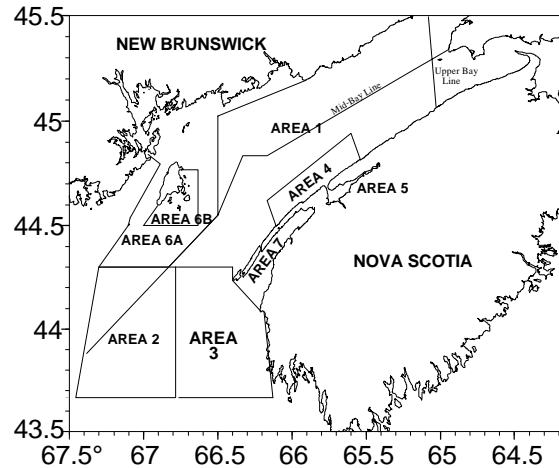


Area 4 Digby Scallop



Background

The sea scallop *Placopecten magellanicus* occurs only in the northwest Atlantic Ocean from Virginia north to Labrador. Within this area, scallops are concentrated in persistent, geographically discrete aggregates or "beds", many of which support valuable commercial fisheries. The larger beds are found offshore and in the Bay of Fundy along the Nova Scotian coast. Scallops in different beds, and in different areas of large beds, show different growth rates and meat yields.

Unlike many commercial scallop species, the sea scallop has separate sexes. Male scallops develop a white gonad in the summer months, while female gonads are bright red. Eggs and sperm are released into the water and fertilization takes place in the sea. Spawning begins in late August to early September, and the larvae drift in the water for almost a month before settling to the bottom in October.

The Digby beds have supported consistent fishing at least since the 1920s and are thought to be self sustaining. Until recently, most of the scallop harvest in the Bay of Fundy came from these beds.

99 Full Bay license holders are licensed to fish in Area 4. These vessels are between 45' and 65' long, and tow 7 to 9 drags off the starboard side.

This industry became a quota fishery in 1997, with limited entry, TAC, gear size, seasonal closures, minimum shell height and meat count restrictions.

The Fishery

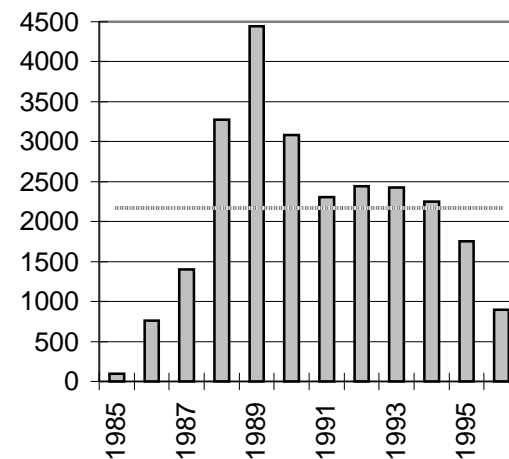
Landings in the whole of the Bay of Fundy by all fleet sectors have declined from 1995 by 49% in 1996, including catches of 76.7 mt from SFA29 outside of the regulation fishing area. The landed value of the catch was approximately \$13.9 million.

Landings (mt)

| Ave | 1991 | 1992 | 1993 | 1994 | 1995 | 1996* |
|-------|------|------|------|------|------|-------|
| 85-90 | 2304 | 2443 | 2429 | 2254 | 1754 | 900 |

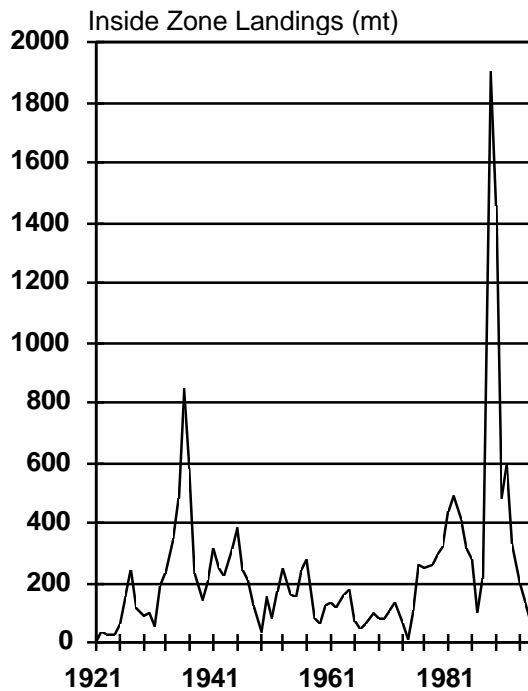
*preliminary

Bay of Fundy Scallop Landings (mt) (dash line: average over time series)



Scallop landings off Digby, N.S. have been variable over the last decade. A strong recruitment pulse, first observed in 1986 and 1987 as 2 year old animals, contributed to unprecedented high landings in 1988 through to 1991. Although scallop abundance increased in many parts of the Bay due to these year-classes, the greatest concentration of scallops was centered on the Inside Fishing Zone. From 1993 to 1996 the beds have been fished down and closures were necessary (see below).

Historical **landings** for the former Inside Zone (0 to 6 mile portion of Area 4) are available from 1921 to 1995.



Landings from the whole of the Digby bed area (0-16 mile, Centerville to Hampton) including Area 4 and portions of Area 1 are available from 1981 to 1995.

Landings 0-16 miles (metric tons meats)

| Year | 81-87 Avg | 88-91 Avg | 1992 | 1993 | 1994 | 1995 |
|----------|-----------|-----------|-------|-------|-------|-------|
| 0-16 mi* | 581.0 | 2158.7 | 721.7 | 531.4 | 361.4 | 290.9 |

* Full Bay Licenses Only

Landings from Area 4 only have been calculated from 1991 to 1996.

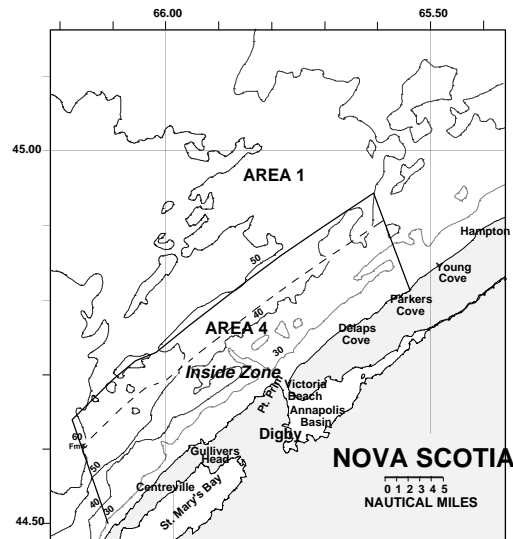
Landings Area 4 (metric tons meats)

| Year | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
|--------|-------|-------|-------|-------|------|-------|
| Area 4 | 678.7 | 318.4 | 244.2 | 162.7 | 94.8 | 71.2* |

* including preliminary landings from 6-8 miles of 9.1 mt

Landings in Area 4 declined steadily from 1991 to 1995 as the large year-classes (1984, 1985) were fished down. Portions of Area 4 were closed in 1995 and 1996 (see below). The November/December 1996 fishery in the Area 4 portion of the Bay of Fundy landed 137003 lb, or 62.1 metric tons according to dockside monitoring statistics. Additional 1996 landings from the 6 to 8 mile portion of the Area are estimated at 9.1 mt.

Place Names in Area 4



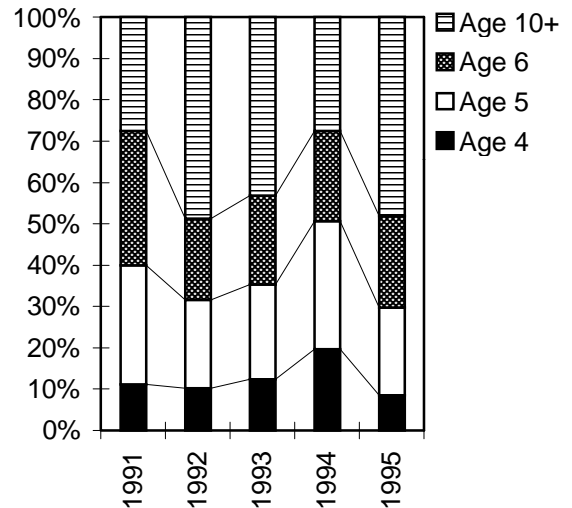
The Digby scallop beds were fished according to seasonal zones from 1986 to 1996. The Inside Fishing Zone encompasses an area within 6 miles of shore, from Parker's Cove to Centerville, and was closed by regulation from May 1 to September 30. The rest of the beds were seasonally unrestricted and are referred to as the Outside Zone. In 1987 the Inside Fishing

Zone was extended to 8 nautical miles from shore (to protect small scallops), to the equivalent of the present Area 4. In 1992, the Inside Zone returned to the 6 mile distance from shore. In 1995, the Inside Zone regulation closure area was extended from Parkers Cove to Port Lorne beginning August 12, 1995, and neither area was opened in October. This was done to protect broodstock and the pre-recruit scallops. Area 4 was established on January 1, 1997.

On this date, an Interim Management Plan was implemented dividing the Bay into 7 fishing areas with each area managed by a total allowable catch, a meat count, shell height, and in some cases, seasonal restrictions. These measures were not defined for Area 4 pending biological review of the stock status.

The part of Area 4 which was the former Inside Zone was not fished in 1996 except for a limited fishery in a portion of the Area from the Digby Gut to Port Lorne which was fished under a dockside monitoring condition from November 15 to December 15, 1996. The meat count for this area was 40/500 g. Fishing also occurred from 6 to 8 miles from shore until the establishment of the 8 mile Area 4 on January 1, 1997.

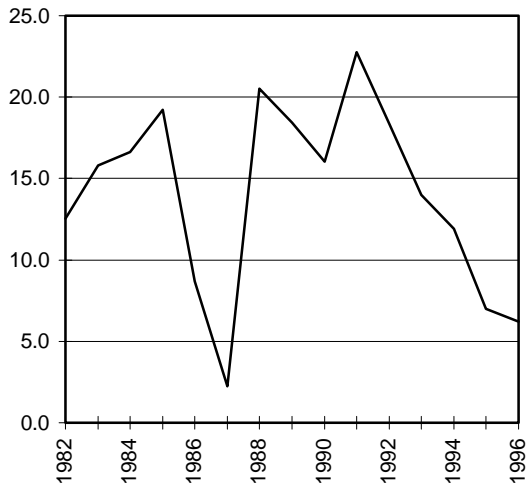
Relative (Within Year) Proportions of Age Groups in the Commercial Catch from Area 4.



Four age groups have dominated the **commercial catch** in Area 4 since 1991. In most years, the scallops age 10 and over dominate the catch, except for 1991 and 1994 when the catches of 5 year old scallops were slightly higher. The regulation meat count was 55 meats/500g from October 1 to April 30, from 1991 to 1995, and 72 meats/500g during the summer months. In 1995, the meat count was 72 meats/500g from May 1, 1995 to June 30, 1995, and 50 meats/500g from July 1, 1995 to July 1, 1996. The decrease in the proportion of 4 year scallops from 1995 to 1996 may be due to this change in meat count.

The total **effort** (hours) for the Inside Zone has been calculated from 1985 to 1996. Effort has been low in 1995 and 1996 due to the closure of the fishery for portions of each year.

Effort (000s hours) for the Inside Zone.

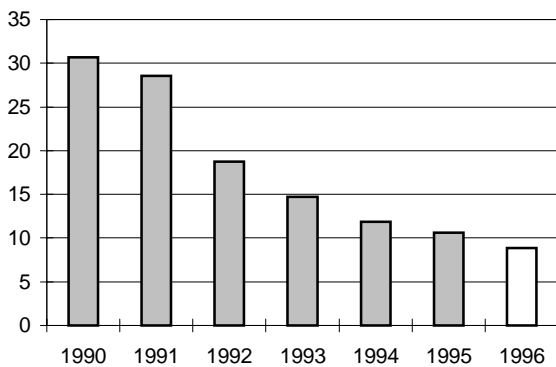


Resource Status

Fleet activity in 1996 was monitored for the first time through a dockside monitoring programme. There was also logbook and port sampling information.

The 1996 log data show catch per unit effort (CPUE) was 8.89 ± 3.25 kg/hour with a minimum of 2.56 kg/h and a maximum of 18.8 kg/h. Due to the differences in sources and area covered, the 1995 and 1996 CPUE data cannot be compared. The log records show that 910 "days" were fished in Area 4.

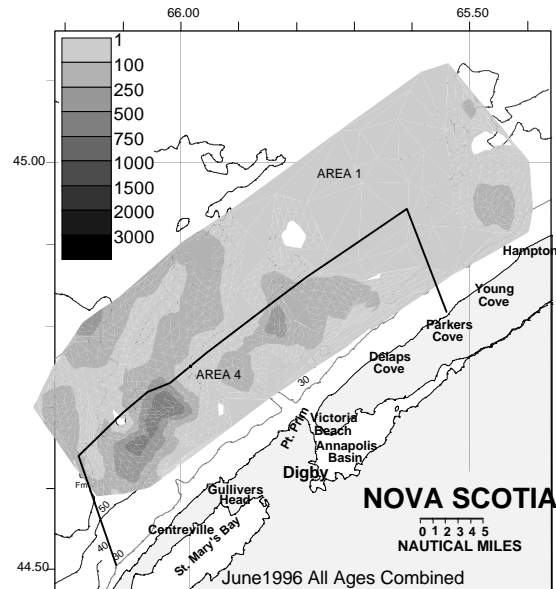
CPUE kg/hour (Open box Area 4, dockside monitoring data; Shaded boxes Inside Zone, log data)



Data from **research vessel surveys** were

used to assess scallop stocks. Comparable area stratified random surveys have been conducted in June since 1991. Previous to this date, surveys were stratified by commercial catch.

Spatial Distribution of Scallops in Area 4. Numbers of scallops/std. tow

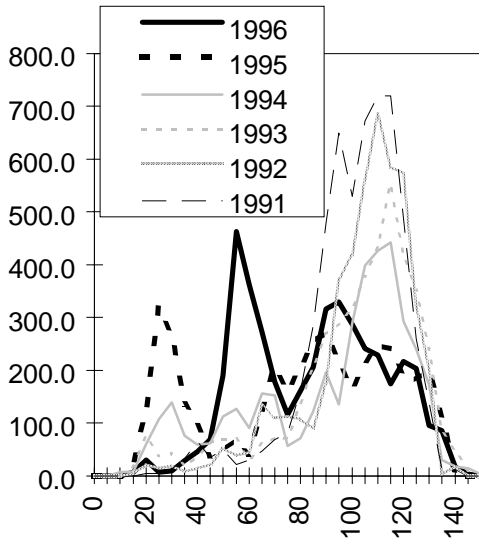


In 1996, 44 stratified-random tows were made in Area 4 using the government research vessel, *J.L. Hart*.

The greatest concentration of scallops in Area 4 is in the area off Centreville and Gullivers Head. In 1995, the dominant age group was Age 2 (1993 year-class). These scallops were located in the portion of Area 4 which was closed to fishing, that is off Gullivers Head and Centreville, but extended to Delaps Cove in the fished area. These scallops were still present in the 1996 survey, with the age 3 animals being the largest age group. Recruitment of the 1991 and 1992 year-classes appears average compared with recent (1987+) years, while the 1993 year-class is above average. There were some age 2 scallops (1994 year-class) in the 1996 survey and these were also concentrated off Centreville in the closed area (i.e., below Pt.

Prim). As in 1995, there is little recruitment above Delaps Cove.

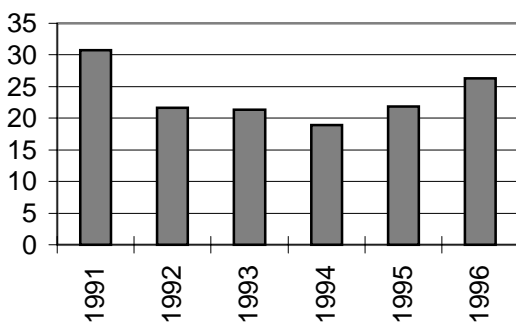
Survey (1991-1996) Total Numbers of Scallops at Shell Height (mm) Intervals



The **total number** of scallops in Area 4 estimated from the survey increased from 1995 in 1996 due to these recent recruitment events and restricted fishery.

The incidence of **clappers** (paired empty shells) declined to 8% in the former “Inside Zone” from 11% in 1995. The clappers were concentrated in the larger scallops off Centreville. The numbers of clappers reflect both natural mortality and incidental fishing mortality.

Total Number of Scallops (Millions) in Area 4 Estimated From the Survey Data.



Population meat weight estimates were calculated from the June 1996 survey data

with a catchability factor. The meat weight of scallops age 5 and over for the entire Area 4 is estimated as 614 mt (95% confidence interval 507 mt, 743 mt). The meat weight of scallops age 5 and over in the area west of Pt. Prim (which was opened to fishing after the survey) is estimated as 246 mt. There are several important sources of **uncertainty** that affect these estimates namely, the survey did not cover the area from 0 to 2 miles and the catch from 6 to 8 miles is not included in the catchability calculations.

Area 4 Exploitation Rate (%) for Ages 5+

| 1991 | 1992 | 1993 | 1994 | 1995 | 1996* |
|------|------|------|------|------|-------|
| 31.5 | 13.3 | 28.2 | 24.7 | 12.4 | 11.2 |

* calculated over the whole of Area 4

Exploitation rate, assuming a natural mortality of 0.1, was calculated from the survey as 11.2% on the animals ages 5 + in the whole of Area 4. Exploitation rate in the open area only (west of Pt. Prim) was approximately 28%. The low levels in 1995 and 1996 reflect the closure of a large portion of Area 4 through these years.

Outlook

Estimated population numbers of animals over the age of 6 has not changed from 1995 to 1996. The effect of the November/December 1996 fishery on the stock is unknown as the survey was completed in June of that year. The 1993 year-class is above average, however it will not enter the fishery until 1998.

Management Considerations

The 1997 interim management plan does not outline meat count, minimum size or total allowable catch restrictions. Biologically-based options were determined.

Yield per recruit analysis indicates that at fishing mortalities (F) greater than 0.40 the optimum age-at-first capture is age 8. The weight at this age from the regression models corresponds to a 16 g mean weight with a shell height of 113 mm (about 4.5"). The corresponding straight meat count is 31/500g.

At a minimum meat weight of 10 g, the scallop age is approximately 5.5 years. This still offers yields near the optimum, only resulting in approximately 6% loss of long term yield. The minimum shell height of 95 mm (3.75") corresponds with the minimum meat weight of 10 g. A blended meat count of 45/500 g should be combined with these later size restrictions.

To protect the 1993 year-class which won't be entering the fishery until 1998, the portion of Area 4 east of Pt. Prim should remain **closed** in 1997.

Total allowable catch (TAC) recommendations were calculated for the whole of Area 4 from 2 to 8 miles for four levels of exploitation based on the population meat yield estimates described above.

| Exploitation Rate (%) | Fishing Mortality (F) | TAC (mt) |
|-----------------------|-----------------------|----------|
| 15 | .27 | 92 |
| 20 | .34 | 123 |
| 25 | .40 | 154 |
| 30 | .48 | 184 |

Application of a yield per recruit model resulted in $F_{0.1}$ of 18% and F_{max} of 43%. Low exploitation rates will allow the yield from the 1993 year-class to reach its full growth potential and will also provide an opportunity for broodstock to seed adjacent areas. The 1996 fishery removed 56.7 mt from the TAC area (Area 4 from 2 to 8

miles). An additional 14.5 mt were removed from Area 4 in the 0 to 2 mile portion.

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References

Kenchington, E., M.J. Lundy and S.J. Smith.
1997. Bay of Fundy Scallop Stock
Assessment: Areas 2,3,4,5,7. Canadian
Stock Assessment Secretariat Research
Document 97/63.

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