CAFSAC
Advisory Document # 80/11

Items from Invertebrates and Marine Plants Subcommittee Meeting

CAFSAC considered the deliberations of the Invertebrates and Marine Plants Subcommittee and offers the following advice.

1. Assessment of the lobster fishery along the Atlantic Coast of Nova Scotia

The lobster fishery along the Atlantic Coast of Nova Scotia (Lobster Districts 5, 6A, 6B*, 7A) has been in a collapsed condition since the mid-1960's. In Richmond Co., for example, landings dropped from a peak of 524 MT in 1955 to 123 MT in 1965 and to 35 MT in 1978; in Guysborough Co. landings dropped from a peak of 952 MT in 1954 to 397 MT in 1965 and to 57 MT in 1978. The main cause of this collapse is believed to be recruitment overfishing.

For Richmond Co. and adjacent areas, changes in the level of landings since 1940 appear to be largely accounted for by those changes in yield per recruit and egg production per recruit which would have followed the changes in size limit and rates of exploitation documented. Results from a stock-recruitment (egg production per female recruit) model, when analyzed in combination with historical data, suggest that with the current low exploitation rates, "stocks" in this area are currently producing about twice the number of eggs per recruit which were produced when recruitment was sustained (prior to the 1940's). This suggests that these "stocks" are now in a recovery mode.

In 1979, landings increased slightly over those in 1978 in southern Cape Breton Island and included an increased proportion of new recruits. The amount and duration of this increased recruitment is insufficient to confirm a trend as yet. West of Chedabucto Bay, however, there has been little or no sign of increased recruitment to date.

The following table illustrates the effect on relative egg production per recruit of changes in size limit and survival rate. Relative egg production of 1.0 pertains to current conditions [size limit = 81 mm (except in 6B where size limit = 70 mm); survival = 0.5 ± 0.1] in the fishery and is equivalent to about 9500 eggs per female recruit.

*Southern Cape Breton Co. portion of 6B.

Proportion surviving S	Minimum legal size limit (mm)				
	63.5	70.0	81.0	89.0	102.0
0.6	-	1.21	1.82	-	-
0.5	0.42	0.55	1.00	1.51	-
0.4	-	0.25	0.56	0.98	-
0.3	0.08	0.11	0.33	0.66	1.66
0.2	0.03	0.05	0.21	0.48	1.35
0.1	0.01	0.01	0.13	0.37	1.15
0.0	0.0	0.0	0.09	0.29	1.00

Under current conditions, a pulse fishing strategy with no open season in alternate years would give a relative egg production of 1.73 and a maximum size limit of 127 mm would give a relative egg production of 1.45.

It should be noted that measures to increase egg production would not necessarily result in a smooth transition to a recovered fishery through increased recruitment. Annual recruitment is likely to be highly variable even at high levels of egg production.

The following table illustrates the effect on yield per recruit of changes in size limit and survival rate. Relative yield per recruit of 1.0 pertains to current conditions and is equivalent to 592 g.

Proportion surviving	Minimum legal size limit (mm)		
	70	81	89
0.5	0.72	1.00	1.15
0.3	0.62	0.92	1.06
0.1	0.55	0.83	0.97

Increasing the size limit from 81 to 89 mm would result in a short-term loss in landings of about 30% by weight at current fishing rates. For Districts 5, 6A and 7A this would represent about 47 MT. Increasing the size limit in District 6B* from 70 mm to 89 mm would result in a short-term loss of 32% which would represent about 22 MT.

Management options advised for this fishery are as follows:

1) Increase the size limit to at least 89 mm;
2) Continue initiatives aimed at further reducing overall effort;
3) Introduce an alternate year pulse fishing strategy;
4) Introduce a maximum size limit of 127 mm.

*Southern Cape Breton Co. portion of 6B.

Options 3 and 4 are advised as short-term measures to aid recovery in this fishery, whereas options 1 and 2 are advised as the best measures to achieve recovery and maintain long-term stability.

2. Assessment of the lobster fishery at Grand Manan

Lobster landings at Grand Manan (Lobster District 2) have been relatively stable (at around 322 MT since the late 1940's). Over 80% (by weight) of all commercial lobsters trapped each fishing season are immature and from the shallow (< 40 fm) waters off southern Grand Manan. Fishermen from North Head, however, have increased their catch from 9% of the total landings during the 1974-75 season to 15% in 1978-79 by directing their efforts to fishing for large, mature lobsters in deep (41-110 fm) waters east and farther south of Grand Manan.

Since 1945 less than 0.2% of the total commercial sized (≥ 81 mm CL) lobsters sampled in southern Grand Manan during the fishing seasons were ovigerous (based on > 40,000 lobsters measured at sea during 1945-53 and 1977-79. In contrast, up to 14% of 210 lobsters sampled off North Head in 41-110 fm, 14 June 1979, were berried.

Crude and optimistic estimates suggest that at best, the berried females found in the shallow waters of southern Grand Manan during the fishing season may contribute up to 30% of the current recruitment into that fishery. Where the remainder originates is still a matter of conjecture. Possibly the large, mature lobsters found in deep waters adjacent to Grand Manan contribute a major part of the recruitment to the shallow areas off southern Grand Manan. This reservoir of mature lobsters has only recently (last 5-7 years) been exploited. To what extent it can continue to be exploited without adversely affecting recruitment into the southern Grand Manan fishery is not known.

The increasing annual landings of mature lobsters by only one fisherman in 1974-75 and approximately 10 in 1980 at North Head has caused the more than 100 other fishermen in Grand Manan to become increasingly concerned about the removal of part of the reproductive stock.

The following management options are offered as possible solutions to this problem:

(1) Establish a maximum size limit of 127 mm. This will protect large reproductive lobsters in the deep water, but will have negligible effect on egg production in the shallow water population. This would be the same as the State of Maine maximum size limit. It would affect the total Grand Manan fishery by less than 10%, the southern Grand Manan shallow water fishery by less than 1.5%, and the North Head fishery (which includes the deep water fishery) by about 50% by weight; however, only a few (approximately 10) fishermen fishing in deep water would be affected.

2) Close deep water areas around Grand Manan to lobster fishing. This will protect the large, reproductive lobsters. It should be noted, however, that many of these lobsters seem to move from deep water into the shallow waters off the New Brunswick side of the Bay of Fundy near the end of the spring fishing season to reproduce and molt. Exploitation of these lobsters in this area has occurred historically.

Egg production (and yield per recruit) in the shallow water populations of Grand Manan could be increased substantially by increasing the size limit. To what extent such an increase in egg production will increase recruitment in these populations is not known but it would almost certainly enhance recruitment in Bay of Fundy populations generally.

The following table illustrates the effect on egg production and yield per recruit of various size limit increases with a current F = 1.4 and M = 0.1.

Minimum legal size (mm)	Yield/recruit		Egg production	
	g	% increase	% potential*	% increase
81	474.6	-	0.24	-
89	563.8	18.8	1.05	339.0
93	610.4	28.6	1.36	466.0
95	636.8	34.2	2.12	783.0
105	690.0	45.4	7.94	3,208.0

*Potential egg production is that which would occur if recruited lobsters were not subjected to fishing mortality.

An increase in size limit in the Grand Manan fishery from 81 mm to 95 mm, which is the size at which 50% female maturity is reached in this area, would increase egg production from 0.24 to 2.12% of potential and yield per recruit by 34%.

A one-step increase in minimum legal size to 95 mm would represent a short-term loss of 80% by weight to the Grand Manan fishery.

In the shallow water Grand Manan fishery, exploitation rates are currently around 75% (F = 1.4). At the present size limit, exploitation rates would have to be reduced (through substantial effort reduction) to 45% (F = 0.6) to increase egg production from 0.24 to 2.68% of potential and yield per recruit by 19%. More modest reductions in effort would help to improve the economic efficiency of the fishery and should be encouraged for this reason as well. Effort reduction could be achieved through lower trap limits, reducing the number of licences, or shortening the fishing season by several weeks in the fall or spring.

The following should be taken into consideration when deciding on the appropriate management action for the Grand Manan lobster fishery.

(a) The Canadian-US boundary dispute at Machias-Seal Island. Any further restrictions on the Canadian fishermen; vis-a-vis the unregulated American fishermen fishing overlapping grounds, would place the Canadian fishermen at a further disadvantage.

(b) The State of Maine has a maximum legal size of 127 mm and attempts to increase the minimum size from 81 mm to 82.3 mm has, to date, met with considerable resistance from fishermen.

(c) The 5" maximum size law in Maine has presented problems in exporting Canadian "jumbo" lobsters to the U.S.