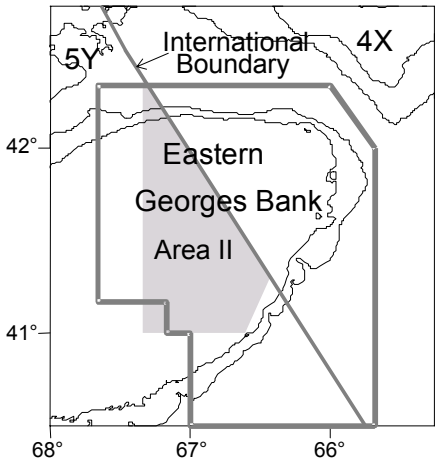
EASTERN GEORGES BANK HADDOCK



Summary

- Combined Canada and USA catches in 2002 were about 7,500 t.
- Adult biomass (ages 3+) has increased since 1993 and was about 78,000 t at the beginning of year 2003, at the lower range of the 1930-55 average.
- The 2000 year-class is estimated to be larger than the good 1975 and 1978 year-classes and the 1998 year-class is the second strongest since the 1978. The 2001 year-class appears weak and early signs of the 2002 year-class indicate that it is also weak.
- The age structure in both the fishery catch and the population continues to broaden.
- Fishing mortality rate has been below F_{ref} = 0.26 since 1995.
- Survivorship to age 1 is generally higher than that observed during the 1980s except for the two most recent year-classes.
- A combined Canada/USA yield of 8,000 t in 2004 would result in a low risk of exceeding F_{ref} but a negligible chance for a 10% biomass increase from 2004 to 2005.

Fishery

Catches (thousands of tonnes) [1]

Year		1998	1999	2000	2001	2002
Canada	Quota	3.9	3.9	5.4	7.0	6.7
	Catch	3.4	3.7	5.4	6.8	6.5
USA	Quota					
	Catch	0.3	0.4	0.2	0.6	0.9
Combined	TAC					
	Catch	3.7	4.0	5.6	7.4	7.5

[1] Includes available discard estimates

Under restrictive management measures, **combined Canada/USA catches** declined from over 6,400 t in 1991 to a low of about 2,100 t in 1995, fluctuated between about 3,000 t and 4,000 t until 1999 and has since increased to over 7,000 t. Greater catches were recorded in the late 1970s and early 1980s, ranging up to about 23,000 t, but subsequently declined and fluctuated around 5,000 t during the mid to late 1980s. (Figure 1)

The 2002 **Canadian catch** of 6,518 t was below the Canadian quota of 6,740 t. Weight of all Canadian landings were monitored at dockside. At-sea observers monitored 10% of the total haddock landed, by weight. Comparison of samples from at sea observations against landings indicated that there was little discarding or highgrading. Discarding and misreporting by the groundfish fishery have been considered negligible since 1992. Discards of haddock by the Canadian scallop fishery were estimated to be 22 t in 2001 and 19 t in 2002. The size composition of the catch in the 2002 Canadian fisheries peaked at 54.5 cm (21.5 in) for otter trawlers and at 58.5 cm (23 in) for longliners. Gill-netters caught few haddock. The percentage of haddock below 43 cm was about 4%.

USA catches for 2002 increased to 945 t and discards again were low because the day and trip possession limits remained high. The combination of area closures, effort restrictions, and trip limits has precluded most operators from making long trips to eastern Georges Bank, with the result that USA catches from there have been low since 1993. The size composition of the catch in the 2002 USA fisheries was 53% large, peaking at 60 cm and 47% scrod, peaking at 53 cm. The scrod market category size composition samples did not contain any fish below 43 cm.

For the **combined Canada/USA fishery catch**, the 1998 year-class (age 4) dominated the 2002 catch, as it did in 2001. 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 2002 catch. The percentage of age 2 fish in 2002 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.

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 2002. The VPA was calibrated to trends in abundance from three bottom trawl research surveys, NMFS spring, NMFS fall and DFO. Data were also available for the period between 1930 and 1955 to approximate the age composition of the catch from eastern Georges Bank in order to reconstruct an illustrative population analysis suitable for comparison of productivity. Assessments for several other stocks have identified a persistent and marked directional discrepancy between past and current estimates of stock

status (retrospective pattern). This stock assessment does not display a retrospective pattern.

Population biomass (ages 3+) during the late 1970s and early 1980s was about 40,000 t, due to recruitment of the strong 1975 and 1978 year-classes whose abundances were estimated at about 50 million each. 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. The biomass has steadily increased from near an historical low of about 9,000 t in 1993 to about 78,000 t (80% Confidence Interval: 62,500 t – 99,100 t) at the beginning of 2003. The recent increase has been due to more consistent and improved recruitment and was enhanced by lower exploitation and by reduced capture of small fish in the fisheries. Biomass has been increasing and is the highest it has been in about 30 years. It is now at the lower range of the 1930-1955 biomass. (Figure 2)

Recruitment has improved in the 1990s and the 2000 year-class (77 million at age 1) is estimated to be larger than the good 1975 and 1978 year-classes. The 1998 year-class (29 million at age 1) is the second strongest since that of 1978. The 1996 and 1999 year-classes were estimated to be about 13 million, comparable to the 1983, 1985 and 1987 year-classes, which were the strongest 3 year-classes over about a 20 year time span. Between the 1991 and 2000 year-classes, no year-classes have been below 4 million fish. Between the 1978 and 1991 year-classes, 7 of the 14 year-classes were below 5 million fish. The two most recent year-classes, 2001 and 2002, based on preliminary estimates, are weak, at about 4 and 2 million fish, respectively. (Figure 2)

Fishing mortality for fully recruited 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, before declining to below the fishing mortality reference, F_{ref} = 0.26 (F_{2002} = 0.19; 80% Confidence Interval: 0.15 – 0.23), where it has remained since 1995. (Figure 1)

Harvest Reference Points

The established fishing mortality threshold reference, F_{ref} = 0.26, was maintained. The pattern of recruitment indicates that the chance of a strong year-class is significantly enhanced for adult biomass above about 40,000 t. Since 1969, only the 1975, 1978 and 2000 year-classes have been above the average abundance of year-classes observed during the period 1930 to 1955. (Figure 3)

A forecast simulation, assuming stable size at age, fishery exploitation pattern by age and natural mortality and with re-sampling from the observed recruitment using two biomass stanzas (below and above 40,000 t), indicated that the median 2005 rebuilding biomass (ages 3+) was about 65,000 t (25% and 75% quartiles: 59,000 t – 76,000 t) if the resource were exploited at F_{ref} = 0.26.

Other attributes like survivorship to age 1, age structure and spatial distribution reflect possible fluctuations in the productive potential and can be used to qualify reference points and acceptable risk. Examination of the recruits per adult biomass ratio suggests that **survivorship to age 1**, for several years during the 1980s, may have been lower than the norm. Except for the two most recent year-classes, the present survivorship appears comparable to that of the 1930 to 1955 period, suggesting that higher recruitment might occur when the biomass is above 40,000 t. 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. Observed DFO survey average weights at length were used to reflect **condition** and did not show any notable trends.

Outlook

The outlook is provided in terms of the possible consequences for alternative catch quotas in 2004 with respect to the harvest reference points. Uncertainty about year-class abundance generates uncertainty in forecast results. This uncertainty is expressed in the outlook as the risk of exceeding F_{ref} = 0.26, the risk of not achieving a biomass increase and the risk that the biomass will decline below the median 2005 rebuilding biomass of 65,000 t.

With an assumed total catch of 8,000 t in 2003, a combined Canada/USA catch of 8,000 t in 2004 would result in a low probability that the fishing mortality rate in 2004 will exceed F_{ref}. At this yield, there is a negligible probability of achieving a 10% biomass increase from 2004 to 2005, due to the 2 weak incoming year-classes, but there is a low probability that the biomass will fall below the median 2005 rebuilding biomass of 65,000 t. The 2000 year-class (age 4) is expected to comprise the highest proportion of the total 2004 yield, accounting for about 60%. (Figure 4)

The risk calculations are dependent on the model assumptions and data used in the analyses. Though these assumptions were deemed most suitable, there may be other plausible assumptions. 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. The risk profiles provide a general sense of the associated uncertainties and can assist in assessing the consequences of alternative catch quotas.

Special Considerations

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

Recruitment of the strong 2000 year-class resulted in almost a doubling of the biomass for ages 3+ by the beginning of 2003. However, due to the subsequent weak incoming year-classes, a TAC greater than 8,000 t in 2004 has a greater than 50% chance of decreasing the adult biomass.

Cod and haddock are often caught together in groundfish fisheries. However, their catchabilities to the fisheries differ and they are not necessarily caught in proportion to their relative abundance. With current fishing practices, exploitation of haddock at F_{ref} may compromise the achievement of rebuilding objectives for cod.

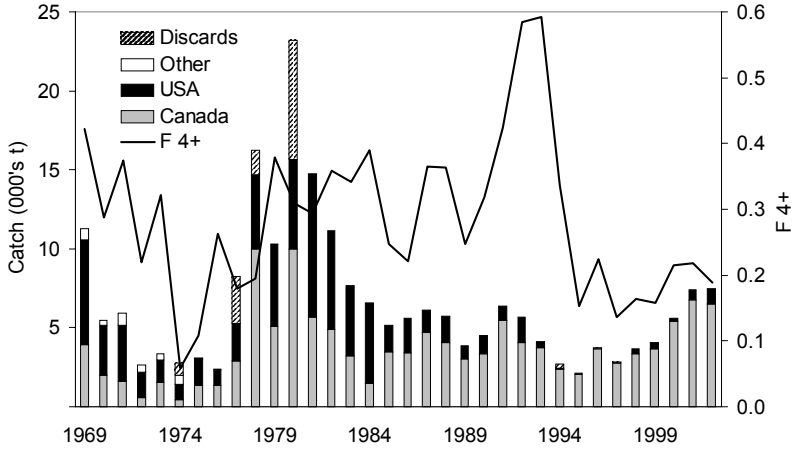


Figure 1. Catches and fishing mortality.

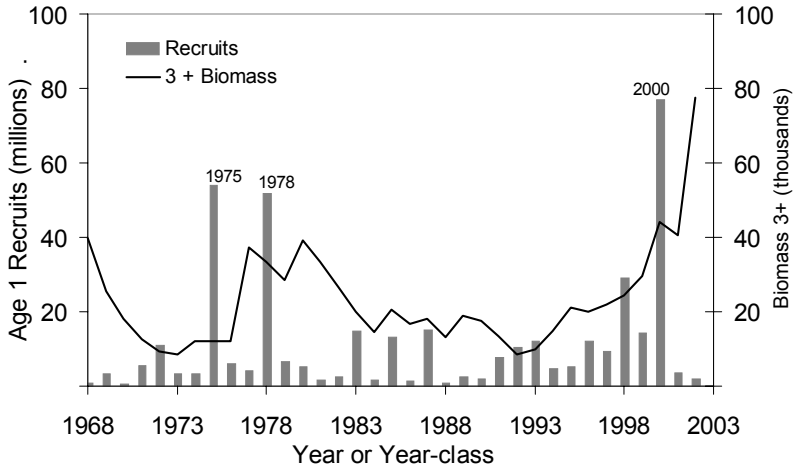


Figure 2. Biomass and recruitment.

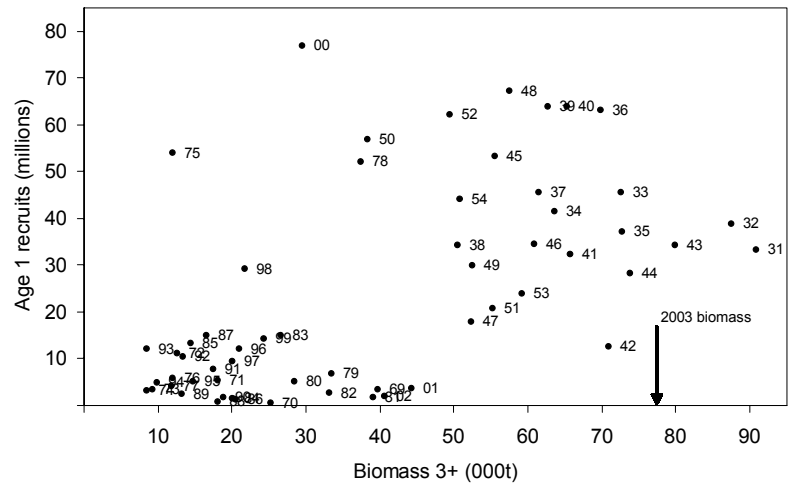


Figure 3. Stock recruitment patterns.

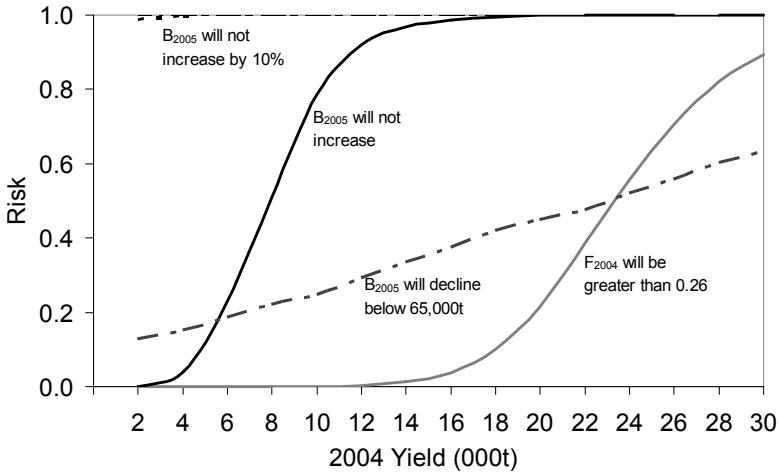


Figure 4. Projection risks.