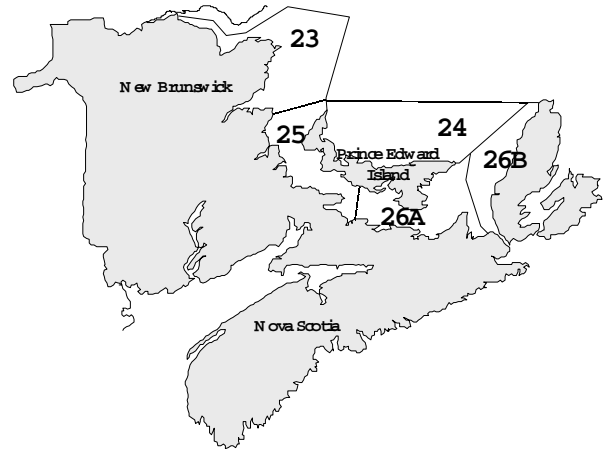


Southern Gulf of St. Lawrence Lobster (Lobster Fishing Areas 23, 24, 25, 26A and 26B)



Background

The American lobster habitat extends along the Atlantic coast from North Carolina to Labrador. In Canadian waters, lobsters may be fished in deep waters (i.e.: Georges Bank) but the most important concentrations are generally observed within 20 km from the shore. In the southern Gulf of St. Lawrence, lobsters are found in depths ranging from 1 to 40 meters.

The life history of the lobster can be divided into a benthic and planktonic phase. The planktonic phase follows the hatching of the eggs during the months of July and August. The larvae will go through the free-swimming period that lasts from 3 to 10 weeks depending on environmental conditions. The planktonic phase ends when the larvae settle on the substrate. After 5 to 6 years of growth, female lobsters in the southern Gulf of St. Lawrence become sexually mature (males become sexually mature at smaller sizes and ages than females). Mating occurs between the months of July and September. Generally, female lobsters extrude eggs one year after mating and carry the eggs, attached under the abdomen, for nearly another year.

Over the years, the lobster fishery has become and is still a major factor in the social and economic development of communities along the Atlantic coast, and especially to communities in the southern Gulf of St. Lawrence. In 2001, the 3,180 license holders in Lobster Fishing Areas 23, 24, 25, 26A and 26B have caught approximately 17,000 t of lobster for a landed value of more than \$200 million.

Summary

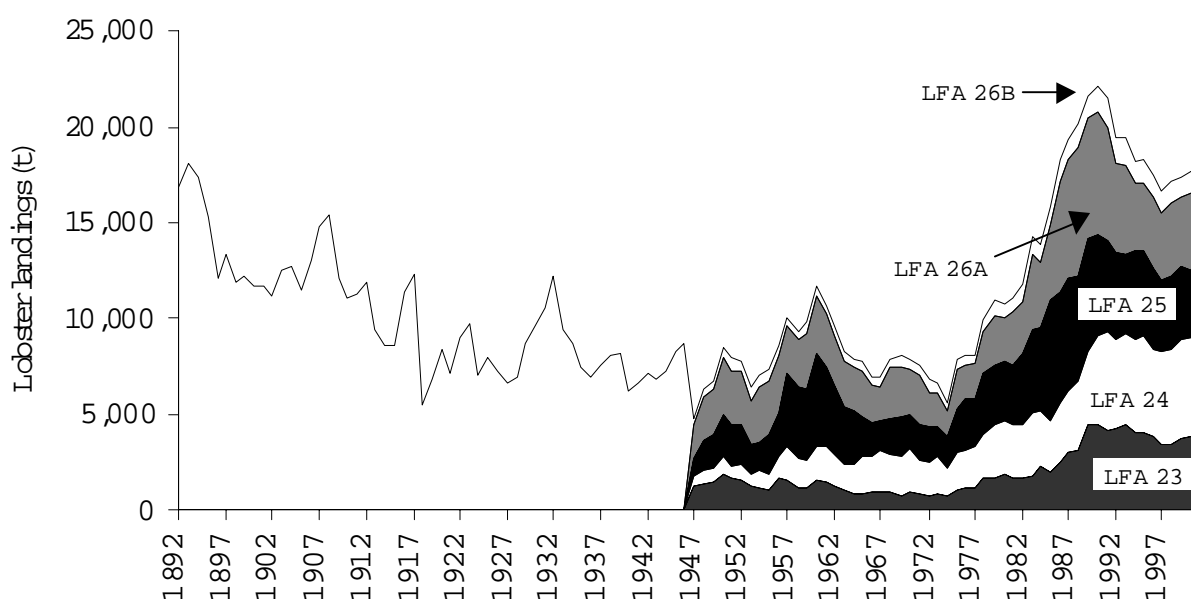
- Overall catches for the southern Gulf of St. Lawrence have been slowly declining since the 1990 record landings, but remain well above the long-term average.
- Most of the catches consist of new recruits (i.e.: lobsters growing to commercial sizes and entering the fishery for the first time).
- Exploitation rates have been generally high with most values ranging between 60% and 90%.
- The objective of having measures in place to double the egg-per-recruit by 2001 was only partially achieved.
- It is not possible to provide an outlook of short-term landings.
- The egg-per-recruit estimates need to be updated with new information before being considered in the next management plan.
- Efforts to reduce exploitation rate are highly recommended.

The Fishery

The **lobster fishery** of the southern Gulf of St. Lawrence (sGSL) began in the mid 1800's. For over more than a century, the fishery developed as a nearshore, small-boat fishery, providing revenues for a large number of harvesters.

The fisheries **management** regime is based on effort control (i.e. input fishery) in five Lobster Fishing Areas (LFAs). Regulated fishing seasons, fixed number of license

holders and a trap allocation by fishermen control fishing effort in each LFA. Since the implementation of regulations limiting fishing activities by LFA in the 1930s and especially following the introduction of limited access to fishing licenses in 1967, the number of license holders has been stable at approximately 3,200. The fishery is also characterized by two fishing seasons: the spring (May-June) season in LFA 23, 24, 26A and 26B, and the summer-fall season (early August to early October) in LFA 25.



Lobster Landings (t) by Lobster Fishing Area (LFA).

Years	23	24	25	26A	26B	Total
1950-59 avg.	1,437	1,057	2,494	2,751	552	8,291
1960-69 avg.	1,069	1,826	2,755	2,440	500	8,590
1970-79 avg.	1,099	2,044	2,217	2,037	539	7,936
1980-89 avg.	2,463	3,090	4,764	4,389	977	15,683
1990-99 avg.	4,007	4,835	4,351	4,306	1,232	18,731
1995	4,069	5,083	4,360	3,536	1,152	18,200
1996	3,784	4,604	4,239	3,720	1,126	17,473
1997	3,467	4,757	3,784	3,481	1,079	16,568
1998	3,453	4,959	3,844	3,804	1,098	17,158
1999	3,752	5,079	3,946	3,554	1,068	17,399
2000	3,808	5,198	3,526	3,934	1,114	17,580
2001*	3,298	5,363	3,304	3,867	1,180	17,012

* Preliminary

In addition to effort control measures, the lobster fishery has regulations aimed at controlling the size and type of lobsters that can be harvested. The minimum carapace size at capture and the prohibition on retaining egg-bearing lobsters are the two most important management measures aimed at allowing lobsters to reach sexual maturity and protecting known egg producers respectively.

Lobster Management Regime in the Southern Gulf of St. Lawrence in 2001.

Lobster Fishing Area (LFA)	Minimum carapace size ¹ (MLS)	Fishing season	Number of license holders	Trap per license holder ²
23	67.5 mm	May - June	722	300
24	67.5 mm	May - June	614	300
25	67.5 mm	Early Aug. - early Oct.	793	250
26A	67.5 mm	May - June	749	300
26B	70.0 mm	May - June	251	300

¹ 50% V-notching of egg-bearing females in all LFAs with the exception of LFA 24.

² A few communal native licenses have more than 300 traps/license.

Information on **landings** in the sGSL is available since 1892. During a short period at the turn of the 20th century, high lobster catches were reported in the sGSL. As fishing effort expanded, these years of good catches were followed by an overall decline. Annual catches decreased from 15,000 t in 1895 to average around 8,000 t between 1915 and 1975. In the mid 1970's, lobster landings in the sGSL increased from 5,594 t landed to a record high of 22,063 t in 1990. This represents a four-fold increase during a 16-year period. The increase in catches has been observed in all LFAs, with some variation in the year of peak landing.

This increase in lobster catches cannot be explained entirely by an increase in fishing effort or overall fishing power. The increase was observed for the entire range of the lobster distribution from southern Labrador

to Maryland (USA), in areas with different management regimes, fishing fleet characteristics and fishing traditions. Poorly understood environmental conditions and possibly complex species interactions throughout the entire range of lobster distribution are believed to have favored recruitment and survival for lobster. This resulted in a significant biomass increase.

Since 1990, landings in the sGSL have shown a steady decline. In 2001, 17,012 t of lobster were landed, which represents a 23% reduction from the peak landing in 1990. However, recent annual catches are still well above the long-term average. This recent decreasing trend in lobster catches is considered to reflect an overall decrease in lobster biomass. Accurate measurements of the magnitude of these changes are difficult with the data presently available.

In 1995, the **Fisheries Resource Conservation Council (FRCC)** was requested to look at the lobster fishery and resource situation in Atlantic Canada. The Council concluded that, although commercial catches were good, exploitation rates in the Atlantic lobster fishery were very high, that the fishery was heavily dependent on recruitment, and that eggs-per-recruit was too low. In 1998, a management plan was initiated with the objective of doubling the relative egg production or egg-per recruit (E/R). New measures were introduced over four years that would allow each LFA in the sGSL to at least achieve this objective.

Landings per Unit of Area (LPUA) in t/km² for Each Lobster Fishing Area (LFA).

LFA	Surface of fishing ground (km ²)	1970		1980		1990		2000	
		Landings (t)	LPUA (t/km ²)	Landings (t)	LPUA (t/km ²)	Landings (t)	LPUA (t/km ²)	Landings (t)	LPUA (t/km ²)
23	4,625	974	0.2	1,917	0.4	4,508	1.0	3,808	0.8
24	2,249	2,266	1.0	2,755	1.2	4,591	2.0	5,198	2.3
25	4,394	1,754	0.4	3,103	0.7	5,320	1.2	3,526	0.8
26A	4,530	2,416	0.5	2,302	0.5	6,363	1.4	3,934	0.9
26B	613	514	0.8	700	1.1	1,281	2.1	1,114	1.8

Note: The fishing ground area for a particular LFA is defined as the total surface between the depth of 2 and 40 m (approx. 1 and 20 fathoms) within the boundary of that LFA.

Resource Status

The resource status is evaluated by examining trends in landings, size composition of commercial catches, effort fluctuations from logbooks filled by volunteer index-fishermen, and exploitation rates calculated using catch-effort and at-sea sampling data.

Landings per unit of area (LPUA) can be considered as indices of fishing ground productivity. In recent years, Lobster Fishing Areas (LFAs) 24 and 26B yielded the most lobster per km². Since 1990, LPUA values for these LFAs have increased and now range between 1.8 and 2.3 t/km². During the same period, the other LFAs have shown a decline, with recent values fluctuating around 0.8 t/km².

Fishing effort is defined as the number of trap hauls, which actually constitute the nominal unit of effort. Since there are no programs or mechanisms to collect effort information for the entire lobster fishing fleet in the southern Gulf of St. Lawrence (sGSL), three methods were used to evaluate the effort level in each LFA:

- the maximum potential fishing effort permitted under the regulations (MP);
- the estimated reported fishing effort from sale transactions (ERST), assuming

that one sale transaction was the effort of one fisherman, for one day, with full trap allocation; and

- the estimated reported fishing effort from index-fishermen (ERIF) and extrapolated to all license holders in the LFA.

Although important variability in trap dimensions and designs is known to exist within and between LFAs, the lack of quantitative effort information did not permit any adjustments for trap efficiency.

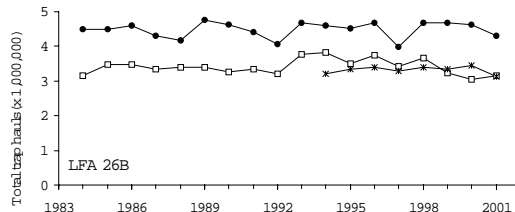
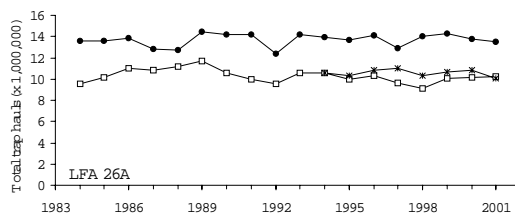
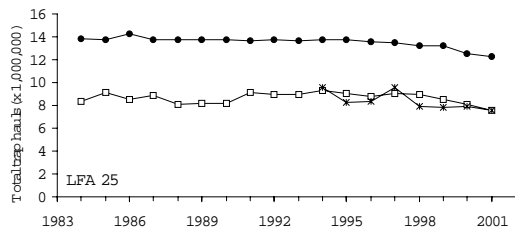
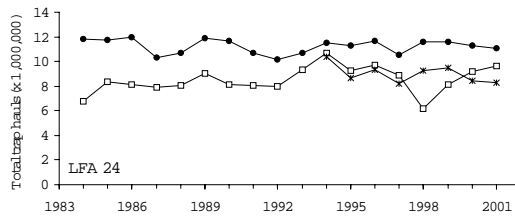
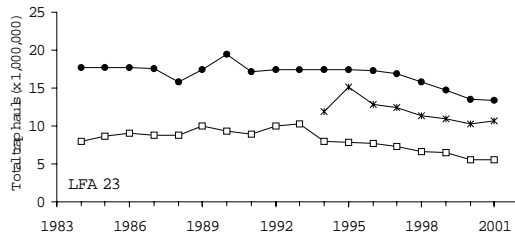
With the exception of LFA 23, ERIF effort levels were similar to the ERST effort estimates. The difference in LFA 23 was associated to the fishermen's practice of selling and reporting the catch of multiple days on one sale transaction, instead of on a daily basis. The extent of this practice within LFA 23 and in the other LFAs is unknown and would result in underestimated ERST values.

The effort levels obtained from sale transactions and index-fishermen suggest that fishing effort in every LFA is not reaching the maximum potential effort permitted in the regulations. If the conditions would allow the maximum potential effort to be reached (i.e.: fishermen able to fish every day of the season with full trap allocation), the present fishing fleet

would increase the number of trap hauls by up to 25%.

Lobster Fishing Effort Estimated (trap hauls) from 1983 to 2001, for Each Lobster Fishing Area (LFA).

- Maximum Potential effort from regulations (MP)
- Estimated Reported effort from Sale Slips (ERST)
- * Estimated Reported effort from Index-Fishermen (ERII)



Lawrence (sGSL), lobster between the legal size and 81 mm (3.2 inches) in carapace length are considered “canner” size lobsters, and include the first molt group recruited into the fishery and approximately half of the second. All lobsters of carapace length of 81 mm and above are classified as “market” size lobsters. Since landings are recorded as canner and market size lobsters, the proportion of cannery in the catch can provide indices of the importance of first recruits in the fishery.

Regulations on minimum legal sizes have changed often over the years. In most LFAs, size increases were conducted during 1987 to 1991, and 1998 to 2001. These size increases have reduced the size range of canner size lobsters and would theoretically reduce the proportion of cannery in the catch. This situation is considered as a source of uncertainty when percentage of cannery is to be used as first year recruitment indices. Therefore, the analysis and interpretation of the proportions of cannery must be conducted with care and in combination with other indices.

Average contributions, by weight, of canner size lobsters in commercial catches are highly variable between Lobster Fishing Areas (LFAs), but somewhat consistent within LFAs over time. The highest values were observed in LFA 24, with percentages ranging between 80% and 87%. The lowest values were ranging between 56% and 67% in LFA 26A. All other LFAs had values ranging from 69% to 84%.

Information on **catch characteristics and size structure** can provide valuable information on the status of the population and the fishery. In the southern Gulf of St.

Average Percentages (in weight) of Canner Size Lobsters in Commercial Catches, by Time Periods and Lobster Fishing Area (LFA). Calculations Performed on Sale Slip Information.

LFA	1984 to 1986 no size increases	1987 to 1991 size increases	1992 to 1997 no size increases	1998 to 2001 size increases
LFA 23	72%	75%	76%	71%
LFA 24	82%	87%*	87%	80%
LFA 25	84%	80%	79%	71%
LFA 26A	65%	67%	63%	56%
LFA 26B	77%	77%	69%	62%*

* There were no minimum legal size increases during that time period, for that LFA.

At-sea sampling during commercial fishing activities constitutes another source of information on catch characteristics and size structure. The percentages of first recruited molt groups exhibit the same patterns between LFAs as the percentage of cannery. From 1984 to 2001, the highest percentages are observed in LFA 24 (range of 75% to 76%), and the lowest in LFA 26A (range of 51% to 59%). All other LFAs had values ranging from 56% to 78%.

Average Percentages (in number) of the First Recruited Molt Group (adjusted to minimum legal size) in Commercial Catches, by Time Periods and Lobster Fishing Area (LFA). Calculations Performed on at-sea Sampling Information.

LFA	1984 to 1986 no size increases	1987 to 1991 size increases	1992 to 1997 no size increases	1998 to 2001 size increases
LFA 23	60%	67%	73%	71%
LFA 24	75%	76%*	76%	76%
LFA 25	74%	56%	68%	60%
LFA 26A	53%	51%	59%	58%
LFA 26B	72%	79%	74%	66%*

* There were no minimum legal size increases during that time period, for that LFA.

Overall, commercial catches, which are composed primarily of canner size lobsters, and the high proportion of lobsters entering the fishery for the first time (first recruited molt group), confirm that landings are dependent on annual recruitment.

The **exploitation rates** were calculated using the catch-effort and the change-in-ratio models. Catch-effort estimates were calculated by combining the catch and effort data of all index-fishermen within a Lobster Fishing Area (LFA). In comparison, change-in-ratio estimates were calculated using data from selected ports representing landing sites for a small area within a LFA.

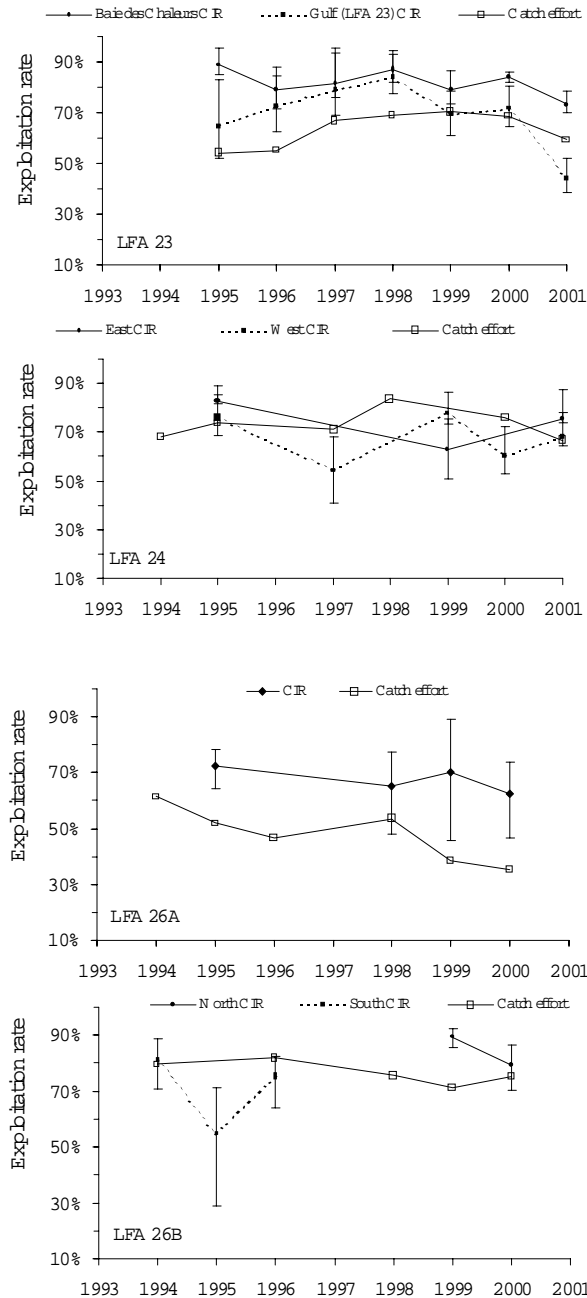
Exploitation rates have been generally high, with most values ranging between 60% and 90%. Both the catch-effort and change-in-ratio estimates gave comparable results except for LFA 26A, where the latter generated lower values (35% to 62%). The use of different minimum legal size (MLS) within LFA 26A could explain part of the discrepancy. Fishermen from the Prince Edward Island (PEI) side fished at the regulated MLS of 67.5 mm (2.66 inches) in carapace length while some fishermen from the Nova Scotia (NS) side are using a carapace length of 70 mm (2.75 inches). The change-in-ratio estimate is based on at-sea sampling mostly from fishermen from PEI while most index-fishermen were from NS.

The high values of exploitation rates in most areas, and obtained using both models, coincided with the high percentage of cannery in commercial catches and the large proportion of the first recruited molt sizes observed in the at-sea sampling data.

Recent increases in the MLS to 67.5 mm (2.66 inches) in carapace length have increased the **proportion of sexually mature females** protected from exploitation in 4 of 5 Lobster Fishing Areas (LFAs). At 67.5 mm carapace length, 29% of the females can reach sexual maturity. In LFA 26B, with a MLS of 70 mm (2.75 inches) since 1990, 47% of the females can reach sexual maturity at that size. A MLS of 70.5 mm (± 2.75 inches) is required to protect 50% of newly mature females, and

protecting 95% of newly mature females would require a MSL of 81 mm (3.2 inches).

Exploitation Rate Calculations Using the Change-In-Ratio (CIR) and Catch-Effort Methods for Different Years and Regions Within Lobster Fishing Areas (LFAs). The CIR 95% Confidence Intervals are Presented.



New information on the female reproductive cycle indicates that up to 20% of small mature females have a 1-year reproductive cycle instead of the previously accepted 2-year cycle. These recent findings suggest

that females from the southern Gulf of St. Lawrence (sGSL) have the opportunity to produce a larger quantity of eggs over their lifetime than was previously believed. New information on molt frequency also suggests that annual double molting is less frequent than initially thought. These findings have not yet been incorporated into model estimates of egg production. Further calculations will be required to determine the sensitivity of the E/R model to these new findings and the extent of the changes in E/R calculations.

Sources of Uncertainty

There can be considerable variability in lobster distribution and characteristics within each Lobster Fishing Area (LFA). These are not considered in the assessment. LFAs are not biological areas but management units. Current monitoring of lobster population parameters is not adequate to measure the small seasonal and geographical scale variability. In addition, distribution and interactions between the different LFA's, including larval drift, are not well understood. Changes in egg production in one LFA may effect recruitment success in neighboring LFAs.

New information on female sexual maturity, reproductive cycle and molt frequency is relevant. Further work with the E/R model is required to determine the sensitivity of the model and the extent of the changes in E/R estimates that this new information may generate.

The official lobster landings are derived from the collection and compilation of sale transactions provided by registered lobster buyers. Since there are no mandatory program for fishermen to provide information on their fishing activities, the lack of accurate information on catches, effort and effort location for the lobster

fishery is a major impediment to assessment and fishery management.

The relationship between females' carapace length and their egg quality, or larval survival is unknown. A detailed knowledge of the larval ecology (survival in the natural environment) is required.

Methods available to estimate the exploitation rate cannot take into consideration the multiple factors that may influence lobster catchability (i.e. water temperature and seasonal change in fishing effort). The two methods chosen require different underlying assumptions and data sets. No estimate of the exploitation rate in LFA 25 was available since most assumptions were violated (molting occurring during the fishery). Nonetheless, exploitation rates alone are not indices of stock status of the lobster population. Stock status indices for the lobster still need to be developed.

Outlook

There is a steady decrease in overall catches since the historical high landings of the early 1990's although some Lobster Fishing Areas are showing small increases or stable landings. It is not possible to provide an outlook of short-term landings.

Concerns about the high exploitation rate, high fishing effort, increasing fishing power and pattern, and low egg-per-recruit values still exist.

Management Considerations

An improvement in the egg-per-recruit (E/R) should be expected as a result of the new management measures implemented during 1998-2001. However, the objective of having the management measures that would allow doubling the 1997 E/R values by 2001 was only partly achieved. The

expected increase in the E/R would have been higher if there was full compliance with the V-notching provision.

Status of the Egg/Recruit (E/R) Values by Lobster Fishing Area (LFA) in the Gulf Region, Prior and After the Four-Year (1998-2001) Management Plan.

LFA	E/R values prior to 1998	Expected E/R values in 2001	
		With V-notching compliance	Without V-notching compliance
23	0.6%	1.3%	0.9%
24 *	0.3%	1.0%	1.0%
25	0.6%	1.3%	0.9%
26A	0.6%	1.3%	1.1%
26B	1.0%	1.9%	1.0%

* V-notching was not part of the 1998-2001 management plan for LFA 24.

Further measures to reduce the risk of recruitment failure are required for the entire sGSL. Since the southern Gulf of St. Lawrence (sGSL) is considered as one lobster population, uniform management measures are highly desirable.

Increasing the minimum legal size is the most effective measure to increase E/R. However, the biomass required to sustain good recruitment (i.e., stock-recruitment relationship) and the relative success of larvae survival from the eggs of small mature females is still uncertain. Measures to increase egg production by protecting larger animals may be a good long-term precaution, but the effectiveness of these measures may be reduced by continuing high exploitation rates. In addition to increasing E/R, efforts to reduce exploitation rates are highly recommended. However, the different methods to achieve reductions have wide economic and management implications.

Based on new information concerning the female reproductive cycle, the relative conservation merit of the different fishing seasons can be better assessed. In LFA 25 where fishing activities occur during the

lobster molting and spawning period, this new information suggests that some newly mature females are being caught before they can extrude eggs and be protected by fishing regulation. This would reduce the effectiveness of conservation measures in that area. In light of new biological information, the E/R estimates need to be updated before being considered in the next management plan.

Information on catches, effort and effort location is essential to properly assess and manage the lobster fisheries. Changes in the data collection methodology are required to further involve fishermen in providing fishing activity information.

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