Northwest Atlantic

SOFIA Major Fishing Area 21

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# 1. Summary

Most stocks in the NW Atlantic obtain their scientific advice from the US or Canadian scientific authorities, although a few West Greenland stocks obtain ICES advice. There is some co-operation between Canada and the USA over shared stocks. Most stocks are assessed on a regular 1–5-year cycle, with most frequent assessments reserved for high pressure stocks. Most stocks are either fully fished (F) or overexploited (O) ([Table 1](#tbl-ISSCAAP_avg_scores)).

Fisheries in this area are highly developed and diverse, with significant catches dating back to early colonisation by Europeans in the sixteenth and seventeenth centuries. Mechanized trawls have been in operation for many decades, and the resources experienced extreme fishing pressures in the late 1970s and early 1980s. Since then, countries have decreased fishing pressure allowing many stocks to rebuild. However, rebuilding has been hampered due to significant changes in productivity of some stocks, such as Newfoundland cod and American plaice, and winter flounder and yellowtail flounder in the Gulf of St. Lawrence, which has been linked to environmental effects. Although catches may be very low, so overfishing is not occurring, these stocks are still considered overfished because they have not recovered to past levels due to low recruitment and high natural mortality. In general, the invertebrate fisheries are in a better state than finfish fisheries, where the abundance of American lobster, for example, is generally increasing in contrast to many finfish resources.

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| Table 1: Summary status across stocks by ISSCAAP based on scores (1=O, 2=F, 3=N) weighted by MSY (or a proxy for MSY) for stocks where status information is available.   | ISSCAAP | Stocks Scored | Average Score | Average Status | | --- | --- | --- | --- | | Clams, cockles, arkshells | 6 | 2.00 | F | | Cods, hakes, haddocks | 21 | 1.54 | O-F | | Crabs, sea-spiders | 6 | 2.00 | F | | Flounders, halibuts, soles | 25 | 1.97 | F | | Herrings, sardines, anchovies | 9 | 1.84 | F | | Lobsters, spiny-rock lobsters | 13 | 1.92 | F | | Miscellaneous coastal fishes | 4 | 2.83 | N | | Miscellaneous demersal fishes | 11 | 1.97 | F | | Miscellaneous pelagic fishes | 7 | 1.24 | O | | Salmons, trouts, smelts | 5 | 1.19 | O | | Scallops, pectens | 10 | 1.95 | F | | Sea-urchins and other echinoderms | 3 | 2.00 | F | | Sharks, rays, chimaeras | 7 | 2.08 | F | | Shrimps, prawns | 10 | 1.75 | O-F | | Squids, cuttlefishes, octopuses | 1 | 3.00 | N | | **Grand Total** | **138** | **1.77** | **F** | |

# 2. Introduction

The total area of the Northwest Atlantic is 6.5 million km2, and includes the 200-mile zones of Canada, Greenland, St. Pierre et Miquelon and USA as well as the NAFO’s Regulatory Area (2.7 million km2). The northwest Atlantic continental shelf is relatively wide covering much of this region ([Figure 1](#fig-Area21Map)). The overall area is encompassed by a southern edge marked by a relatively abrupt transition off Cape Hatteras, where the warmer Gulf Stream comes to within 30 km of shore. The main source of nutrients is offshore slope waters. Shelf and slope waters mix in complex ways both at the surface and at depth, which affects levels of primary production. The northwest Atlantic continental shelf is also the influence of the North Atlantic Oscillation, which will be affected by climate change. These wider oceanographic effects are likely to be affecting stock production and their fisheries.

The discovery of the fish resources of the Northwest Atlantic in the 1490s by Europeans led initially to a fishery operated by fishermen from ports in western Europe and provided the basis for settlement of coastal communities in America exploiting groundfish resources. The earlier fishery exploited cod almost exclusively, but later fisheries for other groundfish species, as well as for pelagic species developed. Catches broadly increased throughout this period with fishing power and post harvest technology until recent three decades when groundfish and pelagic catches declined dramatically. Because of collapses in some cod stocks and significant declines in other groundfish stocks, moratoria were imposed on major groundfish fisheries in the early-1990s to facilitate stock rebuilding.

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| Figure 1: The Northwest Atlantic (Area 21) |

## 2.1 Estimating Stock Status

Three very similar approaches are used in the region to define stock status. All approaches use Maximum Sustainable Yield (MSY) based reference points, although in many cases proxies are used are related to MSY concept, where precise estimation of MSY is not possible.

The approach used in the USA is usually based on integrated stock assessment models that incorporate a stock recruitment relationship as a paradigm rather than fitted empirically. This approach allows estimation of the stock size compared to an unexploited state even where that state is not observed. This is a reasonable approach in terms of decision-making, and justified where stock productivity has been steady over the available data time series. Where this is done and status is reported as a ratio compared to unexploited biomass, status can be determined relative to 20% SSB0, below which a stock is overexploited, and 60% SSB0, over which it is not fully exploited. Between these two reference levels, a stock is considered fully exploited. For these integrated approaches, the uncertainty of the status determination is low.

In practice, stock status is reported in terms of biomass at MSY, which is usually between 30-40% SSB0. References to SSB0 are not always available or used (for example, ICES – Area 27 – does not estimate SSB0 as it is a theoretical rather than empirical point and often can not be determined). For consistency, the 20% SSB0 point is assumed to be Blim if it is estimated or 50% BMSY if BMSY has been estimated. Stocks greater than 1.7 BMSY are considered not fully exploited (1.7\*35% ~ 60%).

Where a modelling approach is not possible, methods usually resort to index-based approaches. In these cases, there may be one or more indices that monitor either abundance or mortality, and reference points relative to MSY levels or MSY proxy levels can be proposed and used for decision-making. The USA has a requirement to monitor status to MSY, and therefore reference points are always couched in these terms. In Canada, they apply a “Precautionary Approach” method which sets a limit reference point (LRP) and an Upper Stock Reference (USR) point which define three zones along the abundance or biomass axis. The index-based approaches are effectively decision frameworks rather than providing definitive status information, so are designed to delivered long-term safe yields rather than ensure a stock is in a particular state. Nevertheless, the indices can be interpreted in terms of abundance status. To this end, a stock below the limit reference point might be considered at high risk of recruitment overfishing, which is the same intent as the LRP at 20% SSB0. If a stock is in this critical zone, it is considered overfished. Using this method in determining when a stock is not fully exploited is more difficult. The zone between the LRP and USR is the “cautious” zone, and effectively indicates a trigger point when management action may be required to avoid the stock falling below the LRP. As a result, it does not indicate that a stock is less than fully exploited. Unless there is specific evidence otherwise, I assume these stocks are fully rather than not-fully exploited. This is often supported by observing that many stocks are below or close to the USR or have dipped below the USR in the recent past.

There are a few stocks that are managed through advice from ICES and from NAFO. ICES applies its own approach (see Area 27 report), that is similar to the Canadian approach above but where possible is linked to explicit MSY references. However, ICES does not generally reference unexploited biomass states when determining status as it does not have a default stock-recruitment relationship. Where NAFO is dealing with its few stocks solely in international waters, they are data-limited and the advice is quite general but still indicates general status, but with higher uncertainty.

For the purposes of this evaluation, I treat integrated assessments and index-based assessments that have well-defined reference points, as both having low uncertainty. The index-based methods are in general more uncertain than integrated models as they depend on fewer sources of information on stock state. US fisheries advice has often adopted an index-based approach where the integrated model has been rejected in the independent review process. Index based methods are often difficult to evaluate and include more untestable assumptions, so will underestimate uncertainty. However, in some cases, particularly for sedentary shellfish, a survey can obtain a reasonable precautionary absolute abundance estimate and can base recommended harvest based on this. In general, other index-based methods have been broadly evaluated, and well-evaluated in some cases, such that they have been shown to be robust. Therefore, these differences in uncertainty are not sufficiently far apart to warrant different classification within the broad determinations in this review.

Where reference is made to groups of stocks and their average status, the mean of the status categories is used. This is a weight mean of the score within the group, where the ideal weight is the single species MSY. Using MSY captures the relative size of the stock and fishery regardless of whether the stock is over- or fully- or less-than-fully exploited. In many cases, MSY is not estimated, so some guesswork is applied based on past catches as to what a reasonable MSY might be. For example, if a stock is being fully exploited and has been around its target level in recent years, the MSY would likely be around recent catches during this period. In general, the results are not sensitive to this choice, the main objective being to capture large differences among the sizes of management units which would otherwise be ignored if an equal weighting is applied.

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| Figure 2: Annual nominal landings (million t) by ISSCAAP species groups in the Northwest Atlantic (Area 21). |
| Table 2: Stock status summary for not fully exploited (N), fully exploited (F), overfished (O) and unknown status (U). ‘O-F’ implies stocks are a mixture of fully exploited and overfished.   | ISSCAAP | O | O-F | F | N | U | | --- | --- | --- | --- | --- | --- | | Abalones, winkles, conchs | 0 | 0 | 0 | 0 | 1 | | Clams, cockles, arkshells | 0 | 0 | 6 | 0 | 0 | | Cods, hakes, haddocks | 11 | 0 | 8 | 3 | 9 | | Crabs, sea-spiders | 0 | 0 | 6 | 0 | 2 | | Eared seals, hair seals, walruses | 0 | 0 | 2 | 0 | 0 | | Flounders, halibuts, soles | 9 | 0 | 14 | 2 | 5 | | Herrings, sardines, anchovies | 3 | 0 | 6 | 0 | 1 | | Lobsters, spiny-rock lobsters | 1 | 0 | 12 | 0 | 1 | | Miscellaneous coastal fishes | 1 | 0 | 1 | 2 | 1 | | Miscellaneous demersal fishes | 3 | 0 | 8 | 0 | 1 | | Miscellaneous diadromous fishes | 0 | 0 | 1 | 0 | 0 | | Miscellaneous pelagic fishes | 4 | 1 | 2 | 1 | 0 | | River eels | 0 | 0 | 1 | 0 | 0 | | Salmons, trouts, smelts | 3 | 2 | 1 | 0 | 0 | | Scallops, pectens | 3 | 0 | 7 | 0 | 0 | | Sea-urchins and other echinoderms | 0 | 0 | 3 | 0 | 0 | | Shads | 0 | 0 | 0 | 0 | 1 | | Sharks, rays, chimaeras | 1 | 0 | 5 | 1 | 1 | | Shrimps, prawns | 1 | 1 | 8 | 0 | 0 | | Squids, cuttlefishes, octopuses | 1 | 0 | 0 | 1 | 0 | | **Grand Total** | **41** | **4** | **91** | **10** | **23** | |

## 2.2 32-Cods, hakes, haddocks

There are a number of separate assessed cod stocks. All of these are subject to some management, although in not all cases is status known precisely. Index based methods are used to apply harvest control rules that should maintain high yield in the longer term. Around Newfoundland, the stocks are designated overfished and there is an effective moratorium on the groundfish fisheries. The cod stocks were overfished in the mid-1960s and early 1990s relative to their productivity and are currently remain at a very low level.

Despite low catches, ecosystem conditions are such that there is overall low productivity including low levels of phytoplankton and zooplankton, and low abundance of key forage species such as capelin and shrimp. These conditions have likely negatively impact cod productivity, so rebuilding has been very slow.

Haddock, red hake and white hake are in a similar situation to cod, whereas silver hake has probably recovered with the decline in catches. These stocks have benefited from the reduction in fisheries targeting cod because they are caught at the same time.

Cusk has been proposed as a protected species in Canada because it was designated as endangered in 2012 . However, it was not registered but in the most recent assessment it has dipped just below the limit reference point despite some previous increase in abundance.

There is no directed fishery for Arctic cod. Arctic Cod is considered an important prey species in the Arctic marine ecosystem and is likely to be affected by climate change. Under ecosystem approach, a fishery on this species may require biomass reference points than the default.

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| Figure 3: ISSCAAP Group 32 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 3: Cod, hake and haddock stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Pollock - Gulf of Maine / Georges Bank | N | | USA | White hake - Gulf of Maine / Georges Bank | F | | USA | Haddock - Gulf of Maine | N | | USA | Haddock - Georges Bank | F | | USA | Atlantic cod - Gulf of Maine | U | | USA | Atlantic cod - Georges Bank | U | | USA | Red hake - Gulf of Maine / Northern Georges Bank | U | | USA | Red hake - Southern Georges Bank / Mid-Atlantic | U | | USA | Silver hake - Gulf of Maine / Northern Georges Bank | N | | USA | Silver hake - Southern Georges Bank / Mid-Atlantic | F | | Canada | Atlantic Cod (NAFO Div. 4T and 4Vn (November to April)) and American Plaice (NAFO Div. 4T) | O | | Canada | Atlantic Cod (Gadus morhua) in NAFO Divisions 4X5Y | O | | Canada | Atlantic Cod (Gadus morhua) Spawning Aggregations in NAFO Division 5Z (Georges Bank) | O | | Canada | Northern cod (NAFO Divisions 2J3KL) | O | | Canada | Cod NAFO Subdivision 3Ps | O | | Canada | Atlantic Cod northern Gulf of St. Lawrence (3Pn, 4RS) | O | | Canada | Haddock (Melanogrammus aeglefinus) in NAFO Divisions 4X5Y | F | | Canada | Haddock - 5Zjm | U | | Canada | Pollock (Pollachius virens) Western Component in NAFO Divisions 4Xopqrs5 | F | | Canada | Silver Hake (Merluccius bilinearis) Scotian Shelf in NAFO Divisions 4VWX | F | | Canada | White Hake from NAFO Div. 4T | O | | Canada | White Hake (Urophycis tenuis) in NAFO Subdivision 3Ps | U | | Canada | Arctic Cod (Boreogadus saida) bycatch in Canadian Arctic Shrimp Fisheries | U | | Canada | Cusk (Brosme brosme) in NAFO Divisions 4VWX5Z | O | | Canada | Haddock NAFO Divisions 3LNO | O | | Canada | Haddock (Melanogrammus aeglefinus) in NAFO Subdivision 3Ps | O | | Canada | Pollock (Pollachius virens) NAFO Subdivision 3Ps | U | | Canada | White Hake (Urophycis tenuis) southern Gulf of St. Lawrence | U | | Greenland | Offshore West Greenland Cod | O | | Greenland | Inshore West Greenland Cod | F | | NAFO | Cod stock in Flemish Cap (NAFO Div. 3M) | F | |
| Table 4: Change in landings before and after mid-1990s of Atlantic cod, Silver hake, White hake and Haddock.   | Period | Max\_Land | Avg\_Land | | --- | --- | --- | | After mid-1990s | 0.122848 | 0.09693109 | | Before mid-1990s | 2.098858 | 1.08081587 | |

For the SRA analysis, the following should be noted:

* Only the catch-only model was tested.
* Significant divergences were reported by some Stan fits. This usually indicates, among other things, a poor fit of the model.
* The species could not be found in FishLife. It is not clear why not.

A catch-only model is not expected to work for these species because there is no abundance information and many of the stocks have unexpectedly not recovered despite low catches over the last couple of decades. Sure enough, the stocks are reported as now not fully exploited (“underfished”), when the majority are still considered overfished ([Table 5](#tbl-SRA_results_32)).

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| Figure 4: ISSCAAP Group 32 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 5: Comparison between SRA results and averaged stock assessments. |

## 2.3 35-Herrings, sardines, anchovies

The main species in this category is Atlantic herring. There are several spawning components grouped into management areas. Components are also split into predominantly spring or autumn spawners. Herring is predominantly found in Canadian waters. In US waters, the stock is considered overfished. In Canada, the picture is mixed with some spawning components having relatively low abundance, others appearing in healthy condition. As with other fish stocks in Atlantic Canadian waters, recent environmental changes may have impacted stock productivity, so F-based harvest strategies are in place that adapt to changing recruitment.

The large Atlantic menhaden stock is caught along the entire US coast, so the stock extends out of Area 21. The stock overall is not considered overfished.

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| Figure 5: ISSCAAP Group 35 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 6: Herrings, sardines, anchovies stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Atlantic herring - Northwestern Atlantic Coast | O | | USA | Atlantic menhaden - Atlantic Coast | F | | Canada | Atlantic herring (Clupea harengus) southern Gulf of St. Lawrence (NAFO Div. 4T) spring and fall spawner components | F | | Canada | Atlantic Herring 4VWX | O | | Canada | Atlantic Herring - NAFO 5Y, 5Z (weirs) | O | | Canada | Atlantic Herring - NAFO 3KLPs | U | | Canada | Atlantic Herring West Coast of Newfoundland (NAFO Division 4R) | F | | Canada | Atlantic Herring - Herring Fishing Area 15 (4S) | F | | Canada | Herring Newfoundland east and south coast | F | | Canada | Herring Quebec North Shore (Division 4S) | F | |
| Figure 6: ISSCAAP Group 35 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 7: Comparison between SRA results and averaged stock assessments. |

## 2.4 33-Miscellaneous coastal fishes

Catches of miscellaneous coastal fishes have fluctuated significantly, although the overall catches remain small. Some inshore stocks are of interest to recreational fisheries, which have resulted in stock assessments. In general, harvest levels have been low in recent years. The highest harvest, for scup, has not yet reduced the stock to full exploitation level. Catches for other species have declined overall.

There are sporadic fisheries for hagfish which is primarily caught for fish skin leather. There has insufficient data gathered to assess this species.

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| Figure 7: ISSCAAP Group 33 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 8: Miscellaneous coastal fishes stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Ocean pout - Northwestern Atlantic Coast | O | | USA | Scup - Atlantic Coast | N | | USA | Black sea bass - Mid-Atlantic Coast | N | | Canada | Longhorn Sculpin (Myoxocephalus octodecemspinosus) St. Mary's Bay | F | | Canada | Hagfish (Myxine glutinosa) Fishery in the Maritimes Region | U | |
| Figure 8: ISSCAAP Group 33 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 9: Comparison between SRA results and averaged stock assessments. |

## 2.5 34-Miscellaneous demersal fishes

The miscellaneous demersal fish catches are dominated by redfish, which consists primarily of two species: beaked redfish (*Sebastes mentella*) and arcadian redfish (*S. fasciatus*). These species, like others from the *Sebastes* genus, have low productivity and are vulnerable to overfishing. Results from assessments of these stocks in the Northerwest Atlantic indicate a mixed picture with the majority of stocks being in a healthy state and one being overfished. Recovery of overfished redifsh stocks may be very slow.

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| Figure 9: ISSCAAP Group 34 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 10: Miscellaneous demersal fishes stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Goosefish - Gulf of Maine / Northern Georges Bank | U | | USA | Goosefish - Southern Georges Bank / Mid-Atlantic | F | | USA | Atlantic wolffish - Gulf of Maine / Georges Bank | O | | USA | Acadian redfish - Gulf of Maine / Georges Bank | F | | USA | Tilefish - Mid-Atlantic Coast | F | | Canada | Acadian Redfish - Unit 3 | F | | Canada | Redfish (Sebastes mentella and S. fasciatus) in Units 1 and 2 | F | | Canada | Redfish Unit 3 | F | | Canada | Common Lumpfish (Cyclopterus lumpus) in Canadian Waters | O | | Canada | Monkfish (Lophius americanus) in NAFO Divisions 3LNO and Subdivision 3Ps | F | | Canada | Redfish in NAFO SA 2 + Divs. 3K | O | | NAFO | Redfish (Sebastes mentella and Sebastes fasciatus) in division 3M | F | |
| Figure 10: ISSCAAP Group 34 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 11: Comparison between SRA results and averaged stock assessments. |

## 2.6 37-Miscellaneous pelagic fishes

Atlantic mackerel (*Scomber scombrus*) catches have been very large in the past, but have declined over all with a few fluctuations. Catches are not expected to increase much in the near future because stock status is poor. Although spawning areas are larger than herring, Atlantic mackerel also has distinct spawning areas in the Northwest Atlantic. These comprise northern and southern components with distinct spawning sites off Canada (northern contingent) and the US (southern contingent). They seasonally overlap in US fished regions. Thus, assessment and management of this population can be sensitive to levels of mixing between contingents, which remain unknown. Nevertheless, these two components are assessed separately, and currently both are in an overfished state.

The other major catch in this category is capelin. Capelin is fully exploited, with some low stock sizes are likely to be responses to environmental changes. The stocks were much more heavily fished in the past, and the offshore fishery was closed in Divs. 3L in 1979 and in Divs. 2J3K in 1992 after stock collapsed. Landings in recent years have been much lower so abundance is higher but probably limited due to environmental conditions.

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| Figure 11: ISSCAAP Group 37 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 12: Miscellaneous pelagic fishes stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Butterfish - Gulf of Maine / Cape Hatteras | N | | USA | Atlantic mackerel - Gulf of Maine / Cape Hatteras | O | | USA | Bluefish - Atlantic Coast | O | | Canada | Capelin Estuary and Gulf of St. Lawrence (Divisions 4RST) | F | | Canada | Capelin in SA2 and Divs. 3KL | F | | Canada | Atlantic Mackerel stock for the Northwest Atlantic (Subareas 3 and 4) | O | | Canada | Capelin 2J3KL | O-F | | Canada | Atlantic Mackerel (Scomber scombrus) northern contingent | O | |
| Figure 12: ISSCAAP Group 37 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 13: Comparison between SRA results and averaged stock assessments. |

## 2.7 38-Sharks, rays, chimaeras

The main directed shark fishery is for spiny or picked dogfish. These are predominantly caught in US waters and the stock extends outside Area 21. Catches in Canada are very low. Spiny dogfish is also caught as bycatch in many fisheries and there are significant discards. The stock stock is regularly assessed and currently is considered in a good state as total removals still below the MSY level.

There are a number of skate species that are regularly caught in US waters in mixed fisheries. A high proportion of these have been discarded. This skate species complex was recently assessed because catches are high and have been decreasing and skate are vulnerable to overfishing. The majority of these skates were determined as not overfished with the exception of thorny skate.

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| Figure 13: ISSCAAP Group 38 annual nominal catches (million t) in the Northwest Atlantic (Area 21). |
| Table 14: Sharks, rays and chimaeras stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Clearnose skate - Southern New England / Mid-Atlantic | F | | USA | Little skate - Georges Bank / Southern New England | F | | USA | Rosette skate - Southern New England / Mid-Atlantic | F | | USA | Smooth skate - Gulf of Maine | F | | USA | Thorny skate - Gulf of Maine | O | | USA | Winter skate - Georges Bank / Southern New England | N | | USA | Barndoor skate - Georges Bank / Southern New England | F | | Canada | Thorny Skate - 3LNO | U | |
| Figure 14: ISSCAAP Group 38 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 15: Comparison between SRA results and averaged stock assessments. |

## 2.8 43-Lobsters, spiny-rock lobsters

Lobster landings are dominated by American lobster (*Homarus americanus*). Lobster fisheries are primarily managed by F-based (effort) limits, and using local initiatives such as v-notching and releasing mature females.

For the larger US coast populations, there are two management units which are assessed. The Maine stock in the North is in a good state and both catches, and abundance has increased. In contrast, the New England stock has decreased in size and abundance is low.

In Canada, management units are smaller fishing areas and therefore more localised. In these stocks, as in Maine, stock sizes have increased with catches and stocks are considered to be in good condition, although increases have not been universally upward in all areas.

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| Figure 15: ISSCAAP Group 43 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 16: Lobsters and spiny-rock lobsters stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Lobster (Homarus americanus) GOM/GBK stock | F | | USA | Lobster (Homarus americanus) SNE stock | O | | Canada | Lobster (Homarus americanus) stock of the southern Gulf of St. Lawrence | F | | Canada | Lobster (Homarus americanus) in Lobster Fishing Areas 27-32 | F | | Canada | Lobster (Homarus americanus) in Lobster Fishing Area 33 | F | | Canada | Lobster (Homarus americanus) in Lobster Fishing Area 34 | F | | Canada | Lobster (Homarus americanus) in Lobster Fishing Area 35 | F | | Canada | Lobster (Homarus americanus) in Lobster Fishing Areas 35-38 | F | | Canada | Lobster (Homarus americanus) in Lobster Fishing Area 41 (4X +5Zc) | F | | Canada | Lobster in Newfoundland | F | | Canada | Lobster - Lobster Fishing Area 17 | U | | Canada | Lobster (Homarus americanus) in the Magdalen Islands (LFA 22) | F | | Canada | Lobster (Homarus americanus) in the Gaspé (LFAs 19-21) | F | | Canada | Lobster (Homarus americanus) on the North Shore (LFAs 15, 16 and 18) and at Anticosti Island (LFA 17) | F | |
| Figure 16: ISSCAAP Group 43 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 17: Comparison between SRA results and averaged stock assessments. |

## 2.9 45-Shrimps, prawns

Catches primarily consist of *Pandalus* spp., which include two species: Northern prawn (*Pandalus borealis*) and striped shrimp (*Pandalus montagui*). Theses prawns are primarily caught in trawls in Canadian waters. Management units are defined in shrimp fishing areas. Most areas have estimates of abundance within healthy levels, but a few are in a critical state.

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| Figure 17: ISSCAAP Group 45 annual nominal catches (million t) in the Northwest Atlantic (Area 21). |
| Table 18: Shrimps and prawns stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | Canada | Estuary & Gulf Shrimp - SFA 8-12 | F | | Canada | Northern Shrimp (Pandalus borealis) and Striped Shrimp (Pandalus montagui) in the Eastern and Western Assessment Zones | F | | Canada | Northern Shrimp (Borealis) - SFA 1 | F | | Canada | Northern Shrimp (Pandalus borealis) in Shrimp Fishing Areas 4-6 | O-F | | Canada | Northern Shrimp - SFA 7 | O | | Canada | Shrimp - Scotian Shelf (SFA 13-15) | F | | Canada | Striped Shrimp (Pandalus montagui) in the Eastern and Western Assessment Zones | F | | Canada | Striped shrimp (Pandalus montagui) in SFA 4 | F | | Canada | Northern Shrimp in the Estuary and Gulf of St. Lawrence | F | | Canada | Northern Shrimp Eastern Scotian Shelf (SFAs 13-15) | F | |
| Figure 18: ISSCAAP Group 45 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 19: Comparison between SRA results and averaged stock assessments. |

## 2.10 31-Flounders, halibuts, soles

There was a significant expansion in the catches of flatfish in the 1960s, followed by a decline particularly in American plaice which is still designated as overexploited in areas assessed in Canadian and international waters. However, in international waters (NAFO Division 3M), the stock has probably recovered to the levels of the mid 1990s, when the fishery was closed, but the fishery remains closed for precautionary reasons. There is a similar mixed picture for witch, winter and yellowtail flounders.

Catches of American plaice, winter flounder and yellowtail flounder in Division 4T (Southern Gulf of St. Lawrence) are very low, taken as bycatch in the fisheries directed at witch flounder and Greenland halibut. Despite this, the rebuilding prospects are low because of the current high level of natural mortality. Therefore, although the stock is designated as overfished, it is possible that simply the stock is now at its new natural unexploited level and will not support a fishery until the environmental situation changes.

Catches have to some extent been compensated for by Greenland halibut, which does not appear to be overexploited. However, the Gulf of St. Lawrence stock is in the “cautious” zone, and its status is expected to worsen as environmental changes could lead to negative effects on the productivity of Greenland halibut.

Otherwise the number of flatfish stocks being assessed has significantly increased. These species are mostly caught in demersal trawl where they may not be a target, but USA National Standards still requires that they are not overfished. In general, stock status results are mixed and these stocks remain vulnerable to being overexploited as bycatch.

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| Figure 19: ISSCAAP Group 31 Annual nominal catches (million t) of selected species in Northwest Atlantic (Area 21). |
| Table 20: Flounders, halibuts and soles stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Witch flounder - Northwestern Atlantic Coast | U | | USA | American plaice - Gulf of Maine / Georges Bank | F | | USA | Winter flounder - Gulf of Maine | U | | USA | Winter flounder - Georges Bank | F | | USA | Yellowtail flounder - Southern New England / Mid-Atlantic | O | | USA | Yellowtail flounder - Cape Cod / Gulf of Maine | F | | USA | Atlantic halibut - Northwestern Atlantic Coast | U | | USA | Windowpane - Gulf of Maine / Georges Bank | N | | USA | Windowpane - Southern New England / Mid-Atlantic | F | | USA | Yellowtail flounder - Georges Bank | N | | USA | Winter flounder - Southern New England / Mid-Atlantic | F | | USA | Summer flounder - Mid-Atlantic Coast | F | | Canada | American Plaice (NAFO Div. 4T) | O | | Canada | Atlantic Halibut (Hippoglossus hippoglossus) on the Scotian Shelf and Southern Grand Banks in NAFO Divisions 3NOPs4VWX5Zc | F | | Canada | Atlantic Halibut Gulf of St. Lawrence (4RST) | F | | Canada | Greenland Halibut - Cumberland Sound | U | | Canada | Greenland Halibut - NAFO 0A and 0B | F | | Canada | Greenland Halibut (Turbot) – 2 + 3KLMNO | U | | Canada | Greenland halibut Gulf of St. Lawrence (4RST) | F | | Canada | Winter Flounder from NAFO Div. 4T, Witch Flounder from NAFO Divs. 4RST and White Hake from NAFO Div. 4T | O | | Canada | Witch Flounder from NAFO Divs. 4RST | F | | Canada | Witch Flounder - 3NO | F | | Canada | Witch Flounder (Glyptocephalus cynoglossus) in NAFO Subdivision 3Ps | F | | Canada | Yellowtail Flounder (Limanda ferruginea) of the southern Gulf of St. Lawrence (NAFO Div. 4T) | O | | Canada | Yellowtail Flounder - 5Z | O | | Canada | Yellowtail Flounder - 3LNO | F | | Canada | American Plaice NAFO Subdivision 3Ps | O | | NAFO | American plaice in Division 3M | O | | Canada | Witch Flounder (Glyptocephalus cynoglossus) in NAFO Divisions 2J3KL | O | | Canada | American Plaice in NAFO Subarea 2 + Div. 3K | O | |
| Figure 20: ISSCAAP Group 31 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 21: Comparison between SRA results and averaged stock assessments. |

## 2.11 55-Scallops, pectens

Catches are dominated by American sea scallop (*Placopecten magellanicus*), although significant catches are taken of Iceland scallop (*Chlamys islandica*) in some areas ([Figure 21](#fig-ann_catch_21_55)). Catches of Iceland scallop were higher in the 1990s and have since not recovered fully.

Scallop is managed by areas. While adult scallops can move to some extent, they are effectively sedentary once pelagic larvae have settled. It is likely that areas’ recruitment is connected through the pelagic stage. The USA conducts a coastwide stock assessment, whereas Canada tends to manage by smaller areas and collects advice based on those areas ([Table 22](#tbl-55Stocks)). Some smaller Canadian stocks are still considered overfished, but judicious use of zones with different management regimes, including closed areas, have resulted in most stocks being fully exploited rather than overexploited and the majority of catches are now sustainable.

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| Figure 21: ISSCAAP Group 55 annual nominal catches (million t) in the Northwest Atlantic (Area 21). |
| Table 22: Scallops and pectens stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Sea scallop - Northwestern Atlantic Coast | F | | Canada | Iceland Scallop in the Canada-France Transboundary Zone of St. Pierre Bank | O | | Canada | Sea Scallop (Placopecten magellanicus) from the Southern Gulf of St. Lawrence | O | | Canada | Scallop (Placopecten Magellanicus) in Scallop Production Areas 1 to 6 in the Bay of Fundy | F | | Canada | Scallop (Placopecten magellanicus) in Scallop Fishing Area 29 West of Longitude 65°30' | F | | Canada | Scallop (Placpecten magellanicus) Browns Bank North in Scallop Fishing Area 26 | O | | Canada | Scallops (Placopecten magellanicus) Georges Bank 'a' in Scallop Fishing Area 27 | F | | Canada | Scallop in Quebec coastal waters | F | | Canada | Scallop in Subarea 20A in the Magdalen Islands | F | | Canada | Iceland Scallop (Chlamys islandica) in the Strait of Belle Isle | F | |
| Figure 22: ISSCAAP Group 55 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 23: Comparison between SRA results and averaged stock assessments. |

## 2.12 56-Clams, cockles, arkshells

Clam fisheries are conducted using dredges, including hydraulic dredges or hand tools while diving or on foot, dependent on availability, water depth and distribution. Management is usually by area, some areas being quite small. There is a minimum landing size, and a target harvest rate (proportion of area or stock size captured) and abundance monitoring by CPUE or survey, dependent on the stock size. Catches are usually reported as meat weight which is usually around 5-15% of the live weight dependent on species, season and age. The meat quantities are relatively small compared to finfish landings.

Landings in this group are particularly marked by a rapid expansion in landings of ocean quahog in the late 1970s. This is a long-lived species, with low natural mortality and so vulnerable to overexploitation. However, the most recent stock assessment indicated that the stock was in relatively good condition and with lower recent catches, not being overexploited.

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| Figure 23: ISSCAAP Group 56 annual nominal catches (million t) in the Northwest Atlantic (Area 21). |
| Table 24: Clams, cockles and arkshells stock status in Area 21. (N - not fully exploited, F - fully exploited, O - overfished and U -unknown status)   | Jurisdiction | Stock Name | Status | | --- | --- | --- | | USA | Atlantic surfclam - Mid-Atlantic Coast | F | | USA | Ocean quahog - Atlantic Coast | F | | Canada | Softshell clam stocks in Québec coastal waters | F | | Canada | Stimpson's surfclam stocks of Quebec coastal waters | F | | Canada | Arctic Surfclam (Mactromeris polynyma) on Banquereau and Grand Bank | F | | Canada | Atlantic Surfclam Îles-de-la-Madeleine | F | |
| Figure 24: ISSCAAP Group 56 Relative catches of selected species in Northwest Atlantic (Area 21). |
| Table 25: Comparison between SRA results and averaged stock assessments. |

## 2.13 Other Species

Landings of species not covered above are generally low. In some cases, such as oysters, catches have decreased substantially, and areas have presumably been depleted. Oysters are also affected by factors such as pollution which may also impact fisheries. Scallop catches have remained buoyant, but some stocks are considered overexploited.

The main increase in catches is for crabs. These consist predominantly of snow crab (*Chionoecetes opilio*, *O. Fabricius*), which are endemic on the western side of the Atlantic, and rock crab (*Cancer irroratus*). These stocks are monitored and managed through effort control and examining landings size. In general, they are considered fully exploited where it is possible to determine status. However, for rock crab, natural mortality has probably been increasing because American lobster is a major predator, and its abundance has been increasing in many areas in recent years.

Salmon is generally considered depleted in the US and Canada. Returns to rivers are low compared to historical levels. As a result, catches are low and commercial fisheries are not encouraged. For example, while fisheries are allowed in Greenland, exports are not so only salmon supply recreation, subsistence and local hospitality only.

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| Figure 25: Other ISSCAAP Groups’ annual nominal catches (million t) in the Northeast Atlantic (Area 27). |

# 3. SRA Summary Results

The SRA assessments used here are a naive catch-only assessment that does not use any other information.

The priors might be improved. There is no fishlife match reported even when the species has life history parameters well estimated. This problem still needs to be resolved.

The match between SRA and the stock assessments on a stock-by-stock basis is poor, but the general status of all stocks combined is better. SRA tends to imply more stocks are overfished, which is arguably more precautionary. In many cases, the status of stocks is unknown both for SRA and stock assessments available to this review.

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| Table 26: Comparison between SRA results and averaged stock assessments overall.   | SRA Status | O | O-F | F | N | U | | --- | --- | --- | --- | --- | --- | | O | 1 | 1 | 5 | 0 | 8 | | O-F | 0 | 0 | 0 | 0 | 0 | | F | 0 | 0 | 2 | 0 | 0 | | N | 0 | 0 | 1 | 0 | 3 | | U | 5 | 3 | 7 | 4 | 6 | |
| Table 27: Marginal SRA status estimates compared to averaged stock assessments.   | Source | O | O-F | F | N | U | | --- | --- | --- | --- | --- | --- | | SRA | 15 | 0 | 2 | 4 | 25 | | Stock Assessments | 6 | 4 | 15 | 4 | 17 | |

# 4. References

Links to the references for individual stock advice are available in the accompanying spreadsheet.

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