

## *Report*

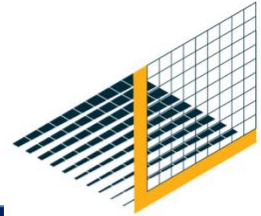
# Value of Atlantic Mackerel and Stock Rebuilding in Canada

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# Table of Contents

<b>1. INTRODUCTION .....</b>	<b>4</b>
1.1 Background .....	4
1.2 Goal and Objectives.....	5
<b>2. METHODS.....</b>	<b>6</b>
2.1 Commercial Fisheries .....	6
2.2 Recreational Fisheries.....	6
2.3 First Nations Fisheries .....	7
2.4 Rebuilding Scenarios .....	8
<b>3. RESULTS .....</b>	<b>11</b>
3.1 Commercial Fisheries .....	11
3.2 Recreational Fisheries.....	17
3.3 First Nations.....	17
3.4 Rebuilding Options.....	19
<b>4. DISCUSSION .....</b>	<b>20</b>

# 1. INTRODUCTION

## 1.1 Background

The Atlantic mackerel is found in temperate waters on both sides on the North Atlantic Ocean. Along the North American coast, this species ranges from Triangle Harbour, Labrador, southward to Cape Hatteras, North Carolina. In Canada, the Atlantic mackerel is most abundant around Newfoundland, in the Gulf and estuary of the St. Lawrence, off the coast of Nova Scotia and in the Bay of Fundy during summer and autumn.<sup>1</sup>

Fisheries and Oceans Canada (DFO) manages Atlantic mackerel fisheries in Northwest Atlantic Fisheries Organization (NAFO) subareas 3 and 4. Between 2005 and 2013, commercial landings decreased from 54,726 t to 8,674 t, then dropped to a record low of 4,272 t in 2015.<sup>2</sup> The total allowable catch (TAC) had been as high as 200,000 tonnes until 2000, then 150,000 tonnes until 2009, down to 36,000 tonnes in 2012, and was further reduced to 8,000 tonnes in 2019. Other protective measures include a continued freeze on new commercial licences for fixed and mobile gear, increased catch reporting requirements, and an increase in the minimum fish size. These measures aim to stabilize stocks and begin a rebuilding process.

Bill C-68 passed royal assent in June, 2019, bringing in numerous measures to “modernize the Fisheries Act”. Restoring and re-building fish stocks is one of six core areas of focus. In the case of Atlantic mackerel, the Act requires the Minister to “develop and implement rebuilding plans for major stocks listed in regulation that are depleted”. In particular, DFO is bound to the following sub-sections set out in Bill C-68<sup>3</sup>:

- 6.2 (1) If a major fish stock has declined to or below its limit reference point, the Minister shall develop a plan to rebuild the stock above that point in the affected area, taking into account the biology of the fish and the environmental conditions affecting the stock, and implement it within the period provided for in the plan.

...and:

- (2) If the Minister is of the opinion that such a plan could result in adverse socio-economic or cultural impacts, the Minister may amend the plan or the

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<sup>1</sup> Government of Newfoundland and Labrador, 2002. Emerging Species Profile Sheets Department of Fisheries and Aquaculture: Atlantic Mackerel (*Scomber scombrus*).

<sup>2</sup> Canadian Science Advisory Secretariat (CSAS), 2019. Assessment of the Atlantic mackerel stock for the Northwest Atlantic (subareas 3 and 4) in 2018.

<sup>3</sup> Parliament of Canada, 2019. Statutes of Canada 2019: Chapter 14 An Act to amend the Fisheries Act and other Acts in consequence (Royal Assent to Bill C-68 June 21, 2019).

implementation period in order to mitigate those impacts while minimizing further decline of the fish stock.

The stock has been assessed at 40% of the limit reference point (LRP) for the last decade.<sup>4</sup> The Atlantic Mackerel Advisory Committee (AMAC) reviews stock assessments, science, management, and other fisheries developments. A Mackerel Rebuilding Plan Working Group (MRPWG) has been established to bring representatives from DFO, provincial governments, industry stakeholders, aboriginal groups and others with an interest in the fishery together. The MRPWG aims to improve the management of Atlantic Mackerel fishery in Atlantic Canada and a Rebuilding Plan document is anticipated in 2020.<sup>5</sup>

Rebuilding Atlantic mackerel stocks will require some fishing to be forgone in the short-term in order to gain more productive fishing in the long-term. There is interest in better understanding past, present, and future values associated with Atlantic mackerel fisheries. A well-informed approach that respects the socio-economic implications of decisions, maintains fairness, and maximizes sustainable value, will represent the best opportunity to engage everyone in collaborative efforts.

## 1.2 Goal and Objectives

The overall goal is to assess economic values of Atlantic mackerel (*Scomber scombrus*) and support decisions regarding stock rebuilding options. The following more specific objectives are to examine:

- **Fishery values** – according to key fisheries including: commercial catch for consumption, First Nations fisheries and commercial catch for bait (primarily for shellfish fisheries), and recreational angling.
- **Rebuilding options** – that involve reduced fishing pressure to allow stocks to rebuild, and may involve trade-offs between current and future fishing; and
- **Economic analysis** – using a cost-benefit framework to assess trade-offs between short-term and long-term fishing under different management scenarios to help rebuild stocks.

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<sup>4</sup> DFO. 2017. Assessment of the Atlantic mackerel stock for the northwest Atlantic (subareas 3 and 4) in 2016. Can. Sci. Advis. Sec. Sci. Advis. Rep., 2017/034.

<sup>5</sup> Fisheries and Oceans Canada (DFO), 2019. Fisheries Management Decisions: Atlantic Mackerel - NAFO subareas 3 and 4 (online: [www.dfo-mpo.gc.ca/fisheries-peches/decisions/fm-2019-gp/atl-16-eng.html](http://www.dfo-mpo.gc.ca/fisheries-peches/decisions/fm-2019-gp/atl-16-eng.html))

## 2. METHODS

### 2.1 Commercial Fisheries

DFO is the source for all commercial fisheries data. Although mackerel bait catches are allowed with certain commercial licences, these are not recorded, so bait catch is estimated as part of DFO Science stock assessments. Landings volume data are compiled by Northwest Atlantic Fisheries Organisation fishing subareas, and by province. Landings values and prices are shown by province only. All landings values and prices are converted to constant 2018 dollars using the Statistics Canada Canadian consumer price index (all items). This allows for real comparison of values over time.

### 2.2 Recreational Fisheries

DFO does not collect annual recreational catch statistics. DFO conducts a survey of recreational fishing in Canada every five years to estimate: angler participation, angling days, amounts caught and kept by species, and spending related to recreational fishing. The survey shows Atlantic mackerel is caught primarily in three provinces: Newfoundland and Labrador, Nova Scotia, and Prince Edward Island (no Quebec data).

The latest survey in 2015<sup>6</sup> indicated that mackerel is the second main species caught in both Nova Scotia and Prince Edward Island. The 2015 report does not provide as much detail by species so the 2010 report is used to depict mackerel angling activity in the region. Before proceeding to use 2010 data it is important to recognize general developments between the two survey years (table below).

**Table 2.1: Key comparisons from 2010 and 2015 recreational fishing surveys**

	2010	2015	% Change
<b>Anglers</b>			
NL	76,254	116,037	52%
NS	64,112	57,613	-10%
PEI	8,680	7,152	-18%
<b>Total</b>	<b>149,046</b>	<b>180,802</b>	<b>21%</b>
<b>Spend per angler (2018\$)<sup>1</sup></b>			
NL	1,678	1,030	-39%
NS	1,008	823	-18%
PEI	743	799	7%
<b>Total</b>	<b>1,335</b>	<b>955</b>	<b>-28%</b>

<sup>6</sup> Fisheries and Oceans Canada (DFO), 2019. Survey of Recreational Fishing in Canada, 2015 (online: <https://www.dfo-mpo.gc.ca/stats/rec/can/2015/index-eng.html>)

*Sources: Department of Fisheries and Oceans, 2010 and 2015, Survey of Recreational Fishing in Canada; Statistics Canada; Consumer Price Index (all items).*

*1. Spending is shown in constant 2018 dollars and only includes “direct” and “wholly attributable” spending according to DFO survey definitions.*

The number of anglers is up substantially in NL (52%), but down somewhat in Nova Scotia (-10%) and Prince Edward Island (-18%). The spending per angler is down in NL (-39%), down in NS (-18%), and up in PEI (7%). Although these are general results for all species, the use of 2010 data for mackerel activity and estimates should keep these trends in mind.

The spending per angler is based on DFO survey questions regarding “direct” expenditures and major purchases “wholly attributable” to recreational fishing. Purchases “partly attributable” to fishing were captured in the survey, but are not used here to remain conservative. For detailed methodology refer to DFO reports online (<https://www.dfo-mpo.gc.ca/stats/rec/can/2015/index-eng.html>). The direct and wholly attributable expenditures included by DFO are:

- **Direct expenditures:** include accommodations, campsite fees, vehicle costs, ferry costs, air costs, other travel costs, owned boat costs, shared boat costs, rental costs, fishing supplies, guide costs, licence fees, access fees, other direct expenditures (food costs excluded to match spending shown in Survey report). Direct expenditures are reported at provincial and territorial levels.
- **Package deals:** include guided charter boat costs, full charter boat costs, fly-in costs, lodge/resort costs, and costs of other packages. Package deals are reported by fishing region within provinces and territories.
- **Major purchases wholly attributable to fishing:** include fishing equipment, camping equipment, boating equipment (separate for new and used), vehicles (separate for new and used), land and buildings, and other major purchases. Major purchases are reported at provincial and territorial levels. The Survey collects information regarding other investments *partially* attributable to fishing, but these are excluded to maintain a conservative approach.

Since anglers in general may target more than one species, the analysis was repeated to include the anglers that only caught mackerel, therefore eliminating the possibility of spending effects from other species, and the resulting value remained essentially the same.

### 2.3 First Nations Fisheries

Fisheries and Oceans is the source for data on First Nations fisheries activity. Only Nova Scotia landings data at species grouping level is readily available from DFO. First Nations landings from other provinces are omitted so this will understate their participation in the fishery. Custom tabulations of annual landings (quantity and value) under commercial communal licences are shown in the results section. Due to confidentiality restrictions

(generally, landings by fewer than 5 licences), data cannot be provided at the species level, except for lobster. Otherwise, the data are grouped to provide as much detail as possible.

## 2.4 Rebuilding Scenarios

From 2017 to 2019, as part of the rebuilding process, DFO evaluated rebuilding strategies for northwestern Atlantic Mackerel<sup>7</sup>. In this report, the management strategy evaluation (MSE) is based on a set of operating models (OMs) that use historical data to project outlooks for the mackerel stock up to the year 2029. Although the U.S. has provisions to catch up to 20,000 mt, recent U.S. catches have been less than or similar to Canada's. The model used here (OMstress3) assumes joint fishery decisions with the U.S. and a total allowable catch (TAC) that is equivalent in both countries, and this is line with management expectations going forward.

The DFO analysis evaluates a set of eleven (11) harvest control rules (HCRs) with respect to the TAC decision each year. This report considers two of the HCRs: 1) “minimize fishing” HCR 4 with an initial TAC of zero to maximize recovery followed by a linear ramp up of the TAC, and 2) “maximize fishing” HCR 10 with a minimum TAC of 8,000 t. The assumptions and approach are described further below.

### General assumptions:

- ❑ **Undeclared catch** - The Rebuilding Plan identified substantial efforts to eliminate undeclared catch so this is assumed to be zero throughout (no implementation error).
- ❑ **Values** – are set for the whole Atlantic region at current average levels discussed above in this report, including \$0.68 per lb for TAC fishing, and \$1.10 for bait fishing to reflect the cost of imported frozen alternatives. The analysis focuses on the TAC and bait fisheries so a value for the recreational fishery is not set.
- ❑ **Revenues versus costs** – the aim is to consider the consequences to the economy of choosing to primarily rebuild stocks or maximize short-term fishing, not to consider the financial position of individuals or businesses. Although commercial fishers incur costs to catch mackerel, which could be subtracted from revenues, the costs flow as expenditures through the economy to boat builders, fuel suppliers, crew, equipment providers and repair and maintenance shops. The initial revenues partly kept by the harvester and partly spent on inputs to fishing is all considered an economic benefit of continued fishing. Bait fishing also incurs costs, but again this is preferable to the

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<sup>7</sup> Van Beveren, E., J.R. Marentette, A. Smith, M. Castonguay, D.E. Duplisea. 2019. Evaluation of Rebuilding Strategies for Northwestern Atlantic Mackerel (NAFO Subareas 3 and 4). DFO Can. Sci. Advis. Sec. Res. Doc. 2019.



Canadian economy versus economic “leakages” of importing bait from other countries. All of the recreational “value” is expenditures incurred to go angling, and these expenditures benefit a wide range of goods and services suppliers. This is a lower-bound estimate of recreational value since anglers are (more than) “willing to pay” this in order to go angling. The benefit is assumed to exceed the cost (often referred to as consumer surplus) or they would not go fishing. We do not complete a full economic impact analysis, so the results in this report understate the economic benefits, but this aligns more closely with an economic analysis than a financial one.

- **Median and average values** – The MSE report focuses on median values for projected catches under different scenarios. This is appropriate, but it is also possible to examine average values, since median values understate potential re-building success.

### HCR 4 assumptions:

- **Recreational fishery** – the current catch level is maintained for the whole period (approximately 425 t annually).
- **Bait fishery** – the current level of estimated annual bait catch (2,500 t) is fixed for the whole period.
- **TAC fisheries (US and Can)** – these are set to the remaining available catch after recreational fishing and bait fishing amounts have been accounted for.

### HCR 10 assumptions:

- **Recreational fishery** – the current level (approximately 425 t) of recreational fishing is preserved as long as sufficient catch is available.
- **Bait fishery** – the bait fishery is the next most valuable fishery and, after recreational catch is accounted for, the current level of estimated bait catch (2,500 t) is preserved as long as available catch allows.
- **TAC fisheries (US and Can)** – these are set to the remaining available catch after recreational fishing and bait fishing amounts have been accounted for.

### Economic analysis:

- **Cost-benefit analysis (CBA)** – The economic assessment relies on a cost-benefit framework where the difference between the two scenarios (minimize fishing vs. maximize fishing) is assessed over the twenty-year period (2020 to 2039). The 2020 to 2039 projected catches for recreational fishing, commercial fishing, and bait fishing are laid out for each scenario (HCR 4 and HCR10). The values (e.g. prices) are applied to the catches in each fishery. The resulting HCR 10 values are subtracted from the HCR 4 values each year to show the annual difference. A net present value calculation (see discount rates next) is performed on the annual differences to produce a result for the cost-benefit analysis.
- **Discount rates** – These are used to handle economic values over time, so future values are converted to (net) present values. This is a percentage that reduces values from year to year. According to the Treasury Board *Canadian Cost-Benefit Analysis Guide*, discount rates may range from 3% to 7% where lower values are preferred for assessments involving environmental, social, and inter-generational issues. Lower

rates are also expected in periods of low interest rates set by the Bank of Canada. Rates of 3% and 5% are used here.

- **Internal rate of return (IRR)** – This is also calculated to indicate the “investment value” of stock rebuilding. IRR is related to NPV, where the IRR value (percentage) is the discount rate that would make the net present value of all future costs and benefits equal to zero. It is also considered the compound annual rate of return expected on an investment.

### 3. RESULTS

#### 3.1 Commercial Fisheries

##### Landings

DFO records indicate there were 8,003 commercial licences for mackerel in 2016. This is comprised of 2000 in the Maritimes Region, 3,016 in the Gulf Region, 2,179 in Newfoundland and Labrador, and 808 in Quebec. These are not all active licences and these do not include fishers that may catch mackerel for bait on a commercial licence for another species (e.g. lobster, crab).

DFO reports Atlantic mackerel landings by province and fishing region in Canada. The table below shows landings in five-year periods since 1999. This indicates the regional and provincial interests in commercial fishing for mackerel. NL has consistently landed the most mackerel, but this varied from 43% of landings in the first five-year period to 79% in the second period, then 77%, and down to 37% in the last five years. NS and PEI followed behind NL with each taking 18% in the first five years, then dropping to the 4-8% range in the middle years, and returning to 20% and 22% for PEI and NS respectively in the last five years.

**Table 3.1: Five-year average landings, by region (tonnes, live wt)**

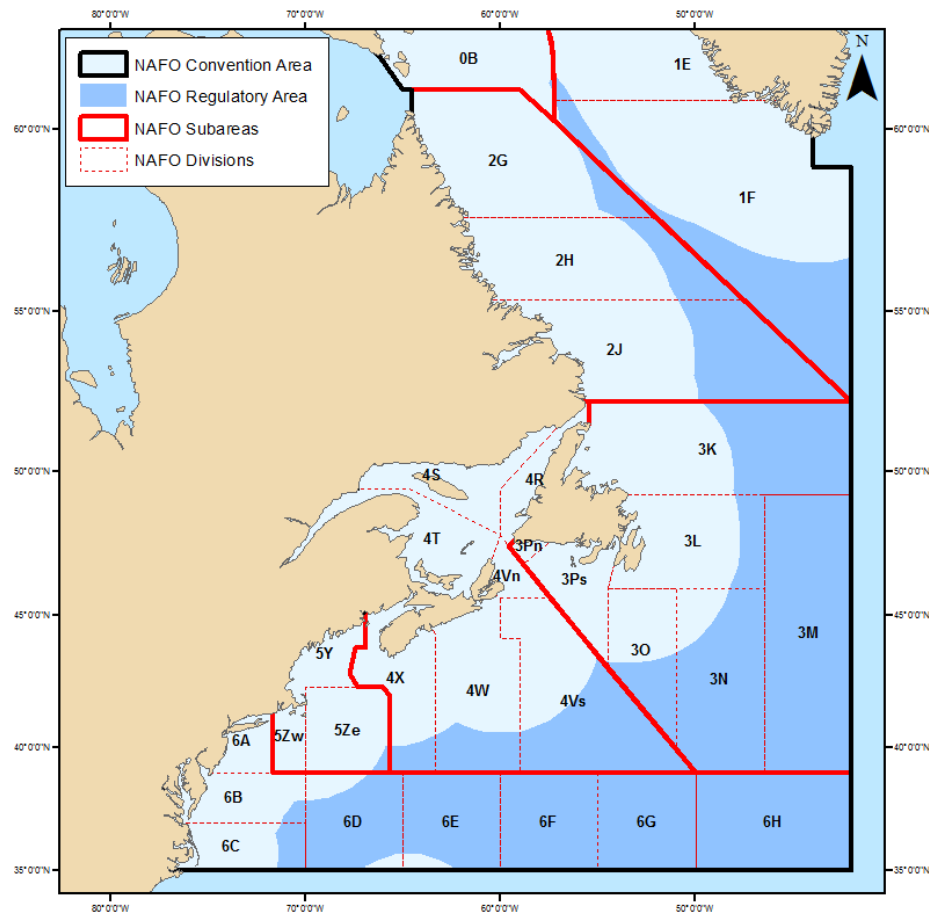
Years	NS			NB			PEI	QC	NL	Total
	Mar	Gulf	Total	Mar	Gulf	Total				
99-03	3,650	1,371	5,021	10	2,117	2,128	4,975	3,932	11,902	27,956
04-08	2,408	1,220	3,628	5	1,407	1,412	3,615	1,769	38,917	49,342
09-13	629	105	734	1	1,172	1,043	1,633	1,581	16,516	21,507
14-18	1,325	376	1,702	-	449	416	1,537	1,156	2,871	7,681

*Source: Department of Fisheries and Oceans, 2018. Zonal Interchange File (online: [www.dfo-mpo.gc.ca/stats/commercial/land-debarq-eng.htm](http://www.dfo-mpo.gc.ca/stats/commercial/land-debarq-eng.htm))*

*Note: Mar = Maritimes Region, Gulf = Gulf of St. Lawrence Region*

DFO also reports landings by NAFO subareas and this provides a better sense of where Atlantic mackerel are caught. The map of NAFO areas in the figure below corresponds to the fishing areas shown in the next table.

Figure 3.1: Map of NAFO subareas for reference



Source: NAFO

The next table shows the percentage of mackerel that is landed in each NAFO area in five-year intervals since 1999. NAFO area 4R along the western coast of NL captures the greatest share of mackerel, the only exception being in the last five years when 4T (Gulf) and 3K (Northeast NL) have caught proportionally more in years of low catches. The shares in 4T and 3K have been the next highest (after 4R) throughout the twenty-year period.

Table 3.2: Percentage of mackerel landings, by NAFO area

Years	2GJ	3K	3L	3PO	4R	4S	4T	4V	4W	4X	5YZ <sup>2</sup>	NA <sup>3</sup>	Total
99-03	0%	7%	0%	0%	36%	0%	42%	1%	0%	11%	0%	1%	100%
04-08	0%	31%	9%	0%	38%	0%	15%	0%	0%	4%	0%	1%	100%
09-13	0%	19%	1%	12%	45%	1%	19%	0%	0%	2%	0%	1%	100%
14-18 <sup>1</sup>	0%	24%	0%	1%	18%	2%	37%	2%	2%	12%	1%	1%	100%

Source: Fisheries and Oceans Canada, 2018. Zonal interchange file format - Custom tabulation.

1. Values for 2017-2018 are preliminary and values from the Gulf region missing as of the 2019 stock assessment.

2. Small portions of Canada's EEZ occur in NAFO Divisions 5YZ.

3. Geospatial data missing.

## Landed Values

The landed value of mackerel by region is reported by DFO and summarized in five-year averages over the past twenty years (table below). The Canadian consumer price index (CPI all items) is used to convert historical values into constant 2018 dollars. This shows the “real” change in value of landings over the period. The distribution of landed values in the region follows the same pattern as the landings, however there are some important regional differences in prices (next table).

**Table 3.3: Five-year average values of mackerel landings, by region (2018 \$000s)**

Years	NS			NB			PEI	QC	NL	Total
	Mar	Gulf	Total	Mar	Gulf	Total				
99-03	2,266	975	3,241	2	1,814	1,816	3,749	2,188	4,023	15,018
04-08	1,639	885	2,524	5	1,116	1,121	2,784	1,075	15,240	22,744
09-13	649	78	726	1	912	837	1,536	1,140	8,478	12,717
14-18 <sup>1</sup>	2,655	449	3,104	-	396	797	2,683	1,280	1,912	9,777

Source: Department of Fisheries and Oceans, 2018. Zonal Interchange File (online: [www.dfo-mpo.gc.ca/stats/commercial/land-debarq-eng.htm](http://www.dfo-mpo.gc.ca/stats/commercial/land-debarq-eng.htm))

Note: Mar = Maritimes Region, Gulf = Gulf of St. Lawrence Region

1. 2018 value is estimated based on regional average price according to DFO

The prices per pound of mackerel in constant 2018 dollars (table below) indicate a wide range in the last five years. Prices in NS and NB tend to be highest, followed by PEI, then QC, and the lowest prices are in NL. The gap between top and bottom widened in the last five years, where Nova Scotia averaged \$0.87 per pound compared to \$0.29 per pound (about one-third) in Newfoundland and Labrador. Forces of supply and demand are both exerted on prices in Nova Scotia. Demand is strong from lobster and crab fishers making good returns on their primary catch, while mackerel supply has dropped so prices have climbed steeply. This is the driver behind Nova Scotia’s leading imports of frozen mackerel for bait (see imports below).

**Table 3.4: Five-year average prices<sup>2</sup> of mackerel landings, by region (2018 \$/lb)**

Years	NS			NB			PEI	QC	NL	Total
	Mar	Gulf	Total	Mar	Gulf	Total				
99-03	0.28	0.38	0.29	x	0.38	0.38	0.33	0.26	0.14	0.25
04-08	0.33	0.31	0.31	x	0.35	0.35	0.35	0.27	0.17	0.21
09-13	0.47	0.46	0.47	x	0.36	0.38	0.42	0.33	0.30	0.33
14-18 <sup>1</sup>	1.00	0.55	0.87	x	0.39	0.77	0.69	0.49	0.29	0.60

Source: Department of Fisheries and Oceans, 2018. Zonal Interchange File (online: [www.dfo-mpo.gc.ca/stats/commercial/land-debarq-eng.htm](http://www.dfo-mpo.gc.ca/stats/commercial/land-debarq-eng.htm))

Note: Mar = Maritimes Region, Gulf = Gulf of St. Lawrence Region

1. 2018 value is estimated based on regional average price according to DFO

2. Straight averages of prices are used rather than prices weighted by landings volume

## Exports

Mackerel is prone to rapid deterioration in quality so it is exported almost exclusively (97%) in frozen form. NL account for 79% of the frozen exports from Atlantic Canada, then 17% is shipped from NS. Additional quantities from NL are processed into pet foods. The exports for recent years are shown in the table below including volumes (MT), values of shipments in 2018 dollars, and prices also in 2018 dollars. Unlike trends for landed values and imports, the export prices for frozen mackerel have declined in recent years from highs of \$1.46 and \$1.54 per pound in 2014 and 2015 down to \$0.88 in 2018. The unusual trend likely has to do with variable export markets. The country taking most of the frozen mackerel product from NL in 2018 was Bulgaria, it was the United States in 2017, China in 2016, and again the United States in 2015. The U.S. may be the highest paying customer, followed by China, then Bulgaria, and in any given year it depends where most of the product goes.

**Table 3.5: Fresh and frozen mackerel exports, 2012-2018**

Year	MT			\$2018			2018 \$/lb		
	Fresh	Frozen	Total	Fresh	Frozen	Total	Fresh	Frozen	Total
2012	6	2,990	2,997	29,188	8,022,479	8,051,667	2.04	1.22	1.22
2013	504	7,177	7,681	781,754	19,462,103	20,243,857	0.70	1.23	1.20
2014	85	2,920	3,004	338,290	9,393,586	9,731,876	1.82	1.46	1.47
2015	8	823	831	48,415	2,799,707	2,848,122	2.78	1.54	1.56
2016	15	2,219	2,234	58,394	5,795,914	5,854,308	1.80	1.19	1.19
2017	80	891	971	96,139	2,627,777	2,723,916	0.55	1.34	1.27
2018	-	3,113	3,113	-	6,060,453	6,060,453	-	0.88	0.88

*Source: Statistics Canada, 2019. Canadian International Merchandise Trade Database (online: <https://www5.statcan.gc.ca/cimt-cicm/home-accueil?lang=eng>)*

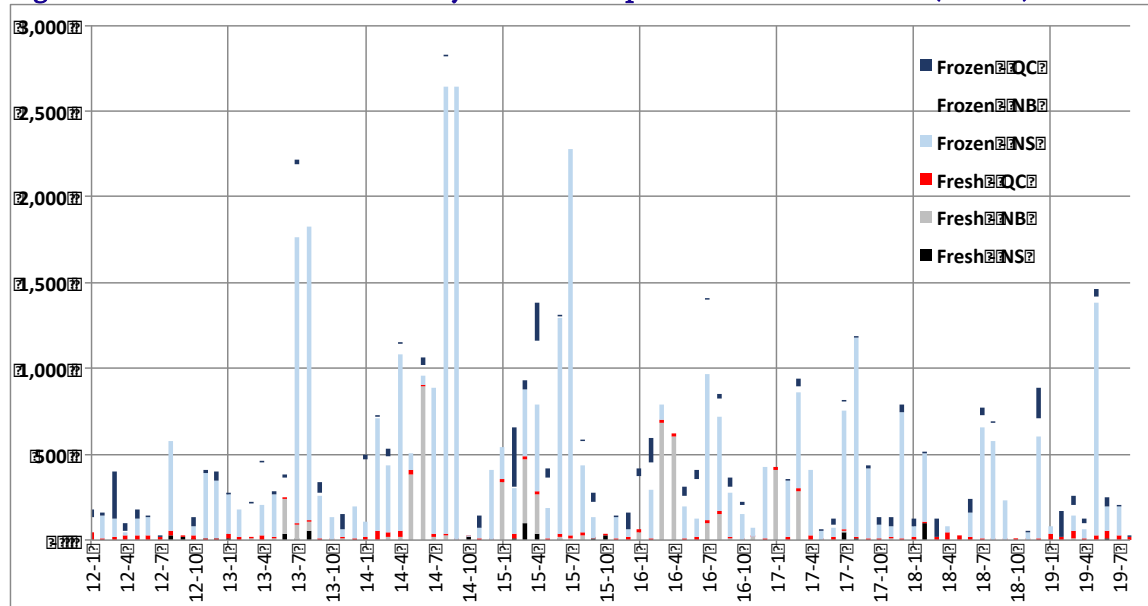
### Imports

The high demand for mackerel as bait, along with the reduced local supply has led to a healthy mackerel import business particularly in Nova Scotia. This has been the case for many years since mackerel catch has not always aligned with the seasons for fisheries where it is used as bait. Given a shortage of cold storage facilities, fishers have relied on imported frozen mackerel to meet their needs.

The monthly imports of fresh (HS code 30244) and frozen (HS 30354) mackerel (figure below) are important to understanding the full picture of demand for mackerel in Atlantic Canada and for understanding the alternative to catching mackerel for bait. The two main observations are that Nova Scotia is the main point of import along with smaller quantities in New Brunswick and Quebec. Second, frozen product dominates over fresh product (see QC red segment at the top of fresh product in figure).

Based on the last eight years of imports, there has been a wide range of monthly import levels from annual peaks under 1,000 tonnes to some over 2,500 (2014 and 2015). The seasonal demand is highest in late summer and early fall (July, August, September) in the lead up to fall lobster fisheries.

**Figure 3.2: Fresh and frozen monthly mackerel imports to Atlantic Canada (tonnes)**



Source: Statistics Canada, 2019. Canadian International Merchandise Trade Database (online: <https://www5.statcan.gc.ca/cimt-cicm/home-accueil?lang=eng>)

The imports are summarized by year and province in the table below to indicate the shortfall in local bait that is made up by imports. The total annual imports range from a low of 2,459 in 2012 to a high of 10,381 in 2014, and over three-quarters (77%) is brought into NS. Imports to NS are not necessarily all used there, as there are NS based bait suppliers that serve needs in other provinces.

**Table 3.6: Annual imports of frozen mackerel by province (tonnes)**

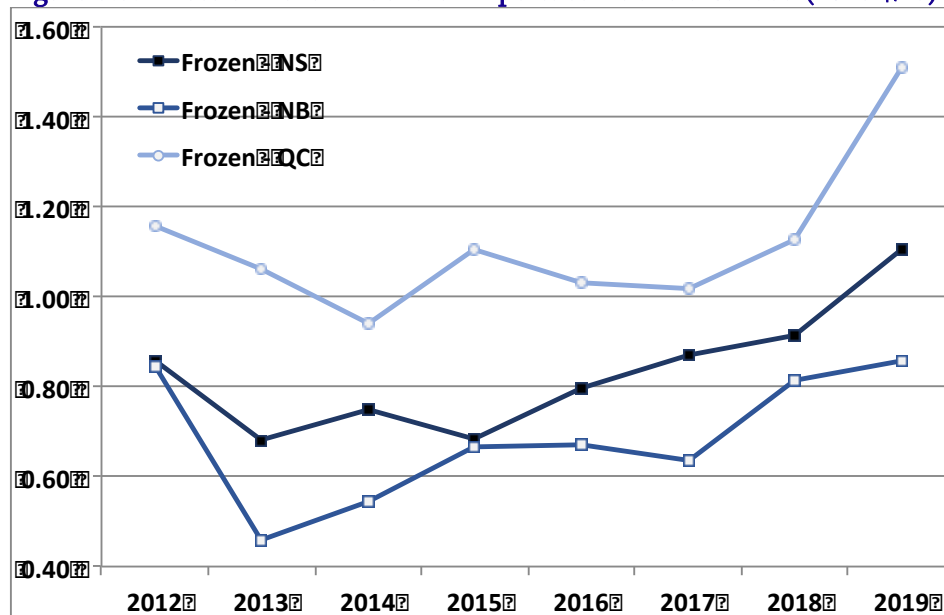
Year	NS	NB	QC	Total
2012	1,763	125	571	2,459
2013	4,799	1,416	226	6,441
2014	8,890	1,281	210	10,381
2015	5,718	1,214	845	7,777
2016	2,934	1,997	381	5,312
2017	4,530	141	266	4,937
2018	2,724	278	488	3,490

Source: Statistics Canada, 2019. Canadian International Merchandise Trade Database (online: <https://www5.statcan.gc.ca/cimt-cicm/home-accueil?lang=eng>)

The price of imported frozen mackerel illustrates the situation for fishers needing bait alternatives as local supplies decline. The price of mackerel in constant 2018 dollars has climbed in recent years (figure below). Prices started to climb in 2015 for the primary Nova

Scotia market, then in 2017 for the secondary markets (NB and QC). Prices are generally highest in Quebec and lowest in New Brunswick, while Nova Scotia prices tend to be just above those in New Brunswick.

**Figure 3.3: Prices of frozen mackerel imports to Atlantic Canada (2018 \$/lb)**



Source: Statistics Canada, 2019. Canadian International Merchandise Trade Database (online: <https://www5.statcan.gc.ca/cimt-cicm/home-accueil?lang=eng>)

The prices of imported mackerel are higher than prices for mackerel landed in Atlantic Canada. However, the full cost of using Atlantic Canada caught mackerel for bait must also reflect the cold storage and holding capacity needed. Interviews with industry members suggest that about \$0.30 is added to the landed price of mackerel for storage and re-sale as bait.

When imported frozen mackerel was available at lower prices up to 2015 there were larger import quantities, then imports curtailed as the prices started to climb steeply and it becomes more economical to make local arrangements for bait. However, this can only be accomplished when enough local supply is available and there is a lag between the time price gaps widen and when investment in storage capacity occurs to make more use of locally available mackerel. At present, fishers are squeezed between shortage of local supply and rising prices for imported mackerel. Herring is also used as bait and some new alternative species have been tried in recent years, but mackerel continues to be the preferred option.

### Bait

DFO stock assessments attempt to estimate “undeclared catch” including bait in the statistical modelling process. Undeclared commercial catch has been estimated at approximately 3,000



tonnes. The analysis below in this report (Table 3.7) suggests about 425 tonnes are caught in the recreational fishery, and this analysis incorporates another 2,500 tonne estimate for bait. These estimates may be improved with further work through surveys and implementation of reporting mechanisms in commercial fisheries.

The value of the bait catch is also unknown, but the above discussion regarding imported frozen mackerel places an upper bound on the value of locally caught bait. Those who catch bait for themselves have the option of buying imported mackerel, but prefer not to when they can catch and store their own more cost-effectively. Some shellfish processors will provide bait in order to secure their lobster or crab landings. The price of that bait may not be clear as it is bundled into arrangements to secure shellfish landings. The value is influenced by the lobster and crab fisheries, as shellfish prices rise and there are strong landings, demand for bait strengthens and becomes more valuable so prices are pushed higher.

### 3.2 Recreational Fisheries

DFO does not collect annual recreational catch statistics so the following is based on the best available survey data. The main areas for recreational mackerel fisheries are very different from the commercial fishery. Recreational fishing locations are often closer to major urban centres where anglers reside. The highest catches in NL are on the Southern and Eastern sides of the province where the main mackerel DFO fishing regions are 5,6, and 7 extending from Port-Aux-Basques along the southern coast and around the eastern side all the way to Hampden in the North. The highest catches in NS are in Halifax, Cape Breton, and Lunenburg counties. The highest catches in PEI are in Central Queens county. The key angling statistics from the 2010 DFO survey are shown by province in the table below.

**Table 3.7: Recreational fishing statistics for mackerel, by province**

	Anglers	Days	Spend (\$2018) <sup>1</sup>	Fish caught	Fish kept
NS	4,663	162,904	10,562,019	646,398	441,406
PEI	74,692	26,506	741,678	98,181	68,899
NL	2,950	77,342	8,390,289	356,835	339,548
<b>Total</b>	<b>82,305</b>	<b>266,752</b>	<b>19,693,986</b>	<b>1,101,414</b>	<b>849,853</b>

*Source: DFO, 2010. Survey of Recreational Fishing in Canada.*

*1. Conversion of 2010 to 2018 dollars based on StatCan CPI (all items).*

### 3.3 First Nations

First Nations can participate in a rights-based fishery, or a Food, Social and Ceremonial (FSC) fishery. The FSC mackerel fishery is used to catch mackerel, which is an important food, but is also in turn used as bait particularly for the FSC lobster fishery where about 10% of boats catch their own bait. The FSC mackerel fishery and FSC lobster fishery are used to feed members of the community.

First Nations may also operate in a Commercial Communal fishery, where the community gets economic benefits from the fishery, which is then used for community-based projects that are decided by the community.

A lack of freezer capacity in the region is a major limiting factor to using mackerel as bait. Furthermore, the lack of local mackerel, combined with its recently high prices of over \$1 per pound when it is available, encouraged First Nations fishers to shift over to imported frozen mackerel. First Nations imported mackerel was \$0.30 to \$0.40 per pound in 2013, and has risen to \$0.70 per pound, which is still less than locally sourced mackerel.

Only Nova Scotia landings data at species grouping level is readily available from DFO. Annual landings (quantity and value) under the communal licences are shown in the table below. Due to confidentiality restrictions (generally, landings by fewer than 5 licences), data cannot be provided at the species level, except for lobster. Otherwise, the data are grouped to provide as much detail as possible. Some general observations are:

- **General fishery** - overall Mi'kmaq landed value is fairly stable in relative terms, ranging between 4-5% of the Nova Scotia total over the past decade. The relative importance by species is similar, with shellfish accounting for upwards of 85% of the total in recent years.
- **Lobster** - Mi'kmaq lobster landings increased three-fold between 2005 and 2014 (from 584 to 1,500 tonnes), presumably reflecting both improved access and improved fishing capability. This produced 2.5 times more revenue, to \$25.4 from \$10.3 million. The Mi'kmaq share of Nova Scotia lobster landed value increased from 2% to the 3% range over the period.
- **Pelagic & estuarial species** – including mackerel, account for less than 1% of provincial tonnage landed, but up to 2% of landed value. Relatively low value herring dominates Nova Scotia landings, while higher valued species such as tuna, swordfish and elver dominate Mi'kmaq landings.

**Table 3.8: Mi'kmaq marine fisheries landings, Nova Scotia, 2005-2014**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Volume (t)</b>										
Cod, haddock, halibut	2,335	2,000	1,945	2,053	2,098	x	x	x	x	x
Groundfish other	1,840	1,006	1,414	1,595	1,120	x	x	x	x	x
Pelagic & estuarial	834	543	471	173	178	x	x	x	x	x
Sub-total:						2,964	2,025	1,748	1,502	1,632
Lobster	584	544	490	737	848	964	1,197	1,141	1,234	1,539
Mollusc & crustacean, other	4,070	3,506	4,101	5,038	4,980	5,709	6,187	5,414	5,057	4,986
<b>Total (t):</b>	<b>9,663</b>	<b>7,599</b>	<b>8,421</b>	<b>9,596</b>	<b>9,224</b>	<b>9,637</b>	<b>9,409</b>	<b>8,303</b>	<b>7,793</b>	<b>8,157</b>
<b>Value (2018 \$000s)</b>										
Cod, haddock, halibut	4,332	4,204	3,880	3,558	3,221	x	x	x	x	x
Groundfish other	1,864	1,266	1,712	1,938	1,238	x	x	x	x	x

## Value of Mackerel in Atlantic Canada

Pelagic & estuarial	1,477	897	763	680	227	x	x	x	x	x
Sub-total:						4,413	3,471	3,177	2,386	17,425
Lobster	10,271	8,009	7,590	8,828	9,337	10,389	12,354	11,138	12,583	25,431
Mollusc, crustacean, other	14,766	8,525	13,894	19,470	15,933	21,903	32,188	24,887	22,352	45,496
<b>Total (2018 \$000s):</b>	<b>32,710</b>	<b>22,901</b>	<b>27,839</b>	<b>34,475</b>	<b>29,957</b>	<b>36,705</b>	<b>48,014</b>	<b>39,201</b>	<b>37,320</b>	<b>88,352</b>

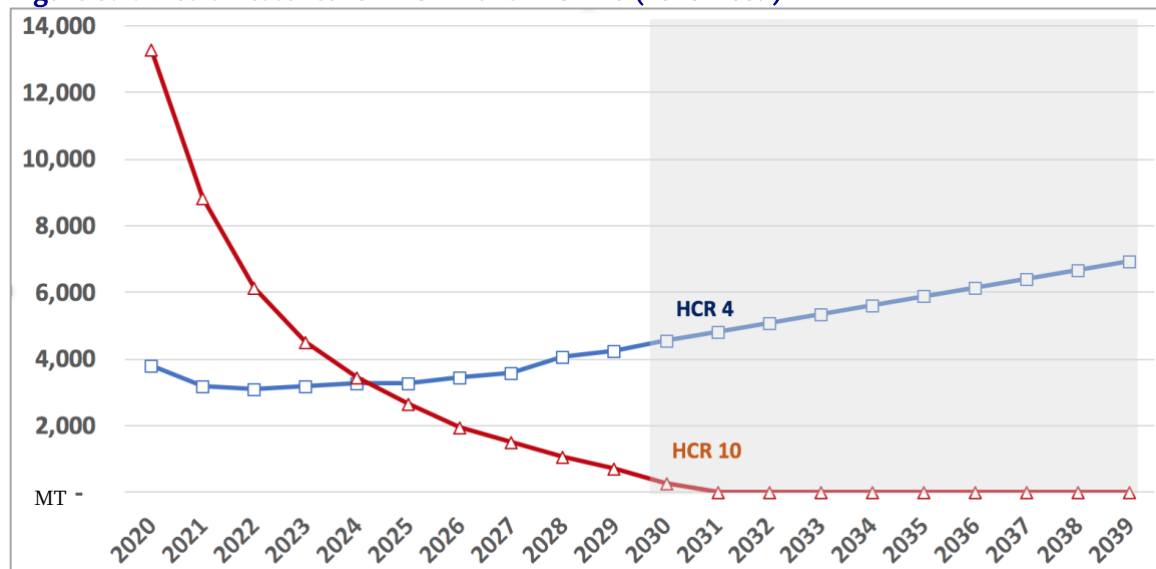
Source: DFO, special tabulation

x = not available due to confidentiality restrictions (< 5 licences).

### 3.4 Rebuilding Options

The two scenarios “minimize fishing” (HCR4) and “maximize fishing” (HCR10) are illustrated in the figure below (Figure 3.4) where model projections to 2029 are extended to the year 2039 using linear regression (grey area).

Figure 3.4: Median catches for HCR 4 and HCR 10 (2020-2039)



Sources: Van Beveren et al. 2018, and Gardner Pinfold (estimates after 2028) Note: Grey shading indicates period of estimates beyond model results, extended to the year 2039 using linear regression. Both lines include Canada and U.S. TACs, Canadian bait catches, Canadian recreational fishing catch, and no “undeclared” catch.

Each result in the table below represents the difference between the economic value (revenues) for a “minimize fishing” path versus a “maximize fishing” path. Positive net present value (NPV) and internal rate of return (IRR) values indicate that minimizing fishing and stock re-building are favourable.

Table 3.9: Cost-benefit analysis (CBA) results for “minimize fishing” (HCR4) versus “maximize fishing” (HCR10) scenario (2020 – 2039)

	NPV (3% discount)	NPV (5% discount)	IRR
Results	\$54,318,923	\$35,755,971	12.9%

*NPV = Net present value; IRR = Internal rate of return. Positive values favour “minimize fishing” (HCR 4).*

Minimizing fishing (HCR 4) and stock re-building is favourable according to all results shown in the table. All net present values and internal rates of return are substantially positive for the HCR 4 scenario. The overall net present benefits of minimizing fishing are an estimated \$54 million dollars, providing a 12.9% return on the “investment” in stock re-building.

Results highlights:

- **Sensitivity analysis** – the price of bait used in the analysis was reduced by half from \$1.10 to \$0.55 per lb in case the currently high prices return to lower levels and this reduces the net benefits in the table. A doubling of price for commercial fishing from \$0.68 to \$1.36 was also considered, and the benefit increases slightly.
- **Discount rate** – A higher discount rate favours “maximize fishing” (HCR 10), while a lower rate favours “minimize fishing” (HCR 4). Higher discount rates place less value on long-term catches and more value on short-term catches. According to Treasury Board of Canada Guidelines, lower discount rates are suitable for this type of analysis given environmental and inter-generational issues involved, and lower rates are more in line with the current investment and interest rate environment. The higher rate is shown for comparison.
- **Internal rate of return (IRR)** – This is another way to compare between the two alternatives. Higher values favour stock rebuilding and lower values favour maximizing fishing. In the current investing climate, rates above 5% are very attractive.

## 4. DISCUSSION

### Indigenous values

Though not examined closely here, indigenous mackerel fishing is not well-represented by economic values. Other social and cultural values of importance must be considered qualitatively. There are also social and cultural values attached to all mackerel fisheries, both indigenous and non-indigenous, including employment and income, individual and community livelihoods, and traditional ties to the fishery.

### Rebuilding options

According to the cost-benefit analysis applied to the projected value of catches derived from the MSE report, minimizing fishing now to help re-build the stock over the long-term is preferable to maximizing fishing now and risking a decline of the stock and closure of various

fisheries. The net benefits of this option are an estimated \$54 million with a 12.9% return on the “investment” in stock rebuilding.

Cost-benefit analysis is the appropriate tool applied by Treasury Board of Canada to help resolve complex economic trade-offs over time. Although it may seem attractive to fish now and deal with consequences later, the analysis shows that in today’s terms the preferred decision is to fish less now and rebuild stocks. Fishing more now and to the point of fishery closure in a few years provides a very limited short-term economic benefit that is heavily outweighed by the prospect of little or no fishing in the future and possibly a longer rebuilding period.

### **Other considerations**

It is important to position the findings in context so they can be interpreted appropriately, and the following outlines a few key considerations:

- **Ecosystem benefits** - The analysis does not include ecosystem benefits of maintaining or rebuilding mackerel stocks. Loss of mackerel stocks could have effects to other species and fisheries, given their role in the ecosystem.
- **Prices** – changes to bait and commercial fishing prices over the long-term was considered, and the sensitivity analysis found the results still favour rebuilding.
- **Uncertainty and new information** - The main uncertainties are the status of the Atlantic mackerel stock from year to year, and projections for rebuilding. These will be updated and improved each year with the latest data available. The cost-benefit analysis performed for this report can be updated with new information as it becomes available. Other management scenarios could also be assessed.