks as a forage species would be warranted.

SOURCES OF INFORMATION

- Cairns, D.K. 1996. An update on the Atlantic silverside fishery of Prince Edward Island, 1995. DFO Atlantic Fisheries Res. Doc. 96/116.
- Collette, B.B., and G. Klein-MacPhee. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, 3rd. ed. Smithsonian Institution Press. Washington.
- DFO. 1997. Proceedings Of The Workshop On Ecosystem Considerations For Krill And Other Forage Fisheries. DFO Canadian Stock Assessment Secretariat Proceedings Series 97/5.
- DFO. 2009. Policy On New Fisheries For Forage Species. (2009-03-13) (<http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/forage-eng.htm>)
- Maguire, J.-J., M. Sissenwine, J. Csirke, R. Grainger, S. Garcia. 2006. The state of world highly migratory, straddling and other high seas fishery resources and associated species. FAO Fisheries Technical Paper 495.

- Montevecchi, W. A. 2007. Binary dietary responses of northern gannets *Sula bassana* indicate changing food web and oceanographic conditions. *Mar. Ecol. Prog. Ser.* 352: 213–220.
- Scott, W.B. and M.G. Scott. 1988. *Atlantic fishes of Canada*. Can. Bull. Fish. Aquat. Sci. 219: 731 pp.
- Sergeant, D.E. and H.D. Fisher. 1957. The smaller Cetacea of eastern Canadian waters. *J. Fish. Res. Board Can.* 14: 83 – 115.

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