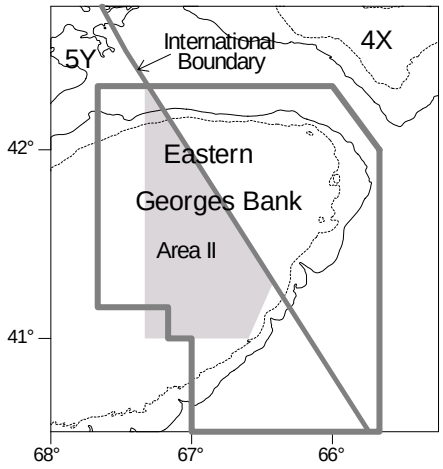
EASTERN GEORGES BANK HADDOCK

[5Zjm; 551,552,561,562]



Summary

- Combined Canada and USA catches in 2004 were about 11,800 mt.

- Adult biomass (ages 3+) increased from about 9,000 mt in 1993 to about 74,000 mt in 2003. Adult biomass subsequently decreased to about 50,000 mt at the beginning of 2005 but is projected to increase after 2006 to well beyond the 1931-1955 maximum biomass of about 90,000 mt.

- The 2003 year class is estimated to be 365 million age-1 fish. Although the current estimate is substantially lower than the previous, the 2003 year class is still estimated to be the largest ever observed in the assessment time series (1931-1955 and 1969-2004). The 2000 and 1998 year classes are also strong. The 2000 year class is estimated to be larger than the strong 1975 and 1978 year classes while the 1998 year class is the third largest since the 1978. In contrast, the 2001 and 2002 year classes are weak (< 5 million age-1 fish) and initial estimates of the 2004 year classes suggest it is also relatively weak (8 million age-1 fish).

- Fishing mortality rate has been below F_{ref} = 0.26 since 1995.

- Productivity has increased since the 1980s due to improved production of recruits per spawner and increases in the number of larger and older fish in the population. Productivity has diminished in recent years due to reductions in average fish size at age.

- Assuming a 2005 catch equal to the 23,000 mt quota, a combined Canada/USA catch of 22,000 mt in 2006 would result in a neutral risk (50%) that the fishing mortality rate in 2006 will exceed F_{ref} = 0.26. A catch of 18,000 mt would result in a low risk (25%) that the fishing mortality rate in 2006 will exceed F_{ref}.

Catches, Biomass (thousands mt); Recruits (millions)

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Avg[1]	Min[1]	Max[1]
Canada	**Quota**	4.5	3.2	3.9	3.9	5.4	7.0	6.7	6.9	9.9	15.4			
	Landed	3.7	2.7	3.4	3.7	5.4	6.8	6.5	6.8	9.7		3.8	0.5	10.0
	Discard	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1		0.1	<0.1	0.2
USA	**Quota**[6]									5.1	7.6			
	Landed	<0.1	<0.1	0.3	0.4	0.2	0.6	0.9	1.6	1.8		2.3	<0.1	9.1
	Discard[2]	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2		1.1	<0.1	7.6
Total	**Quota**									15.0	23.0			
	Catch	3.8	2.9	3.8	4.1	5.6	7.4	7.4	8.4	11.8		6.7	2.2	23.3
	Adult Biomass[4]	24.0	23.1	25.7	30.9	36.9	50.3	44.9	74.3	68.0	49.9	40.8[3]	7.6[3]	90.9[3]
	Age 1 Recruits	6.4	16.9	9.2	27.9	12.8	65.6	3.9	1.6	365.5	7.9	29.0[3]	0.6[3]	365.5[3]
	Fishing mortality[5]	0.20	0.12	0.14	0.13	0.16	0.17	0.17	0.15	0.17		0.28	0.07	0.58
	Exploitation Rate[5]	16%	10%	12%	11%	13%	14%	14%	13%	14%		22%	6%	40%

[1]1969 - 2003
[2] discards not estimated in 1999-2000 but assumed negligible
[3]1931 - 1955, 1969 – 2004
[4]ages 3+
[5]ages 4+
[6]for fishing year from May 1 – April 30

Fishery

Under restrictive management measures, **combined Canada/USA catches** declined from over 6,400 mt in 1991 to a low of about 2,100 mt in 1995, fluctuated between about 3,000 mt and 4,000 mt until 1999 and have since increased to about 11,800 mt (Figure 1). Greater catches were recorded in the late 1970s and early 1980s, ranging up to about 23,000 mt, but catches subsequently declined and fluctuated around 5,000 mt during the mid to late 1980s.

The 2004 **Canadian catch** of 9,745 mt was below the Canadian quota of 9,900 mt. Weight of all Canadian landings was monitored at dockside. At-sea observers monitored 12% of the total haddock landed, by weight. Discarding and misreporting by the groundfish fishery have been considered negligible since 1992. Since 1996 the Canadian scallop fishery has not been permitted to land haddock. Landings until 1995 include those catches reported by the scallop fishery. Discards of haddock by the Canadian scallop fishery were estimated from scallop effort and catch data and ranged between 29 and 186 mt from 1969 to 2004. Survey age composition was used to characterize the age composition of the scallop fishery discards, except for 2004, when observer sampling was adequate to obtain the size composition. The size composition of the catch in the 2004 Canadian fisheries had a mode at 50.5 to 52.5 cm for otter trawlers and at 54.5 cm for longliners. Gill-netters caught few haddock. The percentage of haddock below 43 cm was less than 1% in the groundfish fishery.

USA catches for 2004 increased to 1,952 mt under a 5,100 mt quota. Landings were 1,796 mt and discards were estimated to be 156 mt. In the past, the combination of area closures, effort restrictions, and trip limits precluded most operators from making long trips to eastern Georges Bank, with the result that annual USA catches were less than 400 mt during 1994-2000. Since then, USA catches have increased to an average of 1,300 mt during 2001-2004. USA landings in 2004 were comprised of 21% large (mean

length of 64 cm) and 79% scrod (mean length of 53 cm) market category by weight, compared to 42% large and 58% scrod in 2003. This continues a trend evident since 2001 of an increasing percentage of scrod in the catch.

For the **combined Canada/USA fishery catch in 2004**, the 2000 year class (age 4) and the 1998 year class (age 6) dominated. In comparison to the age composition of the catch during periods when year classes were quickly fished down, the older age groups (ages 9+) continued to contribute significantly to the 2004 catch. The percentage of age 2 fish in 2004 was well below historical averages. The low percentage of younger ages in the recent catches has been due in part to the type of gear used and to avoidance of areas with small fish.

Harvest Strategy and Reference Points

The Transboundary Management Guidance Committee has adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $F_{ref} = 0.26$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

State of Resource

The state of the resource was based on results from an age structured analytical assessment (VPA) that used fishery catch statistics and sampling for size and age composition of the catch for 1969 to 2004. The VPA was calibrated to trends in abundance from three bottom trawl research surveys, NMFS spring, NMFS fall and DFO. Data to approximate the age composition of the catch during 1931 to 1955 were used to reconstruct an illustrative population analysis of eastern Georges Bank haddock that was suitable for comparison of productivity. Retrospective analysis is used to detect a pattern of inconsistencies, where updates of previously estimated fishing mortality, biomass, and recruitment show a tendency to be predominantly higher or predominantly lower. This stock assessment does not display a retrospective pattern.

Population biomass (ages 3+) during the late 1970s and early 1980s was about 40,000 mt, due to **recruitment** of the strong 1975 and 1978 year classes whose abundances were estimated at about 50 million each (Figure 2). However, biomass declined rapidly in the early 1980s as subsequent recruitment was poor and these two year classes were fished intensely at a young age. Improved recruitment in the 1990s, lower exploitation and reduced capture of small fish in the fisheries allowed the biomass to increase from near an historical low of about 9,000 mt in 1993 to about 74,000 mt in 2003, the highest it had been in about 30 years. This increase was supported by the strong 2000 and 1998 year classes. The 2000 year class (66 million age-1 fish) is estimated to be larger than the strong 1975 and 1978 year classes while the 1998 year class (28 million age-1 fish) is the third largest since the 1978. In contrast, the 2001 and 2002 year classes are weak (< 5 million age-1 fish) and initial estimates of the 2004 year classes suggest it is also relatively weak (8 million age-1 fish). These weak year classes have resulted in the recent biomass decrease to 50,000 mt (80% Confidence Interval: 40,500 mt – 63,200 mt) in 2005, leaving the older ages to sustain the fishery in 2004 and 2005. The 2003 year

class is estimated to be 365 million age-1 fish. Although the current estimate is substantially lower than the previous, the 2003 year class is still estimated to be the largest ever observed in the assessment time series (1931-1955 and 1969-2004) and will increase the adult biomass after 2006 to well beyond the 1931-1955 maximum biomass of about 90,000 mt.

Fishing mortality for ages 4+ fluctuated between 0.2 and 0.4 during the 1980s and showed a marked increase between 1989 and 1993 to about 0.6, the highest observed. Since 1995 fishing mortality has been below the reference, $F_{ref} = 0.26$, ($F_{2004} = 0.17$; 80% Confidence Interval: 0.13 – 0.21) (Figure 1).

Productivity

Recruits per spawner, age structure, spatial distribution and fish growth reflect changes in the productive potential. The recruits per adult biomass ratio was generally low during the 1980s but higher during the 1990s, comparable to that of the 1931 to 1955 period, suggesting that higher recruitment might occur when the biomass is above 40,000 mt. However, in the early 2000's, excepting 2003, recruits per spawner were again low. In both absolute numbers and percent composition, the **population age structure** displays a broad representation of age groups, reflecting improving recruitment and lower exploitation, particularly at younger ages, since 1995. The **spatial distribution** patterns observed during the most recent bottom trawl surveys were similar to the average patterns over the previous five years. However, consistent with the pattern observed for previous large year classes, the exceptional 2003 year class at age 0, 1 and 2 was distributed more widely throughout the survey area. Observed DFO survey average weights at length, used to reflect fish **condition,** show a decrease in 2004 for most lengths. Both length and weight at age has declined since about 2000 and are currently the lowest observed in the DFO survey time series. Productivity has increased since the 1980s due to improved production of recruits per spawner and increases in the number of larger and older fish in the population. Productivity has diminished in recent years due to reductions in average fish size at age.

Outlook

The outlook is provided in terms of the possible consequences for alternative catch quotas in 2006 with respect to the harvest reference points. Uncertainty about standing stock generates uncertainty in forecast results. This uncertainty is expressed in the outlook as the risk of exceeding $F_{ref} = 0.26$. The risk calculations provide a general sense of the uncertainties and assist with evaluating the consequences of alternative catch quotas. These calculations do not include uncertainty due to variations in weight at age, partial recruitment to the fishery, natural mortality, systematic errors in data reporting or the possibility that the model may not reflect the stock dynamics closely enough. Also, the risk calculations are dependent on the model assumptions and data used in the analyses. Though the assumptions used were deemed most suitable, there may be other plausible assumptions.

Assuming that the TAC of 23,000 mt is caught in 2005, a combined Canada/USA catch of 22,000 mt in 2006 would result in a neutral risk (50%) that the fishing mortality rate in 2006 will exceed F_{ref} = 0.26 (Figure 4). A catch of 18,000 mt would result in a low risk (25%) that the fishing mortality rate in 2006 will exceed F_{ref}. Adult biomass will increase substantially from 2005 to 2006 when the 2003 year class recruits and will fluctuate after this according to changes in mean weight and recruitment.

Medium term projections, assuming that the stock is exploited at a constant fishing mortality rate of 0.26 and assuming 10 year average recruitment of 20 million (excluding the 2003 year class) or 40 million, the average recruitment which occurred during the period 1931 – 1955, when the stock was at a more productive level, indicated that catches and biomass would be maintained at high levels through 2009.

Biomass, Yield (thousands mt)

	20 Million Recruits			40 Million Recruits		
	Total Biomass	Adult Biomass	Yield	Total Biomass	Adult Biomass	Yield
2005	115	50	23[1]	115	50	23[1]
2006	153	151	22	153	151	23
2007	161	157	46	166	157	46
2008	193	188	57	203	195	58
2009	145	141	43	163	155	46
2010	119	115		145	137	

[1]Total Allowable Catch

Special Considerations

Consistent management by Canada and the USA is required to ensure that conservation objectives are not compromised.

The outstanding 2003 year class will dominate the catch in 2006 and subsequent years. These increasing catches are highly dependent on the magnitude of this year class. Measures should be taken to avoid wastage of this year class due to discarding of small haddock.

Several factors have resulted in a marked decrease in the estimates of biomass and future catch levels compared to the previous assessment. The significant decrease in weights at age and condition, which are also reflected in a reduction in partial recruitment to the fishery for ages 1 to 3 (age 4 is now also only partially recruited), along with a 2 to 3 fold reduction in the current estimate of the 2003 year class are responsible for this less optimistic outlook. If the TAC in 2005 is caught, fishing mortality will be higher than F_{ref} due to the marked reduction in weights at age and its effect of reducing the partial recruitment to the fishery of the 2003 year class at age 3 putting higher than predicted fishing pressure on the fully recruited older ages (F_{5+}=0.39).

Cod and haddock are often caught together in groundfish fisheries, although their catchabilities to the fisheries differ and they are not necessarily caught in proportion to their relative abundance. With current fishing practices and catch ratios, the achievement

of rebuilding objectives for cod may constrain the harvesting of haddock. Additional efforts to protect the 2003 cod year class which, from first indications, is estimated to be larger than has been seen in recent years are warranted. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

Source Documents

TRAC, 2005. R. O'Boyle, and W. Overholtz [eds]. Proceedings of the Transboundary Resources Assessment Committee (TRAC); 14–16 June 2005. TRAC Proceedings 2005/02.

Van Eeckhaute, L,, and J. Brodziak. 2005. Assessment of haddock on Eastern Georges Bank. TRAC Reference Document 2005/03.

Correct Citation

TRAC, 2005. Eastern Georges Bank Haddock. TRAC Status Report 2005/02.

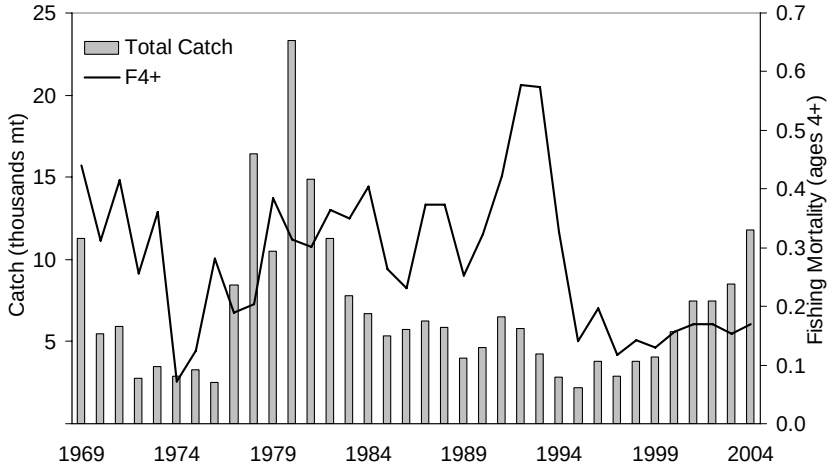


Figure 1. Catches and fishing mortality.

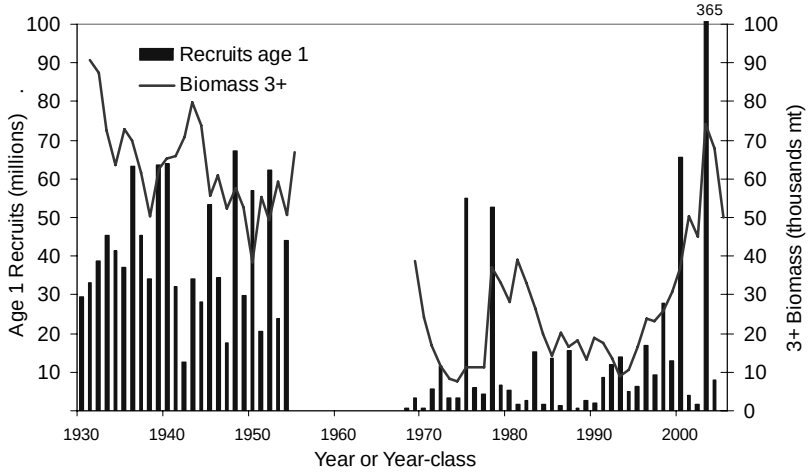


Figure 2. Biomass and recruitment.

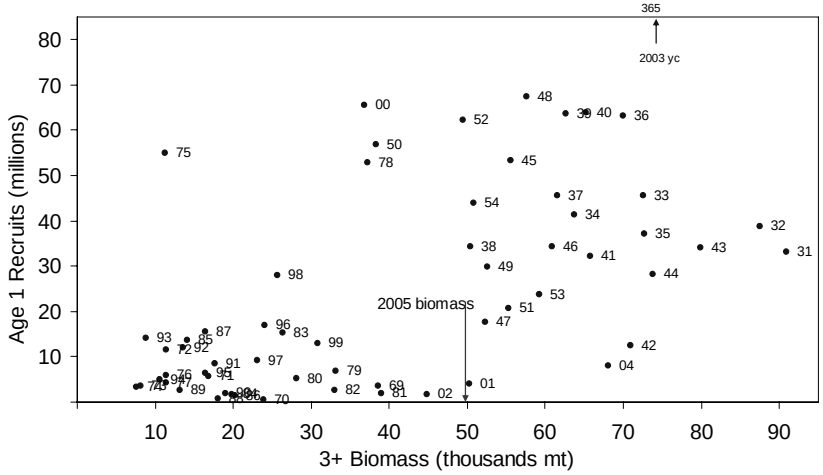


Figure 3. Stock recruitment patterns.

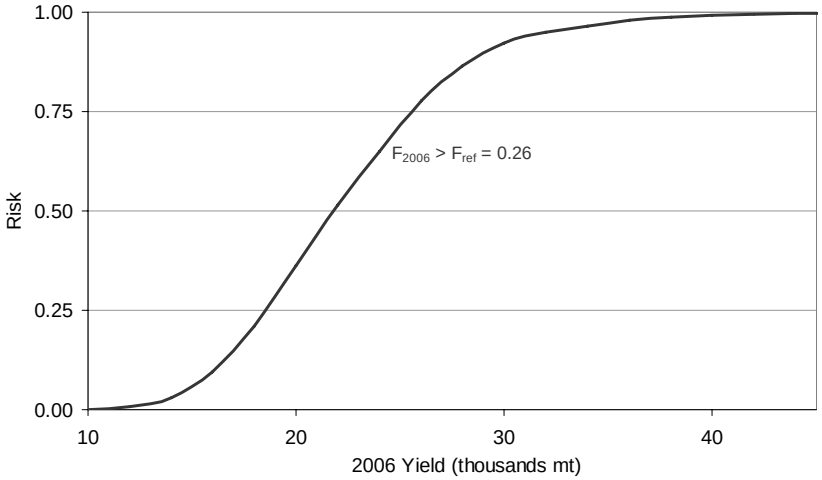


Figure 4. Projection risks.