

Seafood Assessment

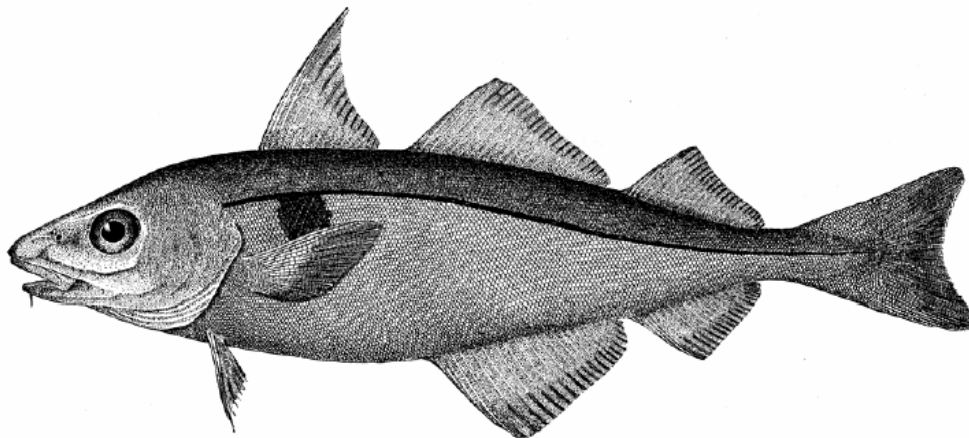


Image: Goode 1884.

Haddock

Melanogrammus aeglefinus

Atlantic Canada

Final

July 2006

Julia K. Baum and Trevor Davies
Dalhousie University

About Sea Choice® and Seafood Assessments

The Sea Choice® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the Canadian marketplace. Sea Choice® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Sea Choice® makes its science-based recommendations available to the public in the form of a pocket guide, Canada's Seafood Guide, that can be downloaded from the Internet (www.seachoice.org) or obtained from the Sea Choice® program directly by emailing a request to us. The program's goals are to raise awareness of important ocean conservation issues and empower Canadian seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on Canada's Seafood Guide is supported by a Seafood Assessment by Sea Choice or a Seafood Report by Monterey Bay Aquarium; both groups use the same assessment criteria. Each assessment synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic/sustainability criteria to arrive at a recommendation of "Best Choices", "Concerns" or "Avoid". The detailed evaluation methodology is available on our website at www.seachoice.org. In producing Seafood Assessments, Sea Choice® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and scientific reviews of ecological sustainability. Information used to evaluate fisheries and aquaculture practices for assessments regularly comes from ecologists, fisheries and aquaculture scientists, members of industry and conservation organizations. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Sea Choice's sustainability recommendations and the underlying Seafood Assessments will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Assessments in any way they find useful, with acknowledgement. For more information about Sea Choice® and Seafood Assessments, please contact the Sea Choice® program via e-mail and telephone information available at www.seachoice.org

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Executive Summary

Haddock is a commercially important groundfish species of the North Atlantic Ocean. It is fairly resilient to fishing pressure, as it matures quickly and is highly fecund, with occasional very strong recruitment. In Canada, three haddock stocks are currently managed: (1) eastern Scotian Shelf/southern Gulf of St. Lawrence, (2) southern Scotian Shelf/Bay of Fundy, and (3) Georges Bank (co-managed with the U.S.). All three stocks were overfished in the 1990s, but the fishery in the former region has been closed since 1993, and fishing mortality on the latter two stocks has declined substantially. Haddock abundance has increased in the past decade, but the populations are now composed mainly of small, slow growing individuals, and productivity has been impaired in some regions.

Trawling, the primary fishing method for haddock, catches several other species as bycatch, including cod and cusk, which are assessed as Special Concern and Threatened respectively by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). There is concern that bycatch in the haddock fishery may impair rebuilding of cod populations. In addition, trawling significantly damages benthic (bottom) marine habitats. Haddock caught using hook and line are a more sustainable alternative because this gear has minimal bycatch and habitat damage associated with it. Several areas in Atlantic Canada and New England have been closed to trawling. In addition, the Department of Fisheries and Oceans (DFO) monitors haddock abundance in long-term research surveys and undertakes population assessments every few years. The management regime, however, has not prevented significant declines of haddock stocks and until the stocks have fully recovered, can be considered only moderately effective. In Canada, haddock captured in hook and line fisheries merit an overall seafood recommendation of ‘Best Choice’, while it is recommended that those caught in trawl fisheries be avoided.

Justification for Reassessment

This report is an addendum to Stevens’ (2004) Northeastern U.S. haddock assessment. Its purpose is to provide information Atlantic Canada’s haddock stocks, and a Sea Choice assessment of these stocks.

Table of Sustainability Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability	√	S Scotian Shelf & Bay of Fundy		
Status of Stocks	E Georges Bank √	√ E Scotian Shelf & S Gulf of St. Lawrence		
Nature of Bycatch	√ (Hook & line)		√ (Trawl)	
Habitat Effects	√ (Hook & line)		√ (Trawl)	
Management Effectiveness		√		

Overall Seafood Recommendation:

Haddock (Hook & Line) Best choice
Some Concerns
Avoid

Haddock (Trawl)
Best choice
Some Concerns
Avoid

About the Overall Seafood Recommendation:

- A seafood product is ranked **Avoid** if two or more criteria are of High Conservation Concern (red) OR if one or more criteria are of Critical Conservation Concern (black) in the table above.
- A seafood product is ranked **Some Concerns** if the five criteria “average” to yellow (Moderate Conservation Concern) OR if the “Status of Stocks” and “Management Effectiveness” criteria are both of Moderate Conservation Concern.
- A seafood product is ranked **Best Choice** if three or more criteria are of Low Conservation Concern (green) and the remaining criteria are not of High or Critical Conservation Concern.

Introduction

Biology

Haddock is a demersal (bottom-dwelling) species in the family Gadidae (subfamily Gadinae), the ‘true cods’ (Nelson 2006). Like many other gadoids (cod, hake, pollock, whiting), it is a commercially important groundfish species. Haddock is distributed on both sides of the North Atlantic Ocean, and in the Northwest Atlantic ranges from Labrador to Cape Charles, Virginia (Brodziak 2005). In Canada, there are several haddock stocks including one in the southern Gulf of St. Lawrence and eastern Scotian Shelf, a major one on the eastern Scotian Shelf and Bay of Fundy, and a major transboundary stock on Georges Bank. Although some haddock stocks undertake seasonal migrations within their areas, there is thought to be relatively little exchange of individuals among the different stocks (Begg 1998; DFO 2005). Haddock are usually found in 45 to 135m of water and in bottom temperatures between 2° and 10°C (Klein-MacPhee 2002).

Adult haddock range in size from about 30cm to up to 1m, and most commercially caught haddock weigh from 1 to 3kg (Brodziak 2005). Haddock are highly fecund, and adult female egg production increases substantially with age, from a few hundred thousand eggs each year in the youngest spawners up to three million eggs in the oldest spawners (FRCC 2004, Brodziak 2005). Haddock have a broad diet, which varies by locality. Among other things, they consume echinoderms (mainly brittle stars), crustaceans, polychaetes, bivalve and gastropod mollusks, and fishes (mostly herring eggs) (Klein-MacPhee 2002). In turn, juvenile haddock are preyed upon by several fish species including other gadoids, and adult haddock are prey of gray seal (Klein-MacPhee 2002).

Fishery

Atlantic Canada and New England’s groundfish fishery has existed since colonial times, and focused originally on cod. Fishing methods have changed substantially over time, from hook and line on small sailing dories, to sailboats, to steamships, and finally in the early 1900s the use of otter trawls and on-board refrigeration (Klein-MacPhee 2002; NRC 1998 cited in Stevens 2004). After World War I, fishers began to target a wider variety of species, including haddock. Groundfish landings decreased during World War II, and then increased in the 1960s, largely due to effort by distant-water factory trawlers from Russia and Spain (Stevens 2004). Canada created a 200-mile Exclusive Economic Zone (EEZ) along its Atlantic coastline in 1977, after which domestic fishing grew substantially. Excessive fishing pressure, first by international fleets, then by the domestic fleet, has led to severe overfishing of many groundfish stocks, including haddock. Over the past decade, haddock populations have begun to recover.

In Canada, haddock are managed by the Department of Fisheries and Oceans. There are five haddock fishing areas in Atlantic Canada (DFO 2002a), but only three of the stocks have been assessed recently: (1) southern Gulf of St. Lawrence and eastern Scotian Shelf, (2) southern Scotian Shelf and Bay of Fundy, (3) eastern Georges Bank. Currently, haddock fishing is permitted only in the latter two areas. Haddock is harvested in Canada inshore, near shore, and offshore by otter trawls, traps, long-lines, and gillnets (DFO 2002a), and most of Canada’s haddock stock is landed in Nova Scotia. In 2002, 1,006 Canadian vessels were licensed to

harvest haddock and total landings were valued at \$27.6 million (DFO 2002a). By 2006, the Maritimes region groundfish fishery included close to 700 active fishers along Nova Scotia's southern shores and in the Bay of Fundy (DFO 2006). The groundfish fishery targets haddock, cod, pollock, redfish and flounder, and catches a number of other bycatch species (DFO 2006). Fishers operate throughout the year with various fleets, adjusting the timing of the fishery based on local abundance, weather, market conditions, and the participation of licence holders in other fisheries such as lobster (DFO 2006). The Georges Bank stock is a transboundary stock that is co-managed with the U.S. In the U.S., haddock are managed by the National Marine Fisheries Service (NMFS) and are regulated under the New England Multispecies Groundfish Fishery Management Plan (FMP) (Stevens 2004).

1) Southern Scotian Shelf & Bay of Fundy Haddock

The southern Scotian Shelf and Bay of Fundy groundfish fishery, which takes haddock amongst its catches, has typically been dominated by mobile gear (trawlers) except during 1990-1993 when the proportion of landings taken by fixed gear (longline and handline) was greater (FRCC 2004). Reported annual haddock landings in this region since 1960 have been variable, peaking at 43,000t, with a long-term average of about 18,000t (DFO 2005a; Figure 1). Quotas for haddock were introduced in this area in 1970 (FRCC 2004), and landings increased substantially from then until the early 1980s (Figure 1). Haddock quota has been low since about 1990. In 2005, total haddock landings of 5,946t on the southern Scotian shelf and Bay of Fundy were well below the 8,000t quota, and the trawl fleet reported difficulties in locating concentrations of large haddock in the Bay of Fundy (DFO 2005a). Low fish prices and high fuel, insurance and bait costs also have contributed to the shortfalls, and industry has said that these factors combined with low catch rates and small fish size, mean there is currently little economic incentive to fish haddock on the Scotian Shelf (DFO 2005a). The quota for 2006/2007 was reduced to 7,000t (DFO 2006).

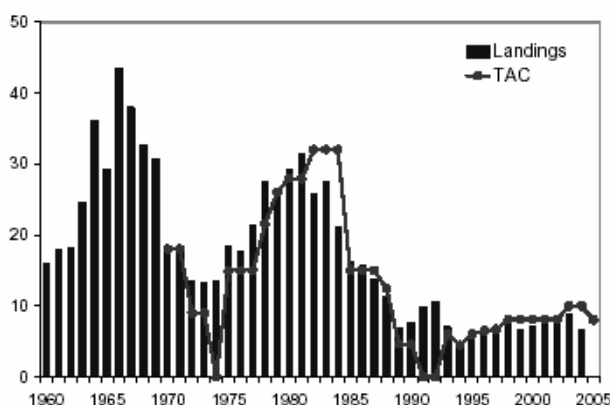


Figure 1. Haddock landings and total allowable catch (TAC) ('000t) on the southern Scotian Shelf and Bay of Fundy (4X/5Y). Source: DFO 2005a.

The distribution of the Scotian Shelf groundfish fishery also has changed over time, and fishing is now more concentrated in the Gulf of Maine and Bay of Fundy (DFO 2005b). Since 2000, the proportion of haddock landed from January to March has since increased (much of it from 4Xn), reportedly because it is possible to direct for haddock with a minimal bycatch of cod (DFO

2005a). Increased catches in 4Xp (Figure 2) reflect targeting for larger haddock in deeper water, which generally has higher market value, and also has relatively low cod bycatch (DFO 2005a).

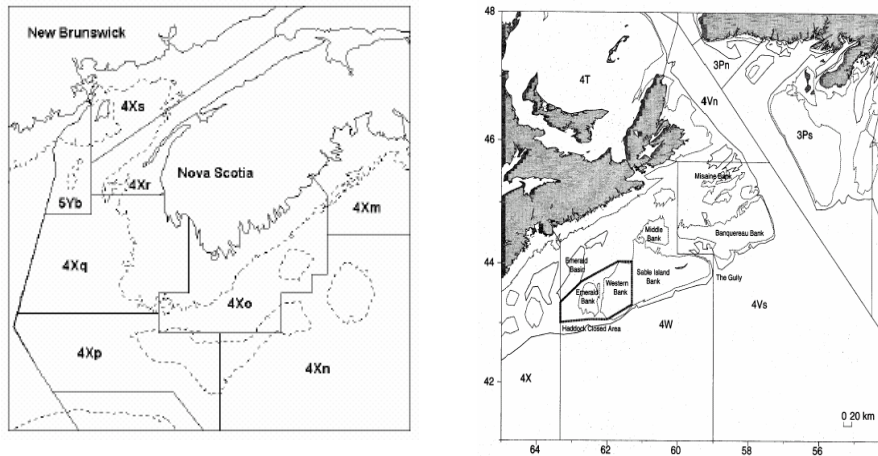


Figure 2. Map of haddock management areas on the southern Scotian Shelf (4X) and Bay of Fundy (5Y) (left panel), and southern Gulf of St. Lawrence (4R) and eastern Scotian Shelf (4VW) (right panel) based on North American Fisheries Organization (NAFO) fishing divisions. Also included in the right panel are the major banks and the closed haddock area.

2) Eastern Scotian Shelf & southern Gulf of St. Lawrence Haddock

The eastern Scotian Shelf and southern Gulf of St. Lawrence haddock fishery collapsed and was closed to all groundfish fishing in 1993 (Mohn and Simon 2002). It has remained closed to date (DFO 2006). Prior to the closure, annual haddock landings in this region averaged about 25,000t from 1960 to 1969, 5000t from 1970 to 1979, and 11,300t from 1980 to 1989 (Figure 3; DFO 2002b).

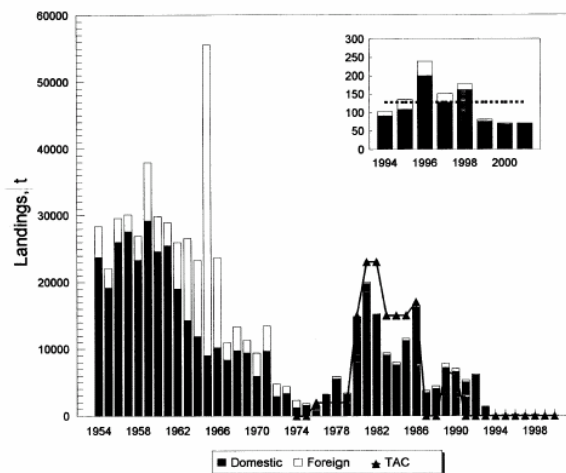


Figure 3. Haddock landings on the eastern Scotian Shelf and southern Gulf of St. Lawrence by domestic and foreign fleets from 1954 to 2001. Inset shows landings since 1994. Source: Frank et al. 2001.

Within this region haddock concentrate on the offshore banks of the Scotian Shelf ranging from Emerald Bank in the west to Banquereau Bank in the east (Figure 2; DFO 2002b). In the past, spawning aggregations on the principal spawning areas, Emerald, Western and Sable Island

Banks were the target of intense fisheries (DFO 2002b). A year-round spawning/nursery ground closure, which encompasses Emerald Bank and part of Western Bank, was established in 1987 (initially exempt to fixed gear) and remains in effect (Figure 2; DFO 2002b). Total annual haddock landings from 1994 to 2000 averaged 140t (DFO 2002b). The Fisheries Resource Conservation Council (FRCC) has continued to recommend that there be no directed fishery for haddock in this management area (4TVW), and that bycatch of haddock should not exceed that required for the normal conduct of fisheries directed towards other species (FRCC 2004).

(3) Eastern Georges Bank

Eastern Georges Bank haddock stock has been jointly managed by Canada and the U.S. since the implementation of the Hague Line in 1984 (Figure 4). In May 2004, a formal quota sharing agreement between Canada and the U.S. was implemented to share the harvest of the transboundary eastern Georges Bank haddock management unit (Brodziak et al. 2008). This agreement includes total allowable catch quotas for each country as well as in-season monitoring of the catch of haddock on eastern Georges Bank (Brodziak et al. 2006).

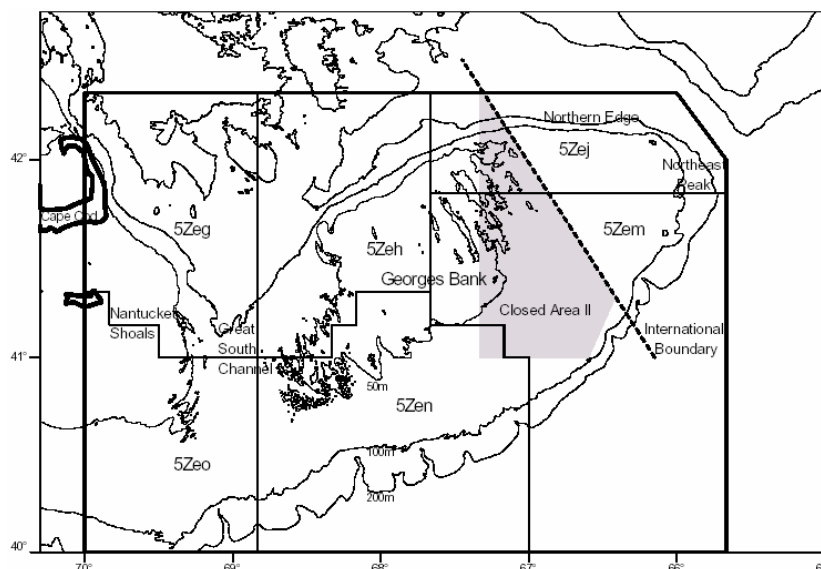


Figure 4. Map of Georges Bank (5Z) haddock management areas based on NAFO subdivisions, and showing the closed area and Canada - U.S. international boundary etc. Source: Van Eeckhaute and Brodziak 2005.

The Eastern Georges Bank haddock stock has been commercially exploited since the late 1880s. Total average catch during the 1930s and 1950s was 25 000t. Catch statistics are unavailable for the 1960s; however, average yearly catches for this period are estimated to be approximately 60 000t. Catches since the 1970s until present have been substantially lower, ranging from 5000 to 10 000t (Figure 5). As in the other haddock stocks, overfishing led to significant long-term declines in spawning biomass and recruitment, and by 1993 adult haddock biomass reached a historical low of only 9 000t (Van Eeckhaute and Brodziak 2005). Since 1994, fishery closures in some areas of the Eastern Georges Bank, decreases in fishing effort, and larger mesh sizes for trawl gear has allowed the stock to largely recover (Brodziak et al. 2006). The 2003 estimate of total adult biomass for Eastern Georges Bank haddock is 74,000t.

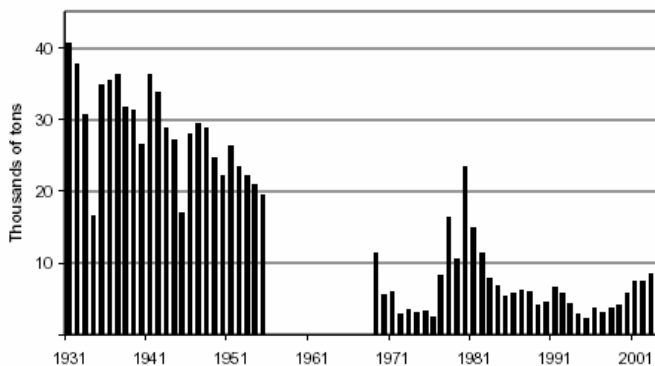


Figure 5. Historical haddock catch in 5Zjm from 1931 to 1955 compared to more recent catches from 1969 to 2004. Source: Van Eeckhaute and Brodziak 2005.

Scope of the analysis and the ensuing recommendation:

This report focuses primarily on Canadian managed haddock stocks in the southern Gulf of St. Lawrence, the Scotian Shelf, Bay of Fundy, and the Canadian and U.S. managed eastern Georges Bank stock. Imported haddock is not analyzed in this report.

Availability of Science

The scientific information required to carry out this seafood assessment is relatively complete, and is accessible. The southern Scotian Shelf/Bay of Fundy and the Georges Bank haddock stocks are assessed every couple of years, with updates almost every year. However, the eastern Scotian Shelf/southern Gulf of St. Lawrence haddock stock has not been assessed since 2001. Assessments are based on long-term standardized trawl surveys, catch data, and other biological information. Because haddock is a valuable commercial species, biological and abundance information are fairly well known. There is some uncertainty as to whether Bay of Fundy haddock should be treated as a separate stock from the southern Scotian Shelf.

Market Availability

Common and market names: Haddock. It may also be called scrod, although this term typically refers to cod.

Seasonal availability: Haddock is readily available in Canada year round (frequently sold frozen).

Product forms: Haddock is available in Atlantic Canada in many forms including fresh or frozen, as bait, boneless, cooked, dressed, fillets, salted, smoked, steaks, or whole (Anon. 2006a).

Import and export sources and statistics: In recent years, haddock has accounted for only a minor proportion of Canada's total fish and seafood exports (1.4% in 2004, 1.5% in 2005) (Anon. 2006b), reflecting the overall decline in groundfish. Among groundfish species, however, haddock is relatively important. In 2005, Canada exported 10,790 tonnes of haddock, while in 2004 9,266 tonnes were exported (Anon. 2006b). Canada imports almost as much haddock as it

exports. Canada imported 8,070 tonnes of haddock in 2005, and 7,412 tonnes in 2004 (Anon 2006b).

Analysis of Seafood Watch® Sustainability Criteria for Wild-caught Species

Criterion 1: Inherent Vulnerability to Fishing Pressure

The life history characteristics of haddock make it fairly resilient to fishing pressure (Table 1). The age and size at maturity of haddock varies slightly amongst stocks, but in all stocks 50% of females are mature by age 3 (Mohn & Simon 2002, DFO 2005a). There is evidence that selective fishing pressure has reduced the size and age at maturity of haddock in the eastern Scotian Shelf/southern Gulf of St. Lawrence stock (Mohn and Simon 2002) and size at maturity in Georges Bank haddock (Brodziak 2005). Haddock growth (both size-at-age and weight-at-age) is depressed in all three haddock stocks. The growth rate or von Bertalanffy growth coefficient (K) is a measure of the rate at which the asymptotic length is approached and it is often used as an indicator of a species' resilience to fishing pressure. According to Froese and Pauly (2006), the von Bertalanffy growth coefficient, K, for haddock is 0.12 – 0.23. The maximum known age for haddock is 14 years (Stevens 2004), but only a small proportion of the haddock survive past age 9 (Brodziak 2005)

Table 1. Life history characteristics of haddock.








Age at Maturity	Growth Rate/Max. Size	Maximum Age	Fecundity	Species Range	Special Behaviors	Population Variability
Median age at maturity (years for female/male): SSSBF: ~3 ESSSG: ~3 Georges Bank: 1.5/1.3	K=0.12 – 0.23 Max. size: 110cm, 16kg, more commonly 35-60cm	~14; ages 9+ rare	Range: 12,000 - 3,000,000 eggs depending on female size	North Atlantic NW Atlantic: Labrador to Cape Charles, Virginia	Spawning aggregations.	Recruitment highly variable.

SSSBF=Southern Scotian Shelf and Bay of Fundy; ESSSG=Eastern Scotian Shelf & southern Gulf of St. Lawrence

Major spawning grounds for haddock include Georges Bank, Browns Bank on the southern Scotian Shelf, and Emerald, Western, and Sable Island Banks on the eastern Scotian Shelf (DFO 2002b, 2005, Brodziak 2005). Haddock form spawning aggregations in these areas at various times of the year, with peak spawning occurring on Georges Bank in late-March through April, on Browns Bank from late April to early May, and on the eastern Scotian Shelf in spring (Brodziak 2005, DFO 2002b, 2005a). Spawning occurs near the ocean bottom over various substrates including rocks, gravel, smooth sand, and mud (Klein-MacPhee 2002). The retention of haddock larvae in suitable nursery areas is highly dependent on oceanographic conditions, and is an important determinant of the strength of haddock recruitment (the number of individuals surviving until the size of entry into the fishery) (Brodziak 2005). Following the larval stage, juvenile haddock gradually move from the water column to the seafloor (thus the name groundfish) where they spend the remainder of their lives (Klein-MacPhee 2002). Haddock recruitment is highly variable, characterized by periods of low recruitment that are punctuated by exceptionally high years. For example, low recruitment on Georges Bank for the past 40 years has been punctuated by two extremely high years, 1963 and 2003 (Brodziak et al. 2006).

Synthesis


Haddock is an early maturing, highly fecund species that is inherently resilient to fishing pressure. Heavy fishing pressure, however, has acted as a strong selective force to decrease the size and age at maturity, which may adversely impact recruitment and natural mortality.

Criterion 1: Inherent Vulnerability to Fishing Pressure	
Primary Factors to Evaluate	Ranking
Intrinsic rate of increase 'r'	Unavailable
Age at first maturity	
von Bertalanfy growth coefficient 'k'	
Maximum Age	
Reproductive potential (fecundity)	
Secondary Factors to Evaluate	
Species range	
Special behaviours or requirements	
Quality of habitat (non-fishery impacts)	

Inherent Vulnerability Rank:

Low (Resilient) 

Moderate 

High (Vulnerable) 

Criterion 2: Status of Wild Stocks

Three separate haddock stocks are currently managed in Canada: the eastern Scotian Shelf & southern Gulf of St. Lawrence (4RST), southern Scotian Shelf and Bay of Fundy (4X/5Y), and a transboundary eastern Georges Bank (5Ze) stock that is co-managed with the U.S.

Factors 1 & 2: Management classification status & Abundance thresholds

All three haddock stocks have been significantly overexploited and can be considered to be *recovering from overfishing*. It is unclear what the biomass is relative to B_{msy} as DFO assessments do not usually report this information. Mohn & Simon (2002) have noted that there are no established biomass reference points for Canadian haddock stocks. These two factors receive a yellow ranking and details for each stock follow.

On the eastern Scotian Shelf and southern Gulf of St. Lawrence, the haddock fishery has been closed since 1993 because of overfishing. Although total haddock abundance has increased since then, the increases have been primarily in small haddock (<42cm), while the abundance of larger haddock has remained very low (DFO 2002b). The increase is partly due to the exceptionally large year class (i.e. age 1 haddock) in 1999, which is the largest observed since 1970. Spawner

biomass has increased steadily since 1993, but it is still quite low relative to the long-term level (Figure 6; Frank et al. 2001). Moreover, the spawner biomass is now comprised largely of (mature) fish smaller than the 43 cm minimum size, and given current slow growth and high natural mortality, such that few of these fish are expected to survive to grow above this size (FRCC 2004). If natural mortality remains high, recruitment is average to low, and growth does not increase, DFO believes there is a high probability that the spawner biomass will decrease to what it considers as possible conservation limits within a few years (FRCC 2004).

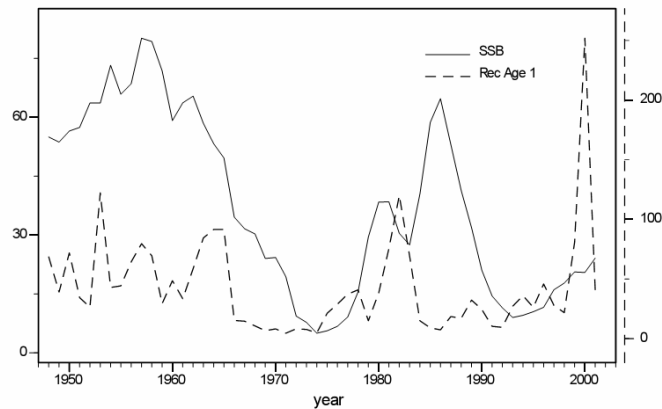


Figure 6. Spawning stock biomass (SSB; in '000 tons) and recruitment of age 1 haddock (in millions) for eastern Scotian Shelf & southern Gulf of St. Lawrence haddock as estimated from the 2001 assessment. Source: Mohn & Simon 2002.

On the southern Scotian Shelf and Bay of Fundy, haddock spawning biomass declined from a peak in 1979 and reached a low of 22,000t in 1990 (Figure 7; DFO 2005a). Spawner biomass increased slowly thereafter until 2003, decreased slightly since then, and was expected to decline from 2006 to 2007 (DFO 2005a). Biomass is near the long-term average on the Scotian Shelf but below the long-term average in the Bay of Fundy (DFO 2005b). Recruitment (age 1 haddock) has been quite good recently: the 1998 year class was the strongest since 1970 at 63 million, and 1999, 2000, and 2003 were also strong (DFO 2005a). Recruitment is typically stronger on the Scotian Shelf than in the Bay of Fundy (DFO 2005a). Both surveys in this region indicate that the proportion of haddock biomass in the Bay of Fundy is declining while the proportion of catches from the area is increasing (DFO 2005a). The haddock catch also is comprised of much smaller fish than in the past and handliners have noted the absence of haddock throughout most of the traditional inshore fishing grounds (e.g. off Cape Sable Island) (DFO 2005b).

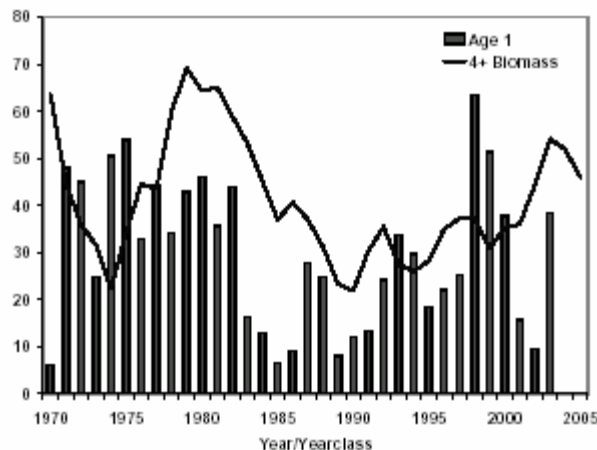


Figure 7. Spawning stock biomass (ages 4+) (000t) and age 1 recruitment (millions) in the subsequent year for southern Scotian Shelf & Bay of Fundy (4X/5Y) haddock. Source: DFO 2005a.

Georges Bank haddock (adult biomass, >3 years old) declined to low levels in the early 1970s, recovered slightly in the early 1980s and fell to a historical low in 1993. Adult biomass remained low throughout the mid-1980s and 1990s but has significantly increased since 2001. Adult biomass decreased slightly in 2005; however, an extremely strong recruitment year from 2003 is expected to increase adult biomass after 2006 to well beyond the 1931-1955 maximum biomass of about 90 000t (Figure 8; Van Eeckhaute and Brodziak 2005).

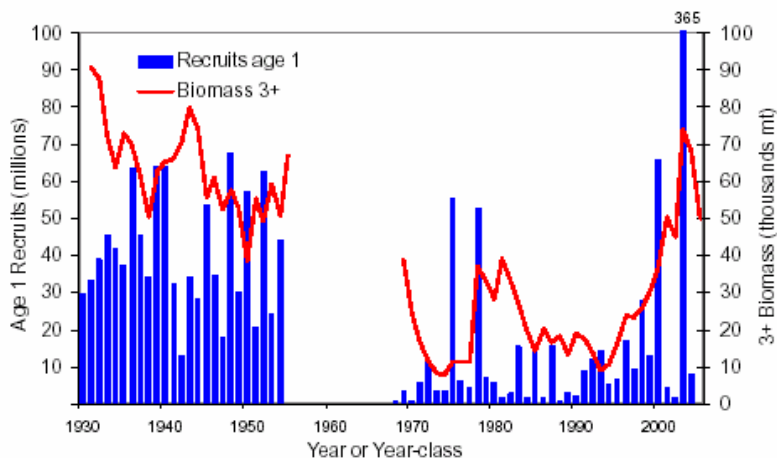


Figure 8. Haddock adult (age 3+) biomass and number of age 1 recruits in areas 5Zjm of Georges Bank from 1931 to 1955 and 1969 to 2005. Source: Van Eeckhaute and Brodziak 2005.

Factor 3: Occurrence of Overfishing

Haddock are no longer being overfished in any region, except perhaps in the Bay of Fundy. Thus, this factor receives a green ranking.

The eastern Scotian Shelf/southern Gulf of St. Lawrence haddock stock experienced very high levels of exploitation from 1970 to 1993 (Figure 9), when the fishery collapsed and was closed. It remains closed to date. Fishing mortality in this region (from bycatch) is quite low, and DFO

(2002) considered minimization of haddock removals to be appropriate (at least for the short term).

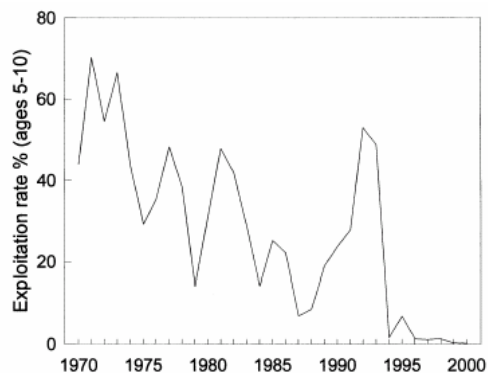


Figure 9. Exploitation rate of eastern Scotian Shelf and southern Gulf of St. Lawrence haddock. Source: Frank et al. 2002.

Low exploitation (and high recruitment) in the early 1990s allowed the southern Scotian Shelf/Bay of Fundy haddock population to start to rebuild (FRCC 2004). A fishing mortality reference point of $F_{0.1}=0.25$ has been used as a harvest strategy for this stock. The exploitation rate on ages 5-7 haddock increased from the 1970s to ~50% in the early 1980s, but then declined to close to $F_{0.1}$ (20%, currently used value of $F_{0.1}=0.25$) in the late 1980s (FRCC 2004). By 1994 it had dropped below $F_{0.1}$ and has remained low since (DFO 2005a). If catches are maintained at the current TAC of 8,000t, fishing mortality will remain below $F_{0.1}$ and spawning stock biomass will decrease from 2006 to 2007 (DFO 2005a). In the past few years, relative fishing mortality (total landings/ages 4+ survey biomass) has been declining on the southern Scotian Shelf but relatively stable in the Bay of Fundy (DFO 2005b). Exploitation in the Bay of Fundy might be too high and be hindering rebuilding of the haddock population (DFO 2005b).

A reduction in fishing mortality below the reference threshold of 0.26 has been achieved for the Eastern Georgian Bank stock since 1995. In addition, an increase in the minimum trawl mesh sizes has reduced the amount of juvenile bycatch which has led to greater abundance of older fish. Current catch levels for 2005 and 2006 are considered to have a low risk (<25%) of fishing mortality exceeding the fishing reference threshold (Van Eeckhaute and Brodziak 2005).

Factor 4: Overall degree of uncertainty in status of stock

Being a commercially important species, haddock receives considerable research attention. Haddock stocks are monitored in a long-term research vessel survey in addition to surveys initiated together by DFO and industry in the 1990s. Evaluation of stock status is derived from these surveys, as well as reported landings, shore and sea-based samples taken from commercial landings for size and age composition (DFO 2002). With respect to the Scotia-Fundy region, although the southern Scotian Shelf and the Bay of Fundy are managed as a single stock, they are thought to be separate stocks (DFO 2005a). Different population dynamics between these areas increases the uncertainty of analyses (DFO 2005a). In addition, past assessments for haddock in this region have a general tendency to over-estimate population abundance in the most recent year, particularly when strong year classes occur (DFO 2005a). This factor therefore receives a yellow ranking.

Factors 5 & 6: Long-term and short-term trends in abundance

Each of the haddock stocks has experienced variable trends in abundance. In general, the stocks reached low points in the early 1970s, and then largely recovered before crashing again in the early 1990s. The short term trends for each stock (i.e. over the past decade) are generally of rebuilding, although southern Scotian Shelf & Bay of Fundy haddock have decreased since 2004 (DFO 2005a). These two factors receive rankings of yellow because of the long-term repeated pattern overexploiting haddock stocks, and because the short-term trend, although generally positive has not yet showed full recovery.

Factor 7: Current age, size, or sex distribution

Haddock has experienced marked reductions in growth rate, size-at-age is at a historical low, and productivity has been impaired in some regions.

The most recent stock assessment described haddock on the eastern Scotian Shelf/southern Gulf of St. Lawrence as being “plagued by poor growth” such that they were both under-weight and under-length (Frank et al. 2001). In 2002, DFO stated that “poor growth, low condition, maturity at a smaller size and high[er than usual] natural mortality have typified the production of this stock in recent times”. Indeed, size-at-age of haddock has decreased markedly in this region and is at a historical low, with age 7 haddock now about the same size as age 4 haddock were in the past (Figure 10). The stock is now dominated by very small, slow growing, young haddock (Mohn & Simon 2002), with unknown long-term implications for stock recovery.

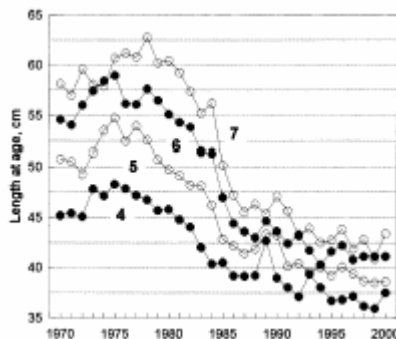


Figure 10. Average length of eastern Scotian Shelf haddock in the summer research vessel (RV) survey between 1970 and 2000, showing the substantial decline in ages 4, 5, 6, and 7 haddock lengths. Source: Frank et al. 2001.

Similarly, haddock on the southern Scotian Shelf and Bay of Fundy have also experienced declines in growth rates. The average sizes-at-age of haddock in the research vessel (RV) survey have been decreasing since the mid-1970s, and many ages are at or near the smallest size observed in the entire time series (Figure 11; DFO 2005a). The population is dominated by small haddock: in 2005, 84% of haddock on the southern Scotian Shelf research survey were less than 43cm (DFO 2005a). Under the current growth regime, productivity is only about two thirds of what it was in the 1970s, mainly because of the decrease in growth (DFO 2005a). Although a yield-per-recruit analysis indicated that there would be no increase in yield by delaying fishing of haddock to older ages, catching the small fish does have implications for future spawning stock

biomass and other aspects of production (DFO 2003a, 2005a). The age composition of haddock shows an expanding age range in recent years on the southern Scotian Shelf, but the age range for the Bay of Fundy remains truncated (DFO 2005b). DFO (2005b) had stated that haddock exploitation in the Bay of Fundy may be too high, and might be hindering stock recovery and rebuilding of the size/age structure of the population in this area.

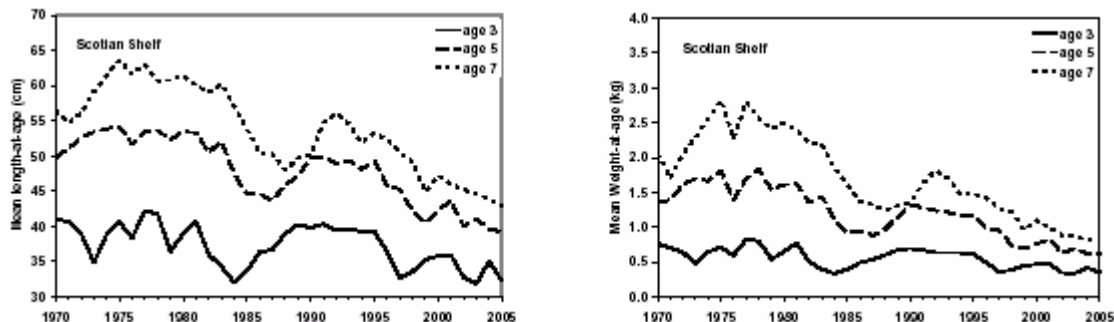























Figure 11. Research vessel data showing the mean length-at-age (cm) (left panel) and mean weight-at-age (kg) (right panel) for southern Scotian Shelf haddock. Source: DFO 2005a.

Mean weights at age of Eastern Georges Bank haddock has declined and are currently below their long-term average for all age classes (Table 2). Consequently, the productivity of the stock has diminished in recent years due to reductions in average fish size (Van Eeckhaute and Brodziak 2005). Environmental change and/or a response to increased haddock density are suggested as possible reasons for this decline (Brodziak et al. 2006). The population age structure of the Eastern Georgian Bank shows full representation of all age classes.

Table 2. Average weight at age (kg) of haddock from the Canadian commercial fishery on the Eastern Georgian Bank during 1969 to 2004. Source: Van Eeckhaute and Brodziak 2005.

	Age Group							
	1	2	3	4	5	6	7	8
Minimum	0.394	0.589	0.812	1.272	1.643	1.631	2.002	2.032
Maximum	0.797	1.215	1.724	2.235	2.639	3.760	4.114	4.009
Median	0.600	0.993	1.399	1.791	2.144	2.507	2.868	3.108
Average	0.583	0.99	1.376	1.797	2.142	2.471	2.814	3.074
2000 – 04	0.484	0.912	1.368	1.708	1.957	2.116	2.337	2.567

Synthesis

Criterion 2: Status of Wild Stocks			
Primary Factors to Evaluate	Rankings		
	S. Gulf St. Lawrence & E. Scotian Shelf	W. Scotian Shelf & Bay Fundy	Eastern Georges Bank
Management classification status			
Current population abundance relative to B _{MSY}			
Occurrence of overfishing			
Overall degree of uncertainty in status of stock			
Long term trend in abundance			
Short term trend in abundance			
Current age, size, or sex distribution			

Conservation Concern: Overall Status of Wild Stocks

Low (Healthy)  **Moderate**  High (Stock Poor)  Stock Critical 

Criterion 3: Nature and Extent of Bycatch

Seafood Watch® defines sustainable wild-caught seafood as marine life captured using fishing techniques that successfully minimize the catch of unwanted and/or unmarketable species (i.e., bycatch). Bycatch is defined as species that are caught but subsequently discarded (injured or dead) for any reason. Bycatch does not include incidental catch (non-targeted catch) if it is utilized, accounted for and/or managed in some way.

Factor 1: Quantity & Composition of Bycatch

The Atlantic groundfish fishery is conducted almost exclusively with otter trawls, a fairly indiscriminate gear type. Consequently, the trawl fishery is considered a mixed species fishery, and bycatch and subsequent discarding of unmarketable (e.g. undersized) or otherwise prohibited species occurs frequently. In particular, haddock, cod, and pollock are often caught together in groundfish fisheries (DFO 2005a). Trawls catching haddock also catch cusk, flatfish, white hake, halibut, and monkfish as bycatch (DFO 2003a). The composition of species caught in the haddock fishery is not entirely known because landings information does not include discards and observer information is available for only a limited proportion of the fleet (DFO 2003a). Of species caught as bycatch, the Committee on the Status of Endangered Wildlife in Canada has designated cod in the Maritimes region (Southern Gulf of St. Lawrence, across the Scotian Shelf and into the Gulf of Maine) as Special Concern (COSEWIC 2003a) and cusk in Atlantic Canada as Threatened (COSEWIC 2003b). Catches and conservation of these species must be considered in any haddock management decisions (FRCC 2004). This factor receives a red ranking for the trawl fishery because of regular bycatch of threatened species.

A small fraction of haddock is caught with hook and line gear. Hook and line fishing is thought to have minimal bycatch impacts, except for undersized catch (i.e. regulatory discards) (Stevens 2004). The hook and line fishery receives a green ranking for this factor.





Factor 2: Population Consequence of the Bycatch

The bycatch of cod in the haddock fishery is of particular concern (FRCC 2004, DFO 2005a). With regard to current fishing practices for the southern Scotian Shelf and Bay of Fundy haddock stock, DFO (2005a) has stated that “the achievement of rebuilding objectives for cod and pollock may constrain the harvesting of haddock”. According to both the Department of Fisheries and Oceans and the Fisheries Resource Conservation Council, an imbalance in quotas between haddock and cod creates potential for discarding and requires improved monitoring (FRCC 2004, DFO 2005a). Further, Mohn and Simon (2002) noted that eastern Scotian Shelf cod “is likely to be impacted by any re-opening of the 4TVW [southern Gulf of St. Lawrence and eastern Scotian Shelf haddock fishery]”. This factor receives a red ranking for the trawl fishery because bycatch appears to be a contributing factor in limiting the recovery of a species of special concern.

Factor 3: Trends in Interaction Bycatch Rates

Fishermen in both the fixed and mobile gear fleets of the southern Scotian Shelf and Bay of Fundy reported to the Fisheries Resource Conservation Council (FRCC) in 2004 that they had made significant progress in directing for haddock with minimal by-catch of cod in what was previously predominantly a mixed cod and haddock fishery (FRCC 2004). Apparently, there are areas and seasons on the Scotian Shelf where both hook and line and mobile gear can harvest haddock with minimal by-catch of cod (FRCC 2004). However, the FRCC recognizes that more effort is required by fishers and DFO management to direct for haddock in specific areas and times so as to minimize cod bycatch, as well as to develop “innovative ideas in gear technology that will accomplish the same end” (FRCC 2004). This is timely given the increasing fishable biomass for haddock and the lack of rebuilding for cod (FRCC 2004). DFO (2005a) has similarly noted that impacts on cod may be mitigated through enhanced monitoring and modifications to fishing gear and practice. This factor receives a yellow ranking because further improvements (and evidence of these improvements) are needed to demonstrate declines in bycatch interaction rates in order to merit a continued green ranking.

Synthesis

Criterion 3: Bycatch	
Primary Factors to Evaluate	Trawl fishery Ranking
Quantity & composition of bycatch	
Population consequence of bycatch	
Trends in bycatch interaction rates	
Secondary factors	
Ecosystem impacts	

Nature of Bycatch Rank:

<p>Low (Minimal) ■ Hook & Line</p>	<p>Moderate ■ Trawl</p>	<p>High (Severe) ■</p>	<p>Critical ■</p>
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Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems

Factors 1-3: Habitat Effects

In Canada, haddock is caught with otter trawls, traps, long-lines and gillnets (DFO 2002a). Most haddock in both Canada and the U.S. are captured with various types of demersal trawl gear (mainly otter trawls) tailored to the habitats of target species or species assemblages (Stevens 2004). The impacts of trawling on benthic (bottom) ecosystems have been the subject of much research over the past decade. Trawling impacts sea-floor communities by scraping the ocean bottom causing: 1) sediment re-suspension (turbidity) and smoothing, 2) removal and/or damage to non-target species, and 3) destruction of abiotic and biotic three-dimensional habitat (Watling and Norse 1998, Auster and Langton 1999).

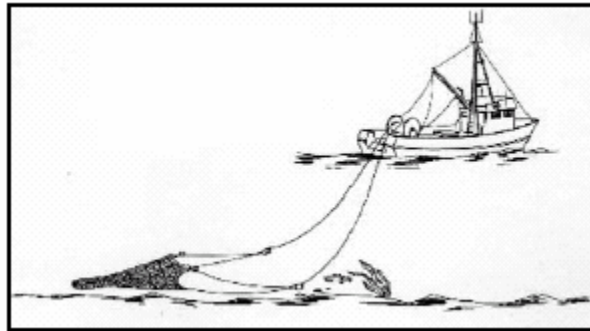


Figure 12. Picture of an otter trawl, courtesy M. Squillante, Monterey Bay Aquarium, adapted from Stevens 2004.

Several studies on the effects of bottom trawling have focused on the heavily trawled fishing grounds of the northwest Atlantic (e.g. Collie et al. 1997; Collie et al. 2000). For example, an experimental trawl study conducted by Prena et al. (1999, cited in Stevens 2004) on the Grand Banks off Newfoundland found that otter trawling on sandy bottom ecosystem could “produce detectable changes on both benthic habitat and communities, in particular a significant reduction in the biomass of large epibenthic fauna”. As Stevens (2004) reported, a 2001 workshop to assess the effects of fishing gear on marine habitats off the northeastern U.S., experts concluded that the “greatest impacts from otter trawls occur in low and high energy gravel habitats and in hard clay outcroppings” (NOAA 2002); p 24). Based on these results and those of the large body of research on this topic, it is evident that otter trawling and other bottom trawling gear can alter the surrounding ecosystem by degrading or removing available fish and invertebrate habitat.

The habitat impacts of bottom trawls are determined by several factors, including 1) the type and weight of gear used (dredge, beam, otter trawl etc.), 2) the resilience of the seabed bottom type

(rock, sand, mud, sponge, or coral), and 3) the amount and frequency of the disturbance. Some types of trawling gear cause less damage (i.e., otter trawls vs. scallop dredge) and some sediment types (and their associated ecosystems) are more resilient to disturbances caused by trawling (Stevens 2004). In a review of fishing effects, Collie et al. (2000) found that fauna associated with sandy (coarser) sediments were less affected by disturbance than those in soft, muddy (biogenic) sediments. Habitat recovery rates from trawl disturbance were slower in muddy and structurally complex habitats, while mobile sandy sediment communities could withstand 2-3 trawl passes per year without significant adverse change (Collie et al. 2000). The bathymetry of the Atlantic continental shelf, and habitat preferences of haddock (pebble/gravel), is such that groundfish trawlers targeting groundfish off the U.S. East Coast encounter both types of substrate (Stevens 2004). Otter trawling is thought to cause less disturbance to the sea floor than other types of trawling (such as inter-tidal and scallop dredging, Collie et al. 2000; NOAA 2002 cited in Stevens 2004), but it is likely that repetitive trawling in these areas causes substantial, and likely adverse impacts to seabed ecosystems along the east coast of Canada and the U.S. (Stevens 2004).






Factors 4 & 5: Ecosystem Effects

The fishing grounds on the continental shelf of Atlantic Canada and New England represent one of the most productive oceanic ecosystems in the world. Analyses of food web structure show that this area is rich in species diversity and abundance, and has a high degree of complexity and connectivity (Brodziak and Link 2002 cited in Stevens 2004). However, intense fishing pressure, particularly in the past fifty years, has resulted in a marked shift from a marine community dominated largely by benthic fishes to one dominated largely by smaller pelagic forage fishes (Frank et al. 2005, Fogarty and Murawski 1998). Recent evidence suggests that the collapse of cod and other commercially exploited groundfish, including haddock, triggered this change and that the new ecosystem state may be impairing the recovery of cod (Frank et al. 2005). One contributing factor to this is the increased predation on groundfish larvae by small pelagic species such as mackerel and herring (Swain and Sinclair 2000). In addition to fishing impacts, natural and anthropogenic environmental impacts (i.e., temperature shifts) may also be resulting in changes to the ecosystem (Stevens 2004).

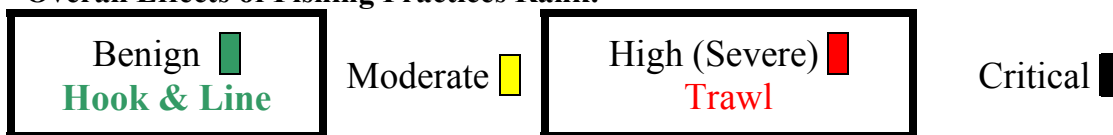
Synthesis

The effects of trawling on various habitat types where haddock are found combined with the substantial amount of fishing effort along the Canada's Atlantic continental shelf over the past 50 years, indicate that trawling for groundfish (including haddock) has significantly altered or damaged a large portion of the seabed and the ecosystem. The effects of these fishing practices on habitats and ecosystems are therefore considered a high conservation concern and this criterion merits a red ranking.

A notable impact is haddock caught by hook and line, a gear type which does not impact habitat.

Criterion 4: Effect of Fishing Practices on Habitats and Ecosystems	
Factors to Evaluate	Trawl fishery Ranking
Impacts of Fishing Gear on Habitat	
Resilience of the Habitat	
Spatial Extent of the Impact	
Disruption of food webs from target species removal	
Changes in ecosystem state	

Overall Effects of Fishing Practices Rank:



Criterion 5: Effectiveness of the Management Regime

Factor 1: Stock Assessments

Assessments of each haddock stock are based on long-term standardized trawl surveys, landings data, and other biological information, and consist of a standard age-based population dynamics model (e.g. sequential population analysis (SPA)). For example, eastern Scotian Shelf/ Bay of Fundy haddock was assessed in both 2003 and 2005 using an SPA based both the research vessel (RV) survey (1970 onwards) and the joint industry/DFO resource survey (ITQ) (1995 onwards) to fit the model. DFO (2005a) has noted that past assessments for this haddock stock tend to over-estimate population abundance in the most recent year. The report from the most recent assessment (Hurley et al. 2005) was not available as of July 2006. The most recent stock assessment for southern Gulf of St. Lawrence and eastern Scotian Shelf (4TVW) haddock was in 2001 (Frank et al. 2001) and should be updated. Georges Bank haddock were assessed by the Transboundary Resource Assessment Committee in 2005 (van Eeckhaute and Brodziak 2005), and a new U.S. assessment was available in 2006 (Brodziak et al. 2006). This factor receives a green ranking.

Factor 2: Scientific Monitoring

Each haddock stock is monitored in a long-term standardized trawl survey conducted on research vessels by DFO and/or NMFS. Surveys have been carried out since 1970 on the eastern Scotian Shelf/southern Gulf of St. Lawrence and the southern Scotian Shelf/Bay of Fundy and provide valuable information on the biomass, abundance, and size-composition for many fish stocks, including haddock (DFO 2003a).. Surveys on Georges Bank have been conducted by DFO each year (February) since 1986 and by NMFS each fall (October) since 1963 and each spring (April) since 1968. On Georges Bank, discarding haddock and misreporting catches have been considered negligible since 1992 (DFO 2002a). This is not the case, however, for southern Scotian Shelf/Bay of Fundy haddock (DFO 2003a, FRCC 2004). DFO (2003a) had reported the

potential for discarding undersized specimens of targeted species or all size classes of non-target species. Moreover, the mix of species caught by the southern Scotian Shelf haddock fishery is not completely known because landings information does not include discards and observer information is available for only a limited proportion of the fleet (DFO 2003a). FRCC has recommended that DFO improve monitoring of this mixed fishery with the objective of obtaining reliable catch estimates for all species (FRCC 2004). Due to these concerns, this factor receives a yellow ranking.

Factor 3: Scientific Advice

The Fishery Resource Conservation Council (FRCC) makes annual recommendations on total allowable catches and other management measures related to Atlantic Canada's groundfish stocks to the Minister of Fisheries and Oceans. The FRCC was created in 1993 to form a partnership between scientific and academic expertise, and all sectors of the fishing industry, and together Council members make quota and management recommendations. There is no evidence indicating that DFO scientific advice is not followed when setting catch quotas for the haddock stocks. This factor receives a green ranking.

Factor 4: Management Plans to Control Bycatch

Bycatch of cod in the eastern Scotian Shelf/Bay of Fundy groundfish fishery is a concern. Haddock catch in the fishery is essentially limited by the amount of cod bycatch the fleet is allowed, and FRCC (2004) considers that the recommended 10,000t haddock quota combined with the recommended 6,000t cod quota, continues "to place harvesters in a challenging situation with respect to potential high bycatches of cod". Given this situation, FRCC has recommended that DFO monitor the fishery more closely, and that harvesters need to invest more effort in trying to target specifically for haddock at specific times and in specific areas so as to minimize bycatch. On the Eastern Georges Bank, cod and haddock are often caught together. The 2003 cod year class in this area is estimated to be the largest in recent years. Modification of fishing gear and practices, enhanced monitoring, and restrained haddock harvest in order to help cod rebuild has been recommended by DFO (Van Eeckhaute and Brodziak 2005). Overall, this factor receives a yellow ranking.

Factor 5: Management Plans to Control Habitat Impacts from Fishing Practices

Within the eastern Scotian Shelf/southern Gulf of St. Lawrence management unit, a juvenile haddock closed area was established on the offshore banks (Emerald and Western) in 1987 (Frank et al. 2000). Frank et al. (2000) found that the closed area's management objective of protecting incoming recruits and thus aiding rebuilding of the stock was not fully met. The expected trend of declining juvenile mortality after, and high mortality preceding the closed areas implementation, was not readily apparent (Frank et al. 2000). Since 1993, however, this entire management unit has been closed to all groundfish fishing. In the southern Scotian Shelf/Bay of Fundy management unit, a spawning season/area closure has been implemented annually on Browns Bank since 1970, and currently runs from February 1st to June 15th (FRCC 2004). On the Eastern Georgian Bank, fishing is closed during the haddock spawning period from January to early June. This factor receives a red ranking due to the reliance on trawl fishing.

Factor 6: Catch Monitoring and Enforcement

Catch monitoring and enforcement currently appears to be inadequate in the sense that on-board scientific observer coverage of the fleet is inadequate, and thus the amount and species of fish being discarded at sea is unknown. Although DFO (2003a) has said that reports from industry indicate discarding and misreporting of haddock on the southern Scotian Shelf/Bay of Fundy have been minimal in recent years, the FRCC presents a decidedly different picture of the situation:








“In recent years, the [FRCC] Council has heard, at many of its consultations, expressions of concern from industry about DFO’s lack of ability to effectively enforce conservation and management measures. The Council is pleased to observe that DFO and the industry have begun to address the concerns and added several tools to assist in curtailing mis-reporting and cheating. It is essential that DFO continue to improve its ability to effectively monitor the Atlantic fisheries. The FRCC recommends that DFO work to reinstate a form of administrative sanctions and work with industry to encourage the courts to strengthen the fines that are being imposed when fishing regulations are violated. DFO alone cannot effectively enforce conservation and management measures without the assistance of a responsible fishing industry. The FRCC continues to urge the fishing industry to operate their fishing operations in a responsible manner to avoid wasteful harvesting practices. Industry has indicated its support for reinstating the administrative sanctions as a deterrent to the continued violation of fisheries conservation and management measures. The small fines provided by the judicial system, for infractions of fishing regulations, are often viewed as a cost of doing business.”-FRCC 2004.

Although violations have apparently been relatively limited, the lack of detection and effective punishment creates an incentive for others to cheat the system (FRCC 2004). FRCC (2004) has recommended that DFO closely monitor the mixed cod and haddock fishery through increased observer coverage (among other things), and has said that DFO needs to be “diligent in the enforcement and protection” of haddock in order to ensure compliance in the fleet. Taking all of these factors into account, this factor receives a red ranking.

Factor 7: Management Track Record

Management is facilitating rebuilding of haddock stocks from the most recent crash, but has not prevented extreme declines of haddock stocks in the past. Until all three stocks are fully recovered and management can demonstrate that it does not allow overfishing to begin once more, it can be considered only moderately effective. Thus, this factor receives a yellow ranking.

Synthesis

Criterion 5: Effectiveness of the Management Regime	
Factors to Evaluate	Ranking
Stock Assessments	
Scientific Monitoring	
Scientific Advice	
Bycatch	
Fishing Practices	
Catch Monitoring and Enforcement	
Management Track Record	

Overall Effectiveness of the Management Regime:

Highly effective  **Moderate**  Ineffective  Critical 

Overall Evaluation and Seafood Recommendation







Haddock in Atlantic Canada are given an overall seafood recommendation of ‘good alternative’ when caught by hook and line, and ‘avoid’ when caught by trawl. Haddock has a fairly low inherent vulnerability to overexploitation because of its low age at maturity, high fecundity, and occasional exceptional recruitment. Canada’s three remaining haddock stocks, eastern Scotian Shelf/southern Gulf of St. Lawrence, southern Scotian Shelf/Bay of Fundy, and Georges Bank have been significantly overfished. The directed haddock fishery on the eastern Scotian Shelf/southern Gulf of St. Lawrence has been closed since 1993. In the two regions that remain open to fishing, fishing mortality has been reduced and the stocks appear to be recovering. The populations today are, however, dominated by very small slow growing individuals.

Trawling, the primary fishing method for haddock, significantly damages benthic marine habitats, and catches several species as bycatch, including cod and cusk, which are assessed by COSEWIC as Special Concern and Threatened, respectively. There is considerable concern that bycatch in the haddock fishery may impair recovery of cod. Several areas in Atlantic Canada and New England have been closed to trawling. Haddock caught using hook and line are a more sustainable alternative because this gear has minimal bycatch and habitat damage associated with it. The DFO management did not prevent significant declines of haddock stocks from occurring and until the stocks have fully recovered, can be considered only moderately effective.

Table of Sustainability Ranks

Sustainability Criteria	Conservation Concern			
	Low	Moderate	High	Critical
Inherent Vulnerability	√			
Status of Stocks	Eastern Georgian Bank √	Southern Scotian Shelf & Bay of Fundy √ Eastern Scotian Shelf & southern Gulf of St. Lawrence √		
Nature of Bycatch	√ (Hook & line)			√ (Trawl)
Habitat Effects	√ (Hook & line)			√ (Trawl)
Management Effectiveness		√		

Overall Seafood Recommendation:

Haddock (Hook & Line)	Best choice 	Good alternative 	Avoid 
Haddock (Trawl)	Best choice 	Good alternative 	Avoid 

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