



## ASSESSMENT OF GEORGES BANK SCALLOPS (*PLACOPECTEN MAGELLANICUS*)

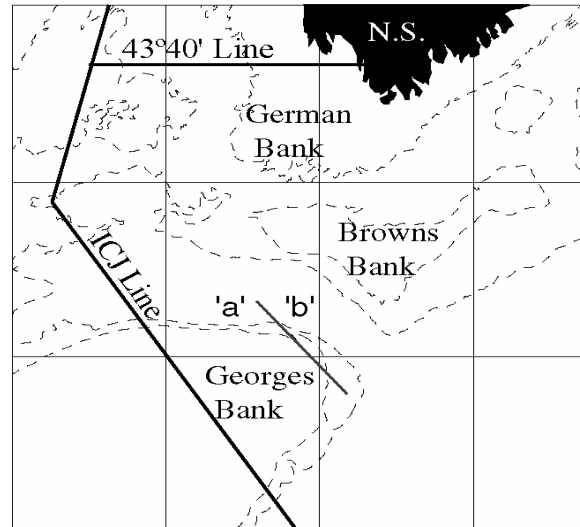
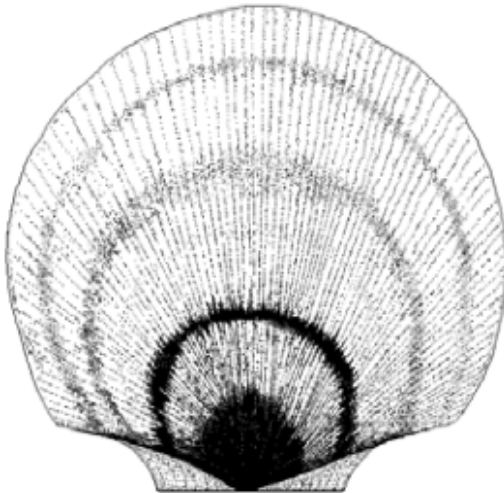


Figure 1: Location of Georges Bank 'a' and 'b'.

### Context

The sea scallop, *Placopecten magellanicus*, is found only in the Northwest Atlantic, from Cape Hatteras to Labrador. Scallops are aggregated in patches and harvestable concentrations are called beds. Major areas of offshore fishing activity are Georges Bank, the Eastern Scotian Shelf (Middle Bank, Sable Bank, and Western Bank), Browns Bank, German Bank, and St. Pierre Bank (south of Newfoundland). Scallops prefer a sandy, gravel bottom and occur in depths of 35 to 120m on the offshore banks.

The offshore scallop fleet consists of wet fish vessels and freezer-trawlers. Generally, these vessels simultaneously fish two New Bedford offshore rakes or drags, 4 to 6.1 m width, one on each side of the vessel.

In support of management of the Georges Bank 2007 scallop fishery, a meeting of the Regional Advisory Process was held 4 May 2007 at the Bedford Institute of Oceanography, in Dartmouth N.S. to,

- Assess the status of the resource
- Provide harvest advice for the 2007 fishery

Participants included DFO scientists and fishery managers, and representatives of the industry.

Annual assessments of the status of the offshore scallop resource take into account the annual survey findings, meat size distribution in the catch and fishery performance. The management of the main scallop fishery on Georges Bank refers to zone 'a' and is the main focus of this document. Georges Bank zone 'b' is a marginal growth area for scallops and has a separate management plan consisting of a rolling TAC. Science advice is also provided for Georges Bank zone 'b'.

## SUMMARY

- Sea scallops on Georges Bank have been fished year round by the Canadian offshore scallop fleet under a TAC since 1986. Prior to 1998, this area was managed as one unit but since then it has been managed as two zones. Zone 'a' is the traditional scallop ground, a more productive area, whereas zone 'b' is a marginally productive area.
- The 2006 TAC was 4000 t for zone 'a' and 200 t for zone 'b'. Total reported landings were 3931 t for zone 'a' and 162 t for zone 'b'. The 2006 landings for zone 'a' were 58% higher than in 2005 and landings for zone 'b' were 19% lower than in 2005.
- The offshore scallop fleet fished primarily fresh scallop products until 2002, when freezer trawlers were incorporated into the fleet. In the first year of fishing the freezer trawlers landed nearly 10% of the TAC. In 2006, the freezer trawlers landed 65% of the catches from zone 'a', an 82% increase from 2005, but did not fish zone 'b'.
- Commercial catch rates of the wet fish fleet reached historically high levels during 2000 to 2002 and have since declined to near average levels.
- Survey catch rates in zone 'a' for both age 3 and age 4+ scallops peaked in 2000. The age 4+ CPUE index declined from 2000 to 2004 but has increased since then. The age 3 CPUE index increased substantially from 2004 to 2005 with a more modest increase from 2005 to 2006. Both indices are now above their respective long-term averages.
- The 2007 TAC scenarios for zone 'a' from 3000 t to 6000 t are predicted to produce exploitation rates of 12% to 25% on the ages 4 to 7 biomass. A TAC of 6000 t is predicted to result in a 2% decline in the ages 4 to 7 biomass, whereas a TAC of 3000 t is predicted to result in a 3% increase.

## BACKGROUND

### Species Biology

Scallops may reach sexual maturity as early as age 2 and have separate sexes. The female gonad is red in colour and the male gonad is creamy white. The major spawning period is from August to October, eggs and sperm are released into the sea and fertilization is external. Fertilized eggs develop into a ciliated larval stage (veliger) in a few days, and will continue to develop while swimming in the water column for 30 to 60 days before settlement to the bottom. Newly settled larvae undergo a series of morphological changes before becoming a juvenile scallop.

Scallop growth is estimated from the position of annual rings on the shell. The growth rates vary from one fishing area to another and are influenced by season, depth and temperature.

## **Fishery**

Georges Bank is one of the main sea scallop stocks fished by the offshore scallop fleet. Since 1986, the offshore scallop fleet has fished Georges Bank year round under an Enterprise allocation management regime. In 1998, the Bank was separated into two management zones. Zone 'a' is the traditional scallop fishing ground and a more productive area than zone 'b' which is marginal scallop habitat (Figure 1).

A TAC and a meat count of 33 meats per 500 grams are used to manage Georges Bank 'a', whereas Georges Bank 'b' is managed by a rolling TAC allocated in 200 t increments for a set fishing period (typically 6 weeks). Additional 200 t allocations are evaluated based on fishery performance indicators such as fleet catch rates and meat counts. Since 2002, there has only been one "roll" of 200 t for Georges Bank 'b' per year, but there have been extensions to the fishing periods.

In 2004, a strong pulse of juvenile (age 2) scallops was observed in the research survey, mainly on the northern edge of Georges Bank 'a'. Following the analysis of the survey data, the offshore scallop industry suggested a voluntary closure of 95 km<sup>2</sup> around one juvenile aggregation. This industry initiative was in place for two years to avoid disturbing the juvenile scallops and to allow them to grow to commercial size. By the start of 2007, most of the scallops in this area would have reached commercial size.

Based upon preliminary analysis of the 2006 fishery data and the annual stock survey data an interim TAC of 3000 t was set for the 2007 Georges Bank zone 'a' fishery. As well, the voluntary closure was lifted.

The 2006 TAC was 4000 t for zone 'a', an increase of 1500 t from the 2005 TAC, and 200 t for zone 'b' (Figure 2). Total reported landings were 3931 t for zone 'a' and 162 t for zone 'b' (Figure 2). The 2006 landings for zone 'a' were 58% higher than in 2005 and landings for zone 'b' were 19% lower than in 2005. The offshore scallop fleet fished primarily fresh scallop products until 2002, when freezer trawlers were incorporated into the fleet. In the first year of fishing, the freezer trawlers landed nearly 10% of the TAC. In 2006, the freezer trawlers landed 65% of the catches from zone 'a', an 82% increase from 2005, but did not fish zone 'b'.

The fishery targeted a slightly larger meat weight (17-18 g mode) in 2006 than in 2005 (15-16 g mode) (Figure 3). The profile of the meat weights in the 2006 catch is similar to the long-term mean (Figure 3). When converted to a catch at age matrix the 2006 fishery had 36% age 4, 37% age 5 and 18% age 6 scallops in the catch.

The commercial catch rates reached historically high levels during 2000 to 2002 and have since declined to near average levels (Figure 4). With the increase in TAC for 2006 for zone 'a' the CPUE also increased by 10% (Figure 4).

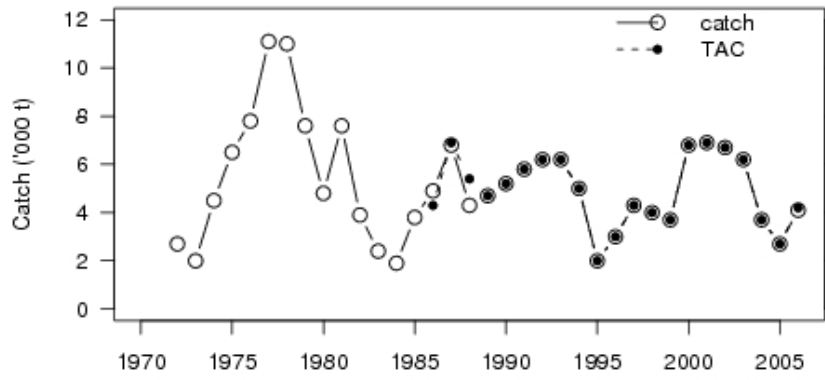


Figure 2. Georges Bank 'a' and 'b' sea scallop landings and TAC.

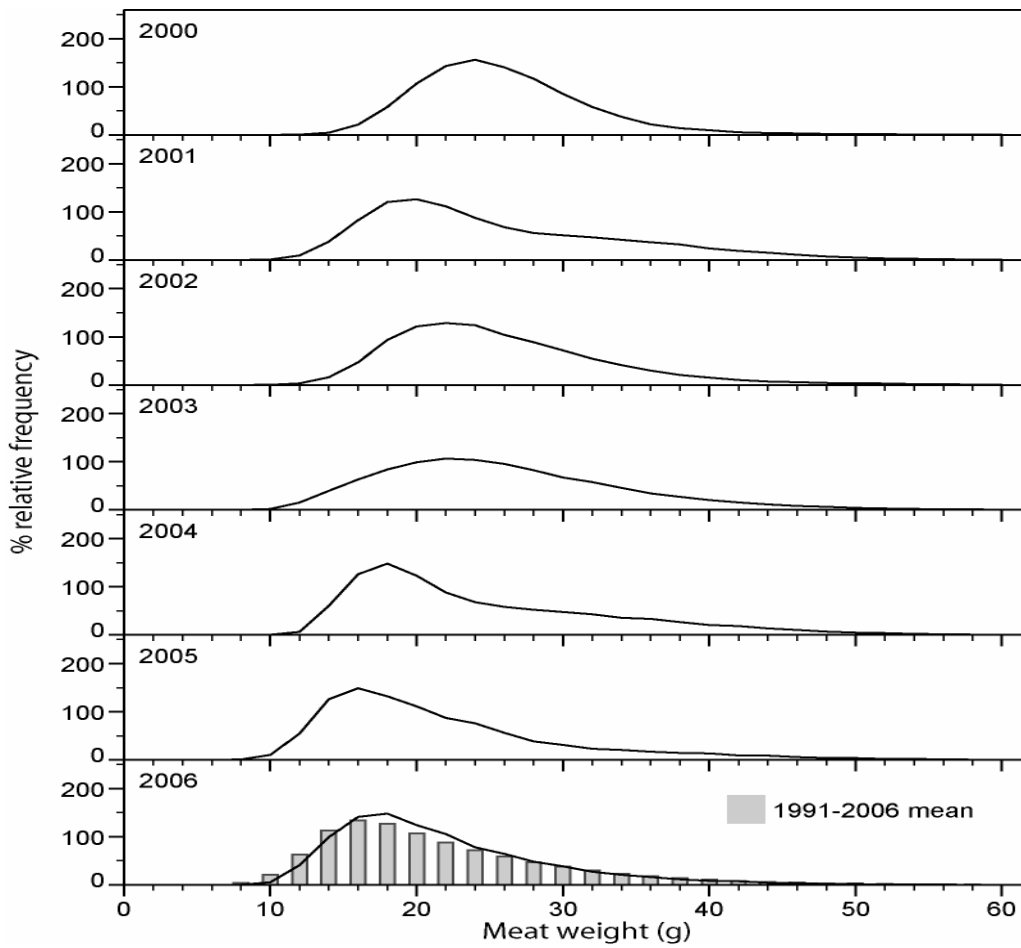


Figure 3. Meat weight profile for the Georges Bank 'a' landings from 2000 to 2006.

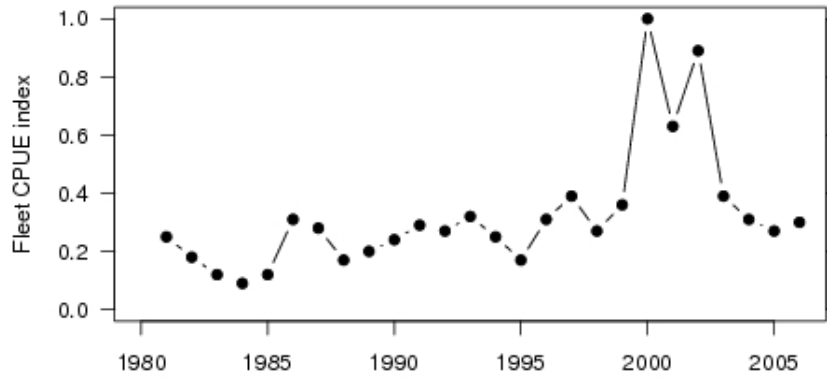


Figure 4. Georges Bank 'a' and 'b' annual fleet CPUE index.

## ASSESSMENT

### Stock Trends and Current Status

There is an industry sponsored assessment survey that takes place annually on Georges Bank that covers both zones. Information is gathered to assess the abundance and composition of the scallop stock. Meat weight data is collected from all of the offshore scallop landings through a port-sampling program that is fully funded by the industry. These data in combination with the annual fishery performance data are used to produce biomass estimates and provide potential exploitation scenarios to Fisheries and Aquaculture Management.

A Sequential Population Analysis estimated population abundance based on survey indices, commercial CPUE's and age composition in the stock, and provided the basis for the 2007 stock projections and catch scenarios.

The mean number of scallops per tow reached a long term high in 2000 when there was a large increase in abundance. The number of scallops per tow declined until 2004 but has been increasing in abundance since. The CPUE index from the survey indicates that the age 3, pre-recruit scallops have increased over the last three years (Figure 5). The age 4+, recruited scallops also increased over the last two years. The abundance of the 2003 and 2002 year classes (ages 3 and 4) are above average and represent 12 % and 27 % of the 2006 ages 3 – 8 biomass, respectively (Table 1).

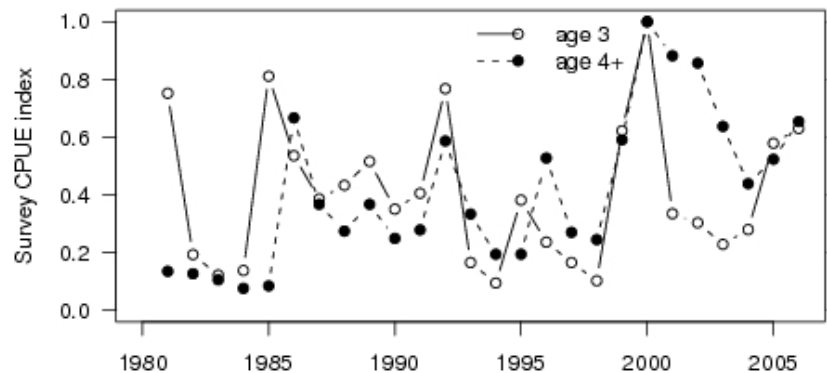


Figure 5. Survey CPUE index of pre-recruits (age 3) and recruited (age 4+) scallops (1981-2006).

Table 1. Biomass (meats x 10<sup>3</sup> t) at the beginning of the year for ages 3 to 8 scallops and the sum of ages 4 to 7 scallop biomass (bottom).

Age	2002	2003	2004	2005	2006
3	1.49	1.74	1.32	3.27	3.87
4	1.87	3.93	4.58	3.49	8.64
5	7.34	2.53	5.65	6.37	5.11
6	8.69	6.48	1.46	5.99	7.06
7	4.42	8.57	6.02	1.33	6.38
8	1.61	3.42	8.16	5.90	1.31
Sum 4-7	22.32	21.50	17.71	17.18	27.18

The ages 4 to 7 scallop biomass for the beginning of 2006 increased 58 % from 2005 (Figure 6, Table 1). This exceeds the long-term average biomass by 41 %. The exploitation rate has decreased since 2001 (Figure 7). In 2001, the exploitation rate was 33 % and has returned to 15 % during 2005 – 2006, similar to that in 1994 – 1999.

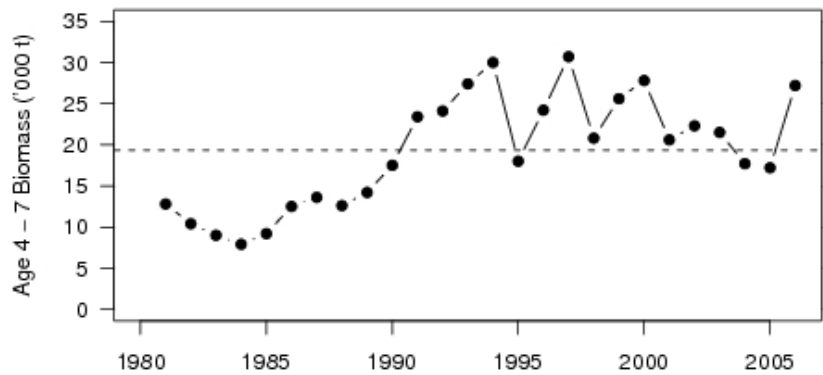


Figure 6. Estimated ages 4 to 7 biomass. The dashed line is the long-term average.

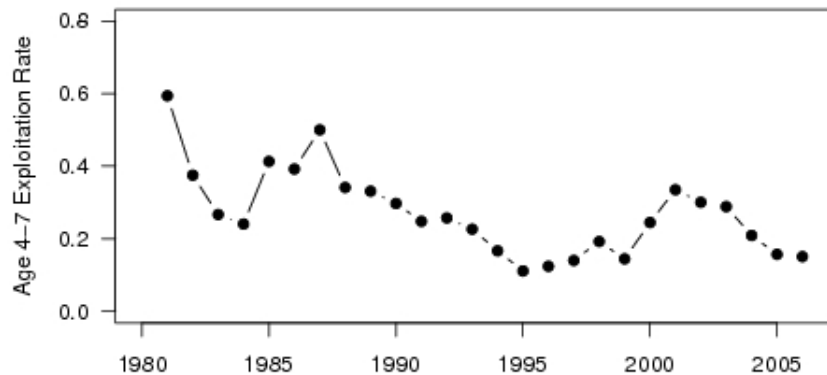


Figure 7. Exploitation rates on ages 4 to 7 scallops.

### Sources of Uncertainty

The sequential population analysis does not capture well the rapid changes in stock age structure that are observed, for example, after large recruitment events. This model inflexibility suggests that, on average, the biomass estimates are conservative. Nonetheless, the model provides an acceptable fit to the recent data (2003 – 2006). Although the estimated 58% increase in biomass between 2005 and 2006 is likely an over estimate (Figure 6), the survey CPUE suggests that the ages 4 to 7 biomass is increasing (Figure 5).

Model predictions depend, in part, on how well year class strengths are estimated. In particular, estimating year class strength at age 2 (juvenile) is challenging because these scallops are not consistently observed in the survey due to their relative low catchability and relatively high spatial aggregation. The catchability and aggregation issues will lead to abundance and distribution estimates that are not precise.

There is spatial heterogeneity in the distribution of age groups. The fishing fleet targets particular scallop size classes that can result in spatial aggregation of fishing effort. This aggregation suggests that CPUE may not be proportional to abundance or biomass.

A lack of recent aging data for Georges Bank scallops may limit the validity of model estimates.

## CONCLUSIONS AND ADVICE

The interim TAC for 2007 is 3000 t. This corresponds to an exploitation rate that is slightly lower than the exploitation rate of the last two years, and would allow for a 3% increase in ages 4 to 7 biomass (Table 2). A TAC scenario of 4000 t, similar to the 2006 TAC would have an exploitation rate slightly higher than in recent years and the stock biomass would increase by 2%.

Table 2. Georges Bank 'a' TAC scenarios for the 2007 fishery.

TAC (t)	Exploitation rate during 2007	Biomass (t) at end of 2007		Change in 3+ biomass during 2007	Change in 4- 7 biomass during 2007
	Ages 4 to 7	Age 3+	Ages 4-7		
3,000	12%	33,400	25,000	+5%	+3%
3,500	14%	33,100	24,800	+4%	+3%
4,000	17%	32,800	24,600	+3%	+2%
6,000	25%	31,600	23,700	-1%	-2%

## SOURCES OF INFORMATION

DFO, 2006. Assessment of Georges Bank Scallops (*Placopecten magellanicus*). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/032.

## FOR MORE INFORMATION

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