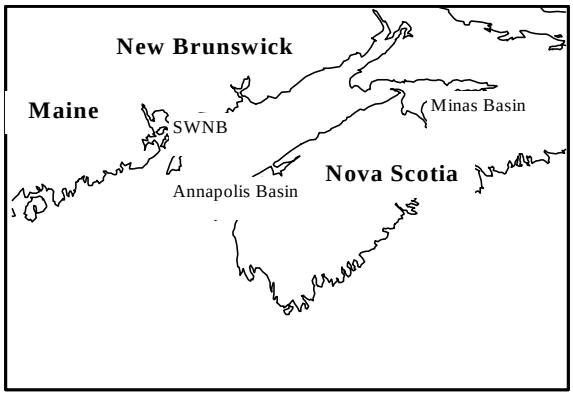

Bay of Fundy Soft-Shell Clams

Background

The soft-shell clam, Mya arenaria, ranges in the Atlantic Ocean from North Carolina to the Arctic, extending south to central Europe. In the early 1900s, it was introduced to California and has since spread north to British Columbia. Although found primarily in muddy, intertidal habitats, it also lives subtidally and in a range of sediment types. There are separate sexes which spawn in June.

There are three major clam harvesting areas in the Bay of Fundy: the Annapolis Basin and the Minas Basin in Nova Scotia and the Quoddy region in southwestern New Brunswick. All of these areas are actively harvested.

The fishery for the soft-shell clam in the Canadian Maritimes has had a long history with archaeological records indicating that clams were an important dietary component of the native tribes two to three thousand years ago. Formal catch records date back to the late 1800s. Harvesting technology has changed very little over the last century. With the exception of a brief period in the 1950-1960s when semi-automated hydraulic harvesting techniques were tried, hand harvesting using a clam fork (or "hack" or "digger") is still the only industry-sanctioned method used in the Bay of Fundy. Many of the fishers work in several primary industry sectors (agriculture, forestry, fishing) over the course of the year.

The fishery has historically been mostly regulated through minimum size limits, harvesting methods and health safety standards (coliform or phycotoxin area closures). Recently, individual licenses have been required (1995) and restrictions have been placed on recreational digging. Fishing occurs year-round in the Bay of Fundy, except in those areas which experience ice cover in the winter. Harvesting can be done by any digger in open areas and only by diggers hired by depuration plants in closed areas. There are four depuration operations in the Bay of Fundy, two in New Brunswick and two in Nova Scotia. Clams are sold to local buyers who are generally suppliers to larger processors.

The Fishery

The fishery is currently managed under the Canadian Maritime Fisheries Regulations which are being restructured with input from the Regional Clam Advisory Committees. The minimum size limit (shell length) is 44 mm (1.75 in.) although some areas have increased this to 51 mm (2 in.). Clams may only be harvested by hand. All diggers must have a clam license and also a personal fisher's registration. These licenses are currently frozen. Harvesting is unrestricted on open flats, but flats which are closed because of public health related issues (moderate contamination) are only allowed to be harvested by depuration plant diggers. These clams are closely controlled and depurated before going to market. Recreational diggers are not required to have a license and are permitted 100 clams/day.

Landings in the Bay of Fundy have decreased somewhat over the last seven years although they are likely under-estimates due to non-reporting of catches. The decrease in catches has not been uniform among the three different fishing areas as SWNB has increased landings over the last two years. The Minas Basin has experienced the largest decrease over the last seven years.

Bay of Fundy Landings (tons), Value ($'000s)

Year	61-70 Avg	71-80 Avg	81-90 Avg	1992	1993	1994	1995
Wt.	1,137	2,041	2,906	1,488	1,098	1,370	1,621
Value	-	-	-	2,208	1,648	2,387	3,223

Available from: Maritimes Regional Advisory Process, Department of Fisheries and Oceans, P.O. Box 1006, Stn B105, Dartmouth, Nova Scotia, Canada B2Y 4A2. Telephone: 902-426-8487. E-mail: d_geddes@bionet.bio.ca

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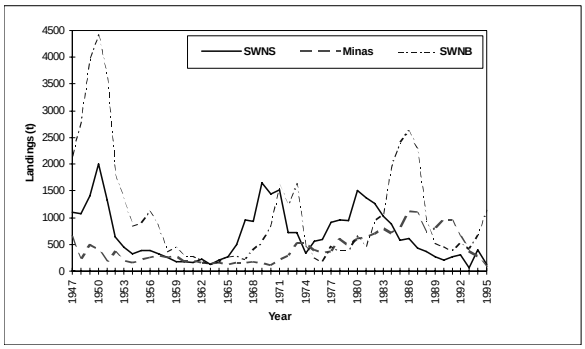
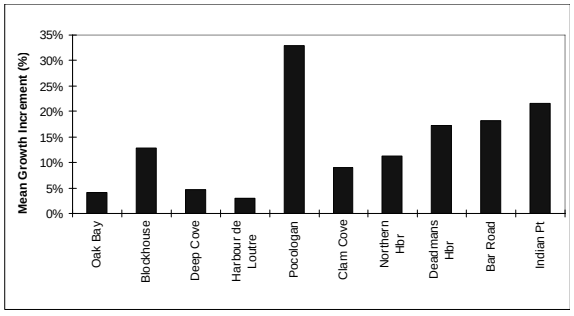
Clam Landings by Region



Growth trials of similar aged animals on beaches in SWNB in 1995 indicate growth rates varied dramatically among beaches suggesting different carrrying capacities for each beach. Past fishery data (1988-91) indicate beaches may differ significantly in the size distribution of clams harvested. No biological data for 1995 are available from the fishery.

Growth of Clams from SWNB (1995)



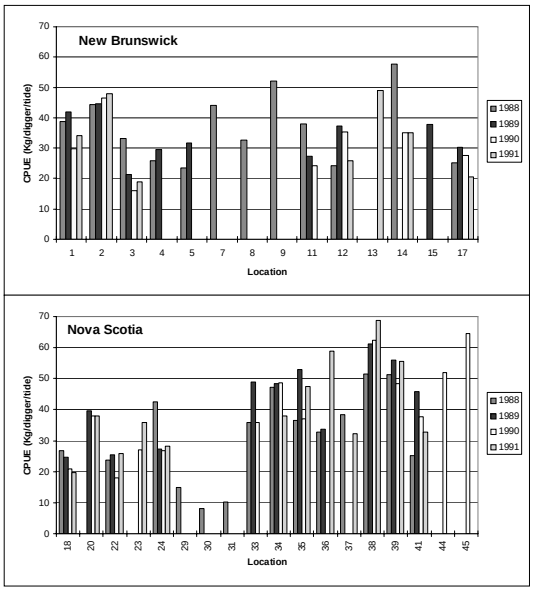
Resource Status

The fishery is monitored through on-site surveys using summer students to collect information on the harvesting levels and practices of the diggers. These data are used to calculate a CPUE index for specific clam beaches to track changes in the catch rate. Helicopter overflights are occassionally used to measure the total harvesting effort for a tide in SWNB.

Catch rate data are not available in 1995. In the period, 1988 to 1991, catch rates from various clam beaches in the Bay of Fundy ranged from 20 to 60 kg/digger/tide. In New Brunswick (Areas 1-17), there was some inter-annual variability, but the same change in patterns was not reflected in all sites. In Nova Scotia, the catch rates in the Annapolis Basin (Areas 18-24) were lower than those found in the Minas Basin (Areas 33-45).

Again, inter-annual pattern changes in the catch rates were not equally reflected in all areas. Catch rates for eastern Nova Scotia are shown for comparison (Areas 29-31).

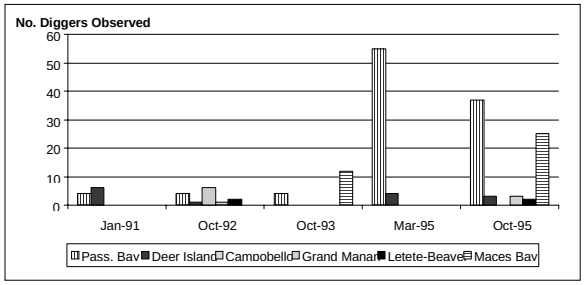
Catch Rates of Clams from Various Beaches in the Bay of Fundy (1988-1991)



Location	New Brunswick	Location	Nova Scotia
1	Oak Bay East	18	Thornes Cove
2	Block House	20	Smith's Cove
3	Ministers Island	22	Harbourview
4	Cement Plant	23	Bear River
5	McCann Cove	24	Deep Brook
7	Bocabec	29	Cole Harbour
8	Digdeguash	30	Three Fathom Hbr.
9	Magaguadavic	31	Clam Harbour
11	Pocologan	33	Economy/Tower
12	Lepreau Harbour	34	Carr's Brook
13	Lepreau Basin	35	Soley Cove
14	Northern Harbour	36	Economy
15	Clam Cove	37	Five Islands
17	Duck Ponds	38	Sand Point
		39	Brodericks Beach
		41	Moose Island
		44	Sonora
		45	Wine Harbour

Helicopter survey data suggest the effort has increased in SWNB over the past four years as the number of diggers seen per flight increased, especially in Passamaquoddy Bay.

Number of Diggers Seen per Helicopter Survey



Recruitment: No data are available to show recruitment in comparison with the spawning stock biomass, but there have been estimates of recruitment to the benthos at several locations. In general, the numbers of recruits in SWNB and in some areas of the Annapolis Basin have been much higher than those reported from Maine (B. Beal, Pers. Comm.)

Juvenile Clam Densities (0+ year class)

Area	Year	Density #/m^2
Lepreau Basin	1993	550
Lepreau Basin	1994	926
Annapolis Basin (mean)	1994	0 - 787
Blockhouse	1995	5,415
Oak Bay	1995	3,304

Sources of uncertainty: The most recent information is 1991. No catch rate information is available for recent years. The CPUE estimates are taken from beaches which are generally open to all diggers or depuration diggers and therefore, the permanently closed beaches are not sampled as extensively.

Predation at the early juvenile stages appears to be very important in the structure of the clam populations in several areas. Moon snails (*Euspira triseriata, E. heros*) and nemerteans (*Cerebratulus lacteus*) appear to be major predators. There also appears to be an interaction between the green alga, *Enteromorpha intestinalis*, and early juvenile clams. High densities of clams have been observed to be tangled in heavy mats of the alga (over 10,000/m^2). The fate of these juveniles is unknown. It is also possible that clam populations in the areas closed for health concerns may act as a potential broodstock for other harvested areas.

Based on results from experiments intended to test the feasibility of enhancement operations, successful recruitment of the juveniles to the benthos appears to be related to sediment type. Recruitment can vary from 0 to over 1,000 /m^2 over a linear distance of 30 m on the beach and is correlated with sediment type.

Outlook

The reasons for the drop in landings from the long-term mean are many, but the primary one is the loss of many harvesting areas due to public health protection closures from faecal coliform bacteria. These closures have a two-fold effect on the fishery. First, they remove clams from the wild harvesting base (although depuration plants can use moderately contaminated areas) and they concentrate the diggers on the other open flats. At some point, depending on the size and productivity of the open beaches, this concentration of fishing effort can over-harvest the clam populations. Other factors which affect the productivity of beaches for harvesting are: the occurrence of phytotoxins (such as paralytic shellfish poison (PSP), diarretic shellfish poison (DSP) and domoic acid or amnesiac shellfish poison (ASP)) or normal changes in biological cycles in response to environmental changes (i.e. cooling or warming trends). These latter conditions, however, are temporary and affect the clam production for only fixed time periods. In comparison, the loss of clam flats due to faecal colifom contamination and the resulting drop in commercial landings will likely be permanent unless remediation measures are taken.

The degree of change in commercial production will depend on: 1) the succeess of the natural recruitment cycles to the open beaches, 2) the success of the remediation programs in the clean-up of the coastal zones and 3) the development of culture-based techniques to increase production.

At the present time, there are not enough productive, open areas to investigate innovative methods to increase the landings of the existing fishery. The issues that management will have to confront immediately are: 1) the impacts of coastal zone development priorities, 2) effective methods to clean up contaminated (closed) areas, 3) the role that depuration will play in the future clam industry, and 4) how to deal with the conflict between culture and wild harvest (i.e. leasing of the flats).

For More Information

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