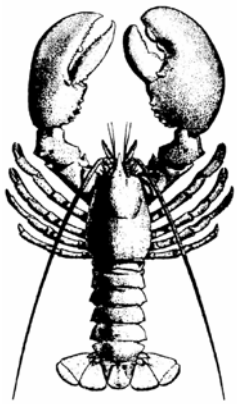


Eastern Cape Breton Lobster LFAs 27-30

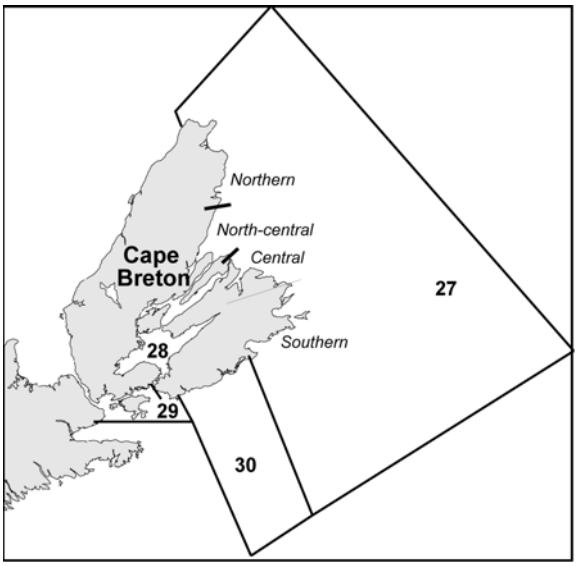
Background

Lobsters are found in coastal waters from southern Labrador to Maryland, with the major fisheries in the Gulf of St. Lawrence and the Gulf of Maine. They belong to a group of animals called Crustaceans which includes shrimp, krill and crabs. They all have external skeletons (shell) that must be shed to grow, a process called molting. Very young lobsters molt 3-4 times a year, increasing in weight by 50% or more with each molt.

In the waters off eastern Cape Breton lobsters take 5-8 years to reach the legal size. Minimum legal size is 70 mm carapace length (CL) in LFA 27, and 81 mm CL in LFAs 28-30. Lobsters between 70 and 80 mm CL are called "canners". A 70 mm lobster weighs about 0.3 kg (3/5 lb), while an 81 mm lobster weighs about .43 kg (close to a lb). Molting season is mid-July until early September. Canner lobsters will typically molt every year and increase in length by 15% and in weight by 50%. Larger lobsters molt less often, with a 1.4 kg (3 lb) lobster molting about every 3 years.

Off eastern Cape Breton, female lobsters can bear eggs at sizes as small as 65 mm CL, but these are the exception. Most lobsters mature between 70 and 85 mm CL. The size at which 50% of lobsters are mature is lowest off northern Cape Breton (about 73 mm) and greatest off southeast Cape Breton (about 84 mm). This difference in size at maturity is related to the warmer waters off northern Cape Breton. The mature female mates after molting in midsummer and the following summer produces eggs that are attached to the underside of their tail. The eggs are carried for 10-12 months and hatch in July- August. The free-floating larvae spend 4-7 weeks feeding and growing before settling to the bottom. The water temperature has a strong effect on how long this stage lasts.

For the first 3-4 years lobsters remain in or near their shelter to avoid the fish and other predators that feed on them. As they grow and have less chance of being eaten, they move about and spend more time outside the shelter. This is when they become more catchable by lobster traps.



The Fishery

Management of the lobster fishery is based on effort controls, a minimum legal size (MLS) and a restriction on retention of egg-bearing females. For management purposes, the coast is divided into Lobster Fishing Areas (LFAs).

Lobster Fishing Area	Season	Trap limit	MLS (mm)	No. licenses
27	May 15-Jul 15	275	70	535
28	May 9-Jul 9	275	81	18
29	May 10-Jul 10	275	81	74
30	May 19-Jul 20	250	81	20

Landings in LFA 27 remained fairly stable from 1947 until the mid 1980s when steady increases resulted in record high landings in 1990. Total landings for LFAs 28-30 also increased in the mid 1980s, but did not approach the historical highs of the late 1800s (>2500 mt).

After peaking between 1989 and 1992, landings declined in each LFA. For the largest LFA (27), 1995 landings were 45% lower than in 1990. Preliminary landings for 1996 indicate a further decline for all LFAs.

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.dfo.ca

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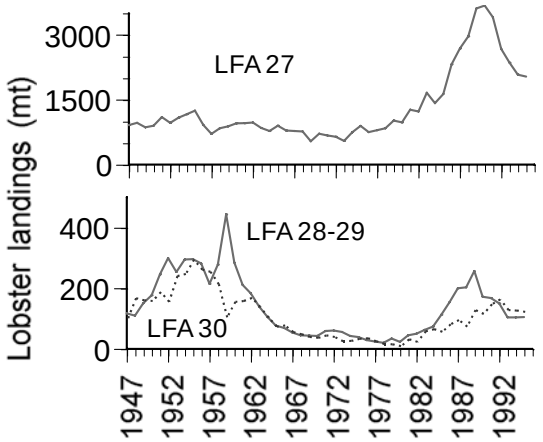

Landings (mt)								
	1992	1993	1994	1995	1996*	10 yr averages		
LFA						61-70	71-80	81-90
27	2778	2458	2190	2142	1563	802	847	2539
28	9	12	13	15	13	*combined with LFA 29*		
29	141	92	91	90	50	97	39	133
30	167	132	130	126	73	94	31	77
Total	3095	2694	2424	2373	1726	993	917	2749

*preliminary

Resource Status

Biological inputs to stock status reviews come from voluntary fishing logs, samples of the commercial catch, ongoing studies of growth and movement, and fishery statistics compiled by the Commercial Data Division.

Number of voluntary logs provided by LFA

	Year					
LFA	1991	1992	1993	1994	1995	1996
27	7	26	42	46	50	48
28	1	1	2	2	1	0
29	5	7	8	10	7	7
30	2	8	6	6	6	7

The logbook records were used to estimate catch rate, and fishing effort. Size measurements of lobsters were used with other data to estimate annual mortality.

Catch rates (kg per trap haul or kg/TH) have been used as an index of lobster abundance. Like landings, catch rates within LFAs 27-30 have declined over the last 5 years. Catch rates differ within the following sub-areas of LFA 27 - Northern (N): northern tip of LFA to Ingonish; North-central (NC): Little River to Point Aconi; Central (C): Point Aconi to Glace Bay; and Southern (S): Port Morien to Gabarus. Declines were lower in the Northern sub-area (about 0.14 kg/TH) than in the Southern (about 0.32 kg/TH). Catch rate declines in LFA 29 and 30 were about 0.13 and 0.35 kg/TH.

Catch rate from logs.

	Average catch rate (kg/trap haul)				
Area	1992	1993	1994	1995	1996
LFA 27 - N	**0.45**	**0.46**	**0.40**	**0.38**	**0.31**
LFA 27 - NC	**NA**	**0.51**	**0.45**	**0.49**	**0.43**
LFA 27 - C	**0.47**	**0.47**	**0.36**	**0.40**	**0.32**
LFA 27 - S	**0.63**	**0.54**	**0.48**	**0.42**	**0.31**
LFA 29	**0.27**	**0.20**	**0.21**	**0.20**	**0.14**
LFA 30	**0.81**	**0.70**	**0.63**	**0.57**	**0.46**

Overall, the decline in catch rates imply that lower abundance is the cause of decreased landings in LFAs 27-30.

An index of **effort** is the number of trap hauls. This index may not reflect any changes in the "quality" of effort (e.g. improved sounders, larger boats etc.). The number of trap hauls from 1992-96 declined in some years in parts of eastern Cape Breton (Northern and Central sub-areas of LFA 27, LFA 29 and LFA 30), but not to the same extent as catch rate. For example, the average number of trap hauls in the Central sub-area of LFA 27 was 5-10% lower in 1996 compared to 1992, but catch rate was down about 30%.

Exploitation, or removal rates have been estimated using 3 methods, each with their own assumptions and limitations. The Leslie method utilizes the relationship between catch rate and abundance (as measured by cumulative catch). Catch rate data from voluntary logs is essential for this method. A second estimate of exploitation is possible from recoveries of tagged lobsters. As part of an ongoing study of growth and movement in LFA 27, tag return data are available for a some ports. A third estimate of exploitation is possible from annual changes in the length composition of the catch. Catch composition analysis requires knowledge of growth rates, samples of the commercial catch and total landings for the area of interest.

Application of the Leslie method to the 1996 season indicates the method is useful for the northern, north-

central, and central areas of LFA 27, where catch rate declines uniformly over the season. For these sub-areas removal rates of 70-84% are indicated using the Leslie method.

1996 exploitation rate (μ) estimates from the Leslie method. NA is not applicable.

Area	N logs	μ (%)
LFA 27 - Northern	18	76
LFA 27 - North-Central	10	70
LFA 27 - Central	8	84
LFA 27 - Southern	10	49
LFA 29	6	NA
LFA 30	7	34

For the southern part of LFA 27 the catch rate decline is less uniform, as is the case for LFA 30. Lower removal rates are suggested for the southern sub-area of LFA 27, and for LFA 30, but there is greater uncertainty in the estimates (wider confidence intervals). For LFA 29 the Leslie method could not be used at all for 1996, since catch rates actually increased in mid-season.

The Leslie method was also used to evaluate whether exploitation has changed in recent years (1992-96) for specific ports. There was no indication of a trend within sub-areas of LFA 27, or in LFAs 29 and 30.

The return rate of tagged, legal-size lobsters can also be used to estimate exploitation rates (the Petersen method). Estimates based on tag returns should be regarded as minimum values because of possible tag loss, unreturned tags and natural mortality occurring between tagging and the fishing season. In the following table the estimated exploitation rates are at least 10% lower than those based on the Leslie method.

Sub-area of LFA 27	Tagging period	N tagged	N returned	μ (%)
Northern	Sept. '94	200	110	55
North-central	Sept. '93	1077	615	57
North-central	Sept. '94	198	129	65
North-central	Oct. '94	544	296	54
Southern	Oct. '95	253	104	41

In catch composition analysis, the number of lobsters in a particular group is estimated in 2 successive years. Any decline in the number is assumed to be due to mortality. Since natural mortality is thought to be low (<10% per year) most of the mortality is assumed to be related to fishing. This approach uses the length frequencies from commercial catch sampling, together with the total landed catch for the area of interest.

Total annual mortality (A) estimated for different molt groups using catch composition analysis.

LFA and port	Period	Sex/size (mm)	Range in A (%)
27 - Little River	93-95	M 70-80	52-56
	93-95	F 70-80	50-62
	93-95	M 81-94	63-66
	93-95	F 81-94	63-69
29 - Petit de Grat	93-94	M 81-93	55
	93-94	F 81-93	53
	93-94	M 94-107	47
30 - Fourchu	93-96	M 81-93	12-47
	93-96	F 81-93	29-36
	93-96	M 94-107	32-55
	93-96	F 94-107	3-33

As for the other methods, the estimates of mortality are generally lower and less variable for LFA 27 than for LFAs 29 and 30.

Sources of uncertainty: Catch rate is assumed to be positively related to abundance, and catchability is assumed to be constant between years. Lower temperatures or surplus food might cause lobsters to be less catchable in some years, but is seems doubtful that catchability has consistently decreased over the last 5-7 years. There are no data on annual changes in lobster food, but there are temperature data. Average temperature at 16-20 m during the fishing season at one port was lower in 1996 than 1994, but temperature at about 8 m was higher than 1994.

Avg temperature (°C) at Little River (May 26-July 8)

Depth	1993	1994	1995	1996
16-20 m	6.2	6.3	7.1	6.0
6-10 m		6.8	8.9	7.7

The exploitation rate estimates make a variety of assumptions, which if violated could affect the results. The assumption of limited movement is reasonable given the results of tagging studies, which indicate most lobsters move less than a few

kilometres between fall and the following fishing season. The assumption of constant catchability over the season (Leslie method) needs evaluation. Increased temperature as the season progresses should increase catchability, but some lobsters may become less catchable as they approach the annual molt. In addition some fishermen suggest that when natural food sources (e.g. capelin) are more available, lobsters may not trap as well.
The catch composition analysis method is dependent on representative samples of the commercial catch. More samples are needed for LFAs 29-30 to increase confidence in the estimates.

There do not appear to have been any major changes in the **environment** that might explain decreased lobster availability in LFAs 27-30 over the last 5-6 years. Temperatures in deeper waters off northeastern Nova Scotia in 1996 were colder than normal, but these cold conditions have persisted since the mid-1980s. Therefore the decline in catches is probably due to a decline in abundance.

Outlook

The decline in lobster landings over the last 5 years in LFAs 27-30 is more severe than most lobster fishing areas in the Maritimes. Whether catch rates and landings in LFAs 27-30 will continue to decrease is uncertain. Previous landings suggest that these LFAs can support more lobsters than at present. Based on current exploitation estimates and egg-per-recruit models, egg production in much of LFA 27 is less than 2% of that of an unfished population. For LFAs 29 and 30, egg production is probably 2-7% of an unfished population. For LFA 27 to reach the target egg production suggested by the FRCC (5% of an unfished population), exploitation rate reductions on the order of 50% would be necessary. The FRCC target could also be reached by a combination of measures such as increased minimum size, reduced effort, and protection of broodstock.

A **management** change considered within LFA 27 was an increase in the minimum legal carapace size by 1.5 mm in each of 1997 and 1998. A vote of all license-holders was held in December 1996. Before the vote the advisory committee decided that a 55% level of support was necessary for the change to be implemented. 53% of fishers supported the proposal.

For More Information

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Reference

Tremblay, M.J. and M.D. Eagles. 1996. Recent trends in the lobster fishery off eastern Cape Breton (LFAs 27-30): catch rate and exploitation. DFO Atlantic Fisheries Research Document 96/141.