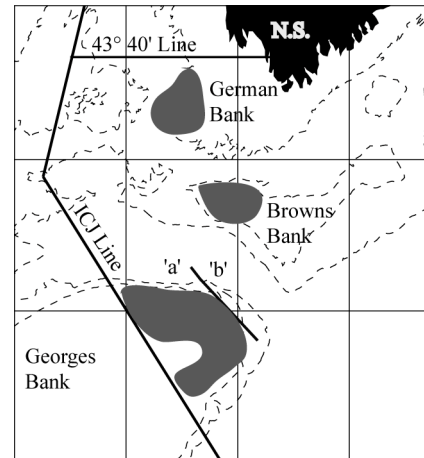


**Georges Bank  
Scallop**



### Background

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 Scotian Shelf (Middle Grounds, Sable Island Bank, Western Bank, Browns Bank, and German Bank), and St. Pierre Bank. Scallops prefer a sandy, gravel bottom and occur in depths of 35 to 120 m.

Scallops have separate sexes. They mature at age 2. The female gonad is red in colour and the male gonad colour is creamy white. The major spawning period is August to October. The fertilized eggs develop in the water column until settlement on the bottom within 30 to 60 days.

Growth is estimated from the position of annual rings on the shell. The growth rate varies from one area to another and is influenced by season, depth, and temperature.

Offshore scallop vessels range from 27 to 46 m length overall. The offshore fleet uses a New Bedford offshore scallop rake or drag, 4 to 4.9 m in width. Two drags are fished simultaneously, one on each side of the vessel.

### Summary

- Catch and TAC were 4,000 t in 1998. The 1993 and 1994 year classes contributed over 70% to the catch.
- Catch-rates declined by 30% from 1997 to 1998 and effort increased by 25%.
- The total biomass estimate for 1998 decreased by more than 25% from 1997 whereas the directed biomass estimate (ages 4-7) remained the same.
- Incoming year classes for the 1999 fishery are weak.
- At an exploitation rate of 22% ( $F_{0.1}$ ) on the directed age group (ages 4-7), the TAC for 1999 would be 2,450 t. At an exploitation rate of 28%, a TAC of 3,050 t would keep the spawning stock biomass stable. At an exploitation rate of 35% ( $F_{max}$ ) on the directed age group, the TAC would be 3,700 t.
- A strong 1996 year class should recruit to the fishery in 2000.

**The Fishery**

Landings (thousands of tonnes)

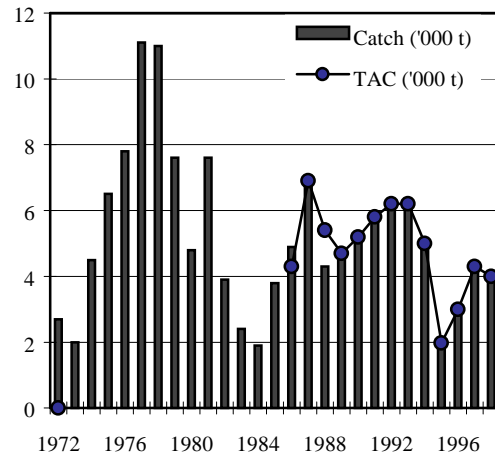
Year	70-79 Avg.	80-89 Avg.	90-94 Avg.	1995	1996	1997	1998
TAC	-	-	5.7	2.0	3.0	4.3	4.0
Catch	5.9	5.1	5.7	2.0	3.0	4.3	4.0

The voluntary introduction of satellite tracking on offshore scallop vessels in early 1998 has allowed micro management of fishing areas to become a reality. Under experimental management in 1998, the scallop grounds of Georges Bank were divided into the traditional area (zone ‘a’) and a marginal growth area (zone ‘b’). Zone ‘a’ continues to be managed by a meat count set at 33 meats per 500 g. Harvest advice on zone ‘a’ only is provided in this status report.

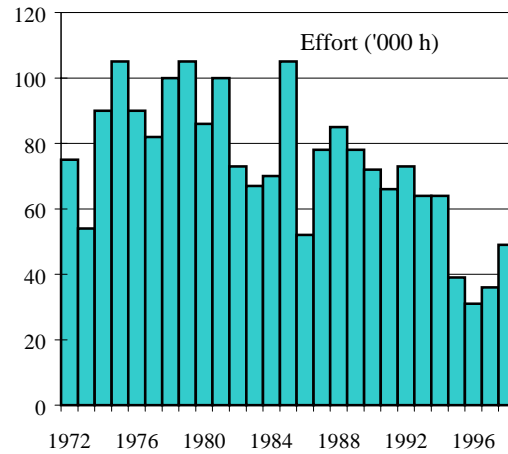
The management of zone ‘b’ included ‘rollover’ TAC’s and a meat count of 50 meats per 500 g. Rollover TAC’s are incremental quotas over a set period as long as catch-rates do not decrease significantly and the meat count is met. For example, in 1998, zone ‘b’ had a quota of 200 t per 6-week periods. At the end of the first 6 weeks, catch-rates and meat counts were such that a further 200 t was allowed over the next 6-week period. After review the TAC rolled 4 times in 1998 for a total of 800 t.

In 1995, a voluntary industry monitoring program to discourage the presence of small meats in the catch (50+ meats per 500 g) was implemented. A low tolerance level (10% by number of meats 10 g or less) added more restriction to the regulatory 33 meat count (33 meats per 500 g).

The overall TAC for Georges Bank zones ‘a’ and ‘b’ reached 4,000 tonnes for 1998. The traditional area (zone a) TAC was set at 3,200 t. Harvesting patterns were very similar from 1997 to 1998.



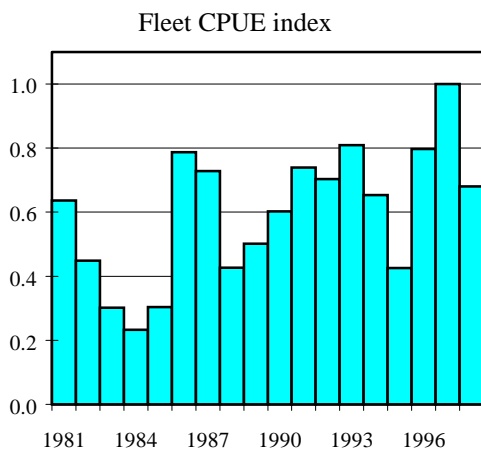
**Effort** was high prior to 1986 then started to decline until 1996. While effort rose 17% from 1996 to 1997, it increased by roughly 25% from 1997 to 1998. However, recent values were well below the long term average(1997-98).



The **average meat weight** in the catch from zone ‘a’ increased from 1993 to 1995. After decreasing in 1996, meat weights were in the high range again in 1997 and 1998. The fishery did not rely heavily on a single year class but spread its effects over a number of ages. The 1993 and 1994 year classes, at ages 5 and 4 respectively made up 36 and 35% of the number of meats in the 1998 catch. None of the main year classes fished in 1998 were very strong.

**Resource Status**

Logbooks provided catch and effort data from which catch-rates (CPUE) were estimated. Landings are monitored at dockside. Catch in numbers at age were derived from port samples. Relative biomass indices were derived from research surveys. Estimates of population abundance are based on commercial catch-rates, research survey biomass indices, and age composition in the stock.

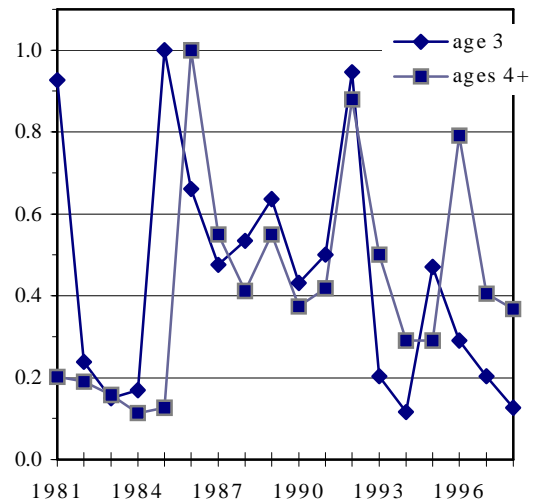


Standardised **commercial catch-rates** varied considerably in the 1990's. Catch-rates for 1997 were the highest encountered since the late 1970's. They decreased 35% from 1997 to 1998. The 1998 catch-rates were in the moderate range of historical values despite the reduction. There was a continuous decline through the course of the 1998 fishery.

**Survey catch-rates** showed a small decrease in the average number of recruited (ages 4+) scallops per tow from 1997 to 1998. While survey results indicated a greater abundance of older recruits (ages 6+; 1992 and older year classes), the number of age 5 (1993 year class) scallops has been reduced by half compared to last year's estimate of age 5 scallops. The abundance of age 4 (1994 year class) scallops has not changed from 1997 to 1998. Age 3 scallops (1995 year class) have

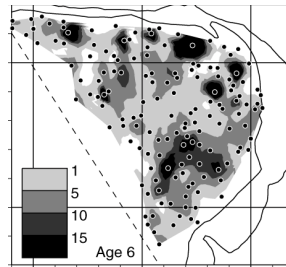
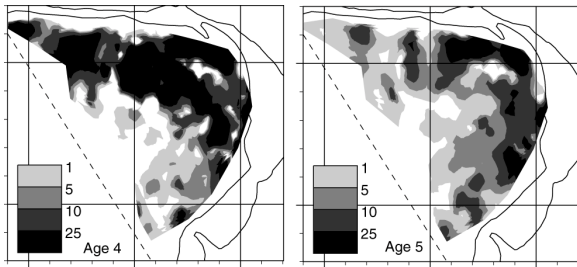
very low densities and are located mainly on the northern Edge.

Survey CPUE index

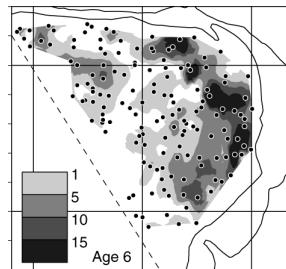
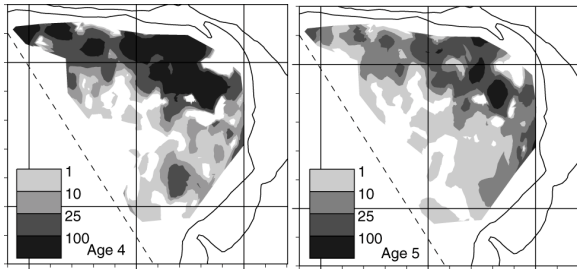


The spatial distribution of abundance at age for ages 4 to 7 from research survey data is presented in the following shaded contour plots.

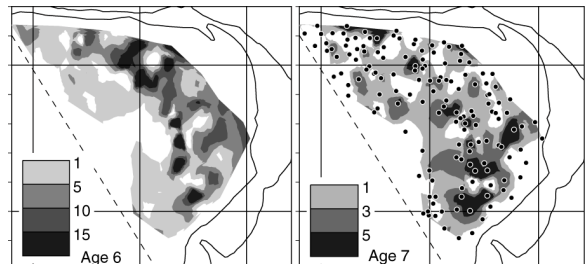
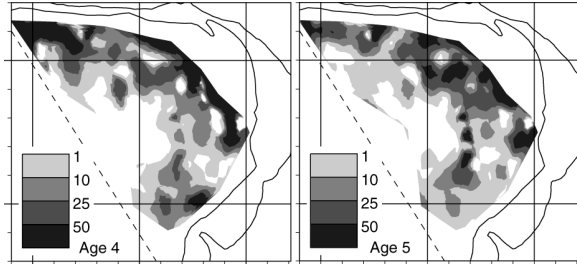
1995



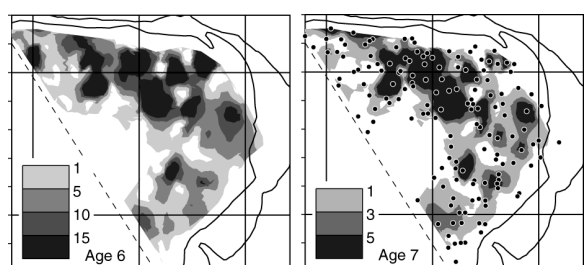
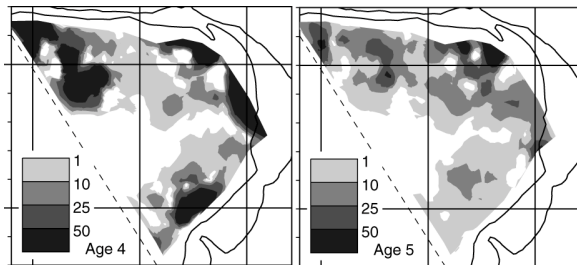
1996



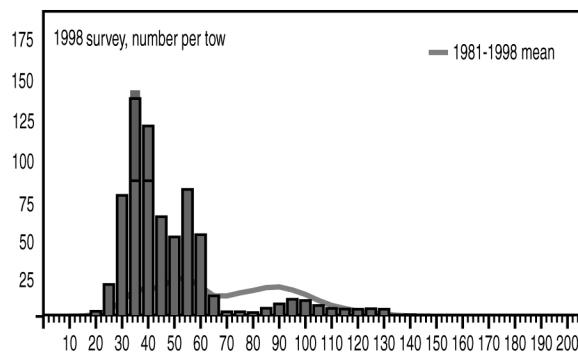
1997



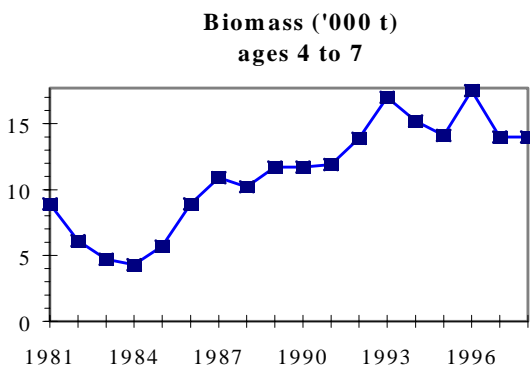
1998



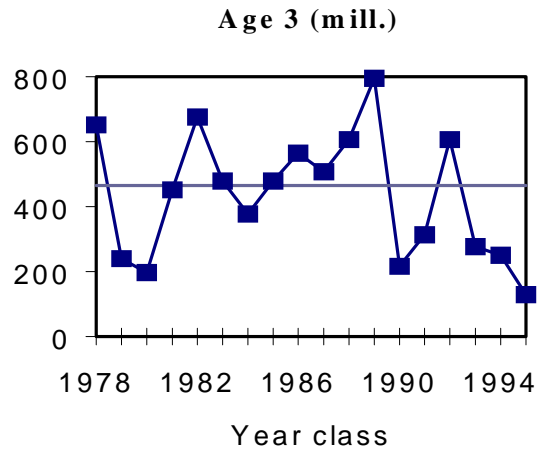
The first observations of the 1996 year class at age 2 suggested a strong year class. The abundance index for juvenile (age 2) scallops from research survey data was not considered totally reliable although the survey gear is lined to capture small scallops. The patchy distribution of the young age group also played a role. Nevertheless, survey results gave a fair indication of the strength of incoming recruitment.



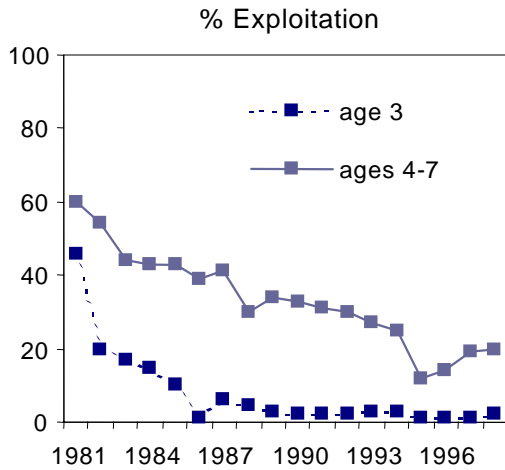
It would appear that the **total biomass** had been increasing from 1995 to 1997. The biomass estimate for 1997 was the highest encountered over the last 10 years. The 1998 estimate decreased by more than 25%. The directed biomass (ages 4-7) had recently peaked in 1996. It had fallen back in 1997. The 1998 **directed biomass** was very similar to 1997.



The **recruitment** of the 1992 year class reached above the long term average (horizontal line in graph below) following two of the poorest year classes (1990 and 1991) since 1981. The improvement was short lived as subsequent year classes were also very weak. The present estimate of the 1995 year class (age 3 in 1998) would rank it as the lowest on record over the last 15 years; a tied position it shares with the 1991 year class. This estimate will likely increase with more data; however, the strength of the 1995 year class will still be comparable to the 2 previous year classes.



The **exploitation rate** on the directed age group dropped from 40 to 30% until 1994 and was lower than before the implementation of TAC's in 1986. It decreased significantly from 1994 to 1995 and rose slowly after that. The exploitation rate on the directed age group was around 20% over the last 2 years. The exploitation rate on age 3 has stayed low since 1986 when the 33 meat count forced the fishery to direct for older scallops. Exploitation of age 3 scallops has been reduced to almost nil with the monitoring of small meats in the catch starting in 1995.

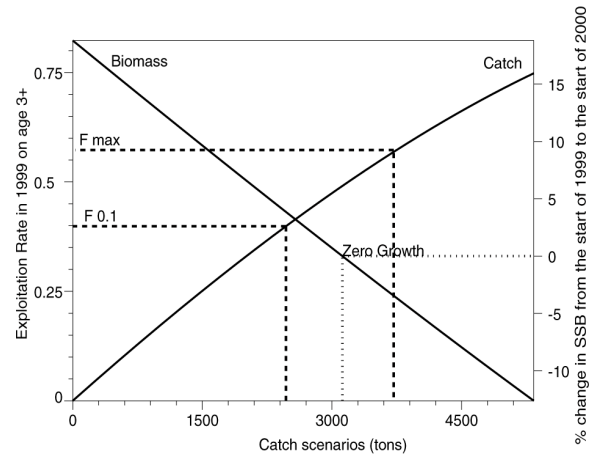


TAC(t)	Exploitation rate		Biomass (t) ages 4-7 End of 1999	Change in SSB
	age 3+	ages 4-7		
2,450	40%	22%	13,950	+4%
3,050	48%	28%	13,400	0%
3,700	56%	35%	12,800	-3%

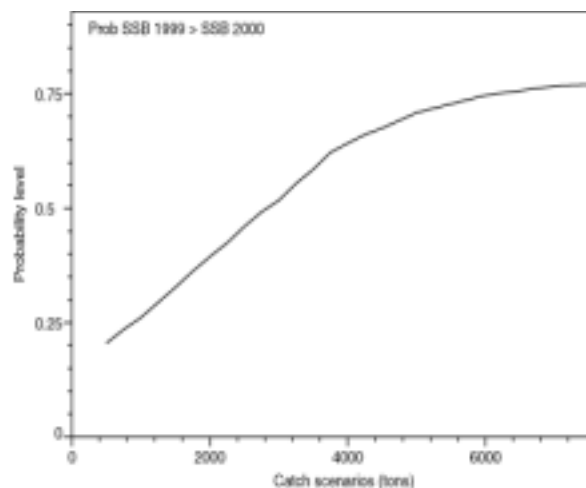
Other catch scenarios may be considered in the plot below.

**Outlook**

Catch projections at  $F_{0.1}$  corresponding to an exploitation rate of 22% on the directed age group would be around 2,450 t for 1999. The biomass of the directed age group is projected to increase 13% at the end of 1999 under that scenario while the spawning stock biomass rises 4%. The 1994 and 1995 year classes would represent 18% of the population estimate. The 1996 year class is expected to contribute approximately 55% of the population estimate in 1999. The biomass is expected to increase further in 2000 mainly because of the large 1996 year class. Catches of 3,050 t in 1999 would allow the spawning stock biomass to remain stable. The biomass for the directed age group would increase 9%. This scenario has an exploitation rate of 28% on ages 4-7. A catch scenario at  $F_{max}$ , 3,700 t, corresponds to an exploitation rate of 35% on the directed age group. The biomass of the directed age group would rise slightly, 4%, but the spawning stock biomass would decline 3%.



The projection results carry a certain degree of **uncertainty** that is a function of how well year class strengths are estimated. In the model used here, this uncertainty can be expressed as risk of achieving reference targets for specific harvesting plans. For example, under a catch scenario of 2,450 t for 1999, there is a 40% risk that the spawning stock biomass (SSB) in 2000 will be less than the 1999 estimate. These uncertainty calculations do not include variations in weight at age, partial recruitment, variations in natural mortality, systematic errors in data reporting or model misspecifications.



The same age/shell height model was assumed for all years. There is spatial heterogeneity in the distribution of age groups. Associated fleet dynamics directing the fishery on particular age groups also take place.

### ***For more Information:***

Contact: Ginette Robert  
 Invertebrate Fisheries Division  
 Bedford Institute of Oceanography  
 P. O. Box 1006  
 Dartmouth, NS B2Y 4A2

Tel: (902) 426-2616  
 Fax: (902) 426-1862  
 E-Mail: RobertG@mar.dfo-  
 mpo.gc.ca

### ***References***

Robert, G., G.A.P. Black, M.A.E. Butler, and S.J. Smith. 1999. Georges Bank scallop stock assessment - 1998. DFO Can. Stock Assess. Sec. Res. Doc. 99/67.

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Maritimes Regional Advisory Process  
 Department of Fisheries and Oceans  
 P.O. Box 1006, Stn. B203  
 Dartmouth, Nova Scotia  
 Canada B2Y 4A2  
 Phone number: 902-426-7070  
 e-mail address: myrav@mar.dfo-mpo.gc.ca

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