Fisheries Resource Conservation Council

Sustainability Framework for Atlantic Lobster 2007

Report to the Minister of Fisheries and Oceans

July 2007

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Pictures on cover, clockwise from left, courtesy Mr. d'Entremont, NS, Mr. Clayton Halfyard, NL and Communications New Brunswick

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Letter to the Minister

July 4, 2007

The Honourable Loyola Hearn, P.C., M.P.
Minister of Fisheries and Oceans
200 Kent Street
Ottawa, ON
K1A 0E6

Dear Minister Hearn:

The Fisheries Resource Conservation Council ('FRCC' or 'Council') is pleased to present you with its report entitled "*A Sustainability Framework for Atlantic Lobster 2007*". This report is in response to your request to review the *1995 Conservation Framework for Atlantic Lobster.*

The FRCC's 18 public consultations, the Atlantic Lobster Focus Group Workshop involving over 35 industry participants, and the over 80 written briefs illustrate the considered reflection by many organizations and individuals on, not only what has been done over the past decade but also what needs to be done. The report attempts to solidify the ideas and thoughts brought forward and to add to the process of enhancing the sustainability of Canada's fisheries. The FRCC is convinced that the process that led to this report was and will be of benefit to Canada's lobster fishery.

Today, as in 1995, the FRCC recognizes the complexities of advising on such a diverse fishery and has sought to provide advice that is relevant to harvesters. From 1995 to 2007, the Council expanded its focus of sustainability to include recognition of the economic, social and institutional components of the fishery as well as the ecological. In its report the FRCC has outlined a vision for the lobster fishery based on these four components of sustainability. The vision that guided the development of this report should also be of value to stakeholders.

Some lobster fishing areas have benefited from strong resource recruitment over the recent past. Most Atlantic coast communities dependent on the lobster resource have been fortunate that the pessimistic resource forecast in the FRCC's 1995 Report has not materialized. It is not clear to either the FRCC or to stakeholders the cause for increased landings in many areas that have made little adjustment to the fishery.

In some areas, harvesters did adopt the spirit and recommendations of the 1995 Report and thereby improved the sustainability of their industry. These harvesters, through their associations and with the support of individuals from the Department of Fisheries and Oceans (DFO) had the vision to adapt the 1995 Report to their local realities. These participants are to be commended for their determination to enhance sustainability.

The FRCC has observed that, relative to the economic importance of the lobster fishery, very little data is collected on the fishery to facilitate sound scientific analysis and management. The fishery has been managed with minimal information rather than comprehensive knowledge. The FRCC is avoiding setting an alarmist tone to the report but has emphasized the need to reduce risk by reducing exploitation rates and establishing better controls on fishing effort. The Council concludes that better information through additional monitoring on-shore would benefit industry, management and science.

The FRCC believes that it is very important for the industry to adjust and control fishing effort to maintain balance with the available resource. Larger investments for vessels and licences, the strengthening of the Canadian dollar, fuel cost increases, etc, are all factors affecting the returns from fishing. These factors have further exacerbated the social and economic dependence on additional landings. For many areas of the fishery, this has resulted in increased fishing effort that the FRCC considers a threat to sustainability.

The 18 public consultations conducted throughout Canada's east coast community, brought forward one recurring issue: the lack of compliance. The FRCC does not believe that an increase in enforcement resources, as suggested by many, will in itself resolve the problem. This report does address, however, the need for a change of attitude. It is the FRCC's view that the most successful deterrent to cheating will be the introduction of an effective sanctions tribunal and the implementation of more effective monitoring processes at landing sites and on the sea. The FRCC advises that a sanction board should be established whether the new *Fisheries Act*, 2007 is adopted or not.

In response to your request to provide further analysis on ecosystem considerations, the FRCC reviewed the ecosystem issues for lobster and the potential benefits of adding such considerations to improve management. Many ecosystem issues were raised in discussions with stakeholders at consultations and during the three-day Atlantic Lobster Focus Group Workshop. Steps towards the practical inclusion of key ecosystem considerations are already underway within DFO and the FRCC encourages further development of this approach. There is sufficient knowledge to move forward from single-species management towards ecosystem-based management in respect to lobster.

DFO should implement the *Atlantic Fisheries Policy Framework* to allow harvesters a stronger influence on the future of the fisheries. Although, at consultations, some harvesters were critical of the action taken by DFO to proceed with incremental management measures, others have been frustrated by the reluctance of the department to implement measures desired by the majority. Collaboration and leadership seem to be key elements of fisheries management successes in general, but it is particularly important for lobster. This success is evident in many of the Québec lobster fishing areas.

The lobster sustainability framework review presented is not prescriptive. Where it may appear so, it is to exemplify what can be done to enhance sustainability. What will be done in each area will largely depend on local initiative and the willpower of those involved to accept the challenge to implement change to achieve their vision for the fishery.

Finally, I would like to note that this report would not have been possible without the significant contributions by those who attended public meetings and/or provided written briefs; without the input, advice and analysis provided by DFO scientists and managers; and, finally without the dedication of Council members and provincial delegates.

I sincerely thank them all and hope their efforts are helpful to you and the entire lobster industry.

Sincerely,

Jean Guy d'Entremont

Jean Guy d'Entremont,
Chairman

1. Introduction

1.1 Introduction

The Fisheries Resource Conservation Council ('FRCC' or 'Council') is pleased to review the *1995 Conservation Framework for Atlantic Lobster* ('1995 Report'). This review provides an opportunity to assess the relevance of a report written over a decade ago and to provide a long-term strategic outlook for the lobster resource and its beneficiaries on the east coast of Canada. In its review of the 1995 Report, the FRCC is undertaking an assessment of industry's and the Department of Fisheries and Oceans' ('DFO') contribution to implementing the measures recommended to address the conservation issues noted in the 1995 Report.

The fishing industry has changed considerably since the publication of the 1995 Report. The progression of technology has contributed to improved efficiency of the industry. This progress has increased harvesting capacity during a period of relatively high resource productivity. The lack of alternative fishing opportunities that result from the slow recovery of groundfish stocks has increased industry dependence on the lobster resource. The increase in harvesting effort, the lack of diversity, and the increased economic-dependence on the resource combine to elevate the risks to sustainability.

1.2 Mandate and approach

In February 2006, the Honourable Loyola Hearn, Minister of Fisheries and Oceans Canada, asked the FRCC to undertake a review of the *1995 Conservation Framework for Atlantic Lobster*. The Minister requested that the Council consider a modernized approach to fisheries renewal with respect to ecosystem considerations and an enhanced stewardship role for industry. The Council's most significant challenge in completing its task was dealing with diversity: diversity of resource abundance and productivity, diversity of fishing approaches and effort, diversity of economic conditions, and diversity of institutional capacity and industry engagement.

Guided by the mandate, the Council met first with DFO biologists and managers from throughout Atlantic Canada and Québec in order to obtain comprehensive knowledge of departmental programs as well as detailed background information and an historical perspective of the biological, scientific, management and environmental regimes.

The Council staged its public consultations in two phases to accommodate the timing of lobster fishing around eastern Canada. The first round of consultations occurred in the spring of 2006 and covered northern New Brunswick, eastern Newfoundland and Québec. The second phase of consultations was held in September/October 2006 in regions not targeted during the spring consultations. A total of 18 public meetings were held, two of which were addressed to First Nations people across Atlantic Canada and Québec. Each consultation consisted of a presentation describing the Council's lobster assignment followed by presentations from participants and open dialogue. The public process allowed everyone the opportunity to voice their concerns, accomplishments and ideas respecting the lobster resource and fishery. Approximately 800 stakeholders attended these consultations. In addition, the FRCC received over 80 written briefs from various stakeholders. Many participants saw this exercise as an opportunity to reflect on the status of the resource and what was required for the long-term sustainability of their fishery.

Following consultations, the Council held a three-day focused workshop in Halifax. The workshop included 35 harvesters and processors as well as scientists, managers and a few international participants. The purpose of the meeting was to ensure that the FRCC received practical input from the principal interested parties throughout eastern Canada on the key issues, opportunities and options contained in briefs and highlighted during public consultations.

FRCC Workshop on Atlantic Lobster, November 2006, Halifax, Nova Scotia.

1.3 Background and context

The early process of consultation that brought the FRCC to fishing areas in Québec was highlighted by the endorsement of the 1995 Report by both industry and regional DFO. For areas of Québec, many of the recommendations had been implemented and substantial changes were made that led to improved sustainability of the lobster fishery in the region. Looking to other areas and exploring perspectives elsewhere in eastern Canada, it became clear that the 1995 Report was not uniformly accepted and that not all harvesters in the various Lobster Fishing Areas (LFAs) had made a concerted effort to improve the sustainability of their fishery. During the consultation process, the Council learned that harvesters either "swear by the 1995 Report" or "swear at it".

The FRCC notes that its pessimistic resource forecast as portrayed in its 1995 Report has not come to pass. While the resource is relatively low in some areas, e.g. LFA 25, lobster landings remain relatively high and above the long-term historical average, in spite of minimal response to the 1995 Report in many areas. The FRCC notes however, that an increase in fishing effort has occurred in most areas since 1995. Although fishery collapses remain a possibility, the FRCC does not believe that the lobster resource is in danger of immediate collapse. The Council does however, have concerns that the lobster resource and the fishery are not as robust and resilient as could be expected for such an important industry. The high exploitation rates that have been experienced over the past ten years appear to be very risky, exposing the resource and its beneficiaries to the real risk of a marked decline. Consequently, this report focuses on providing advice to minimize risks to sustainability.

The Council is pleased to recognize the effort made by some harvesters to adopt enhanced conservation measures since the 1995 Report; however, most of the issues identified in 1995 and most of the threats to sustainability, remain as threatening today in most areas of the fishery. The FRCC heard from many responsible harvesters and their affiliated groups during its consultation process. The progressive initiatives in the Québec industry, the partnership with science in the Maritimes and the expressed willingness of many participants who seek change are an inspiration to the FRCC to provide a strategic plan for adaptive change in the industry that will enhance sustainability.

There remains a need for further initiative and leadership by both the industry and DFO. The issues currently include – enhanced resource conservation measures, the need for improved information, controls on exploitation and fishing effort, socio-economic adjustment and the flexibility to adapt to industry dynamics, compliance, and the issue of overall industry governance. While these are key issues to be addressed, overall landings are relatively high and significant economic return is extracted from the resource. With few exceptions, it was difficult for the FRCC to make a direct correlation between action, or inaction, and the status of the resource. Similarly, the Council is concerned that the overall landings may be interpreted as an increase in resource abundance or as an endorsement of present practices. Although resource abundance and improved productivity may be resulting in high landings in some areas, the increased landings in others appear to be primarily a result of increased effort and higher exploitation rates.

The Council highlights the potential risk of single species dependence that has evolved over the past decade. As the shift in dependency from multi-species fisheries including groundfish to lobster took place, the shift was anticipated to be of a more temporary nature. Although the expansion of shellfish species such as snow crab and shrimp have filled the gap for some harvesters in some regions, for many harvesters and communities economic stability now rests on the lobster resource.

At the time of the 1995 Report, the effect of the Marshall decision on the commercial sector was unknown. The Sparrow decision had already recognized the right of First Nations to access the resource for Food, Social and Ceremonial purposes. The Marshall decision provided First Nations with access to the commercial fishery. The entry of First Nations into the commercial fisheries has proven to be rewarding for First Nation communities. Their entry to the commercial fishery was facilitated through federally funded initiatives. Although most stakeholders recognize and accept the aboriginal right to the resource, the lack of communication among all stakeholders creates unnecessary misunderstanding and friction.

The challenge of improving overall governance structures and processes remains to be fulfilled. However, there has been some success, e.g. the Fishermen & Scientists Research Society in Nova Scotia. Unfortunately, fiscal constraints within DFO and the need for a more organized approach by industry have resulted in limited progress. The FRCC notes that considerably

more organizational and institutional capacity would be expected from such a large and economically valuable industry than currently exists.

The Council has undertaken its analysis and provided recommendations with the view that minimizing risk is necessary to achieve sustainability. In this context the FRCC provides a review of the 1995 Report as well as a renewed plan within a "*Sustainability Framework for Atlantic Lobster*" that should guide the industry for the foreseeable future.

1.4 Definition of sustainability

While the concept of "sustainability" has been implicit in fisheries management from the early days, the concept has evolved more recently from the conservation of single species to the inclusion of both ecosystem and human factors, with a balance between resource conservation and human concerns. In the context of sustainable utilization, the modern concept of sustainability is seen as having ecological, social, economic and institutional components.

The ecological component of sustainability incorporates the conservation of single species, but also aims at conserving other species and includes the fundamental responsibility of conserving the resilience and structure of the ecosystem. The FRCC notes that from a resource population dynamics perspective, sustainability does not correspond to a unique combination of yield or fishing effort value. Typically, the biomass capable of producing the maximum sustainable yield is viewed as optimal, but fisheries are sustainable at higher and lower biomasses. The Council also notes that, due to natural variability and changes in the environment, some resources may be threatened biologically even in the absence of exploitation. As well, consideration of other connected ecosystem components, including other species and habitat, broadens the challenge.

The economic component of sustainability focuses on the creation of sustainable benefits and the maintenance of sustainable enterprises within local and global economies while the social component aims at a reasonable distribution of the benefits. In this context, a sustainable fishery policy is concerned with human systems because the sustainability of communities is closely linked to the sustainability of fisheries and vice versa. The FRCC believes that fisheries management should focus on conserving fishery resources to achieve long-term sustainable fisheries that provide jobs, economic opportunities and food. Achieving these goals should increase the stability and resilience of communities.

The institutional, or governance, component of sustainability involves the provision of suitable financial, administrative and organizational capability over the long-term. It refers to the set of rules that are used and the bodies that have the responsibility to implement them (government, industry, community, or otherwise). Institutional sustainability helps ensure that the rules that are adopted are practical, that it is possible to implement them, and that monitoring, control and surveillance is adequate. Good governance systems are participatory, transparent, effective, efficient and accountable.

The modern concept of sustainability requires that a reasonable balance should be struck between the four components. Systems that give disproportionate importance to one or another component will have lower chances of reaching overall sustainability. Without a balance, the pendulum will swing from over-fishing to protection where all the importance is given to resource conservation to the detriment of other components. "Reasonable balance" will vary according to biological productivity of the ecosystem, social preferences and societal values. Implementing the modern concept of sustainability requires the involvement, accountability, and commitment of diverse parties.

The Council's mandate is primarily concerned with the bio–ecological component of sustainability, but the major threats to lobster conservation have strong social, economic and institutional components. Due to the strategic nature of this report, the FRCC will consider all aspects of sustainability with regard to the lobster fisheries. While the Council recognises the connectedness of the four components of sustainability, there is insufficient information or knowledge for a fully integrated analysis.

1.5 Precautionary approach

The factors affecting the productivity of lobster remain uncertain, but management decisions must nevertheless be made. The Precautionary Approach (PA) provides guidelines on how to manage in such a context (*FAO 1996. FAO Technical Guidelines for Responsible Fisheries No 2. Precautionary Approach to Capture Fisheries and Species Introduction. ftp://ftp.fao.org/docrep/fao/003/W3592e/W3592e00.pdf*). The PA involves prudent foresight to:

- Avoid irreversible damage in order to protect the needs of future generations;
- Enable prior identification of situations to be avoided and the measures available to promptly correct the situation;

- Effect quick implementation of corrective measures;
- Give priority to protecting the productive capacity of the resource;
- Match the harvesting capacity with the productivity of the resource; and
- Review periodically the type and amount of fishing activity that is allowed.

The Government of Canada is committed to the implementation of the Precautionary Approach (*A Harvest Strategy Compliant with the Precautionary Approach. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/023*) and the FRCC endorses its relevance to the management of fisheries.

The implementation of PA framework generally involves the identification of targets and thresholds in terms of exploitation rates and biomass, to identify when a stock should be considered within safe biological limits and when management action is required to prevent the fishery from reaching danger zones where the resource is considered to have unacceptably high risk of collapse. Exploitation rates are available for most LFAs but biomass estimates are not available for lobster resources in Canada. PA frameworks using reference points could be defined for exploitation rates, and catch per unit of effort or other proxy could be applied to the lobster resource.

The FRCC considers that the combination of input controls and technical measures used in the lobster fishery combined with good rapport between the fishing industry and DFO provide the basis for a reasonably stable fishery. Nonetheless, considerable improvements can be made to increase the knowledge base for fishery science, management and industry participants and to enhance sustainability in the broader context. These improvements can reduce the effects of poor fishing strategies and practices, and provide the potential to reach the full benefits that can be generated from the lobster resource.

1.6 Vision statement

The FRCC sets forth a vision for the lobster fishery that has a foundation based on its concept of sustainability covering the ecological, social, economic and institutional components of the fishery. The vision statement has guided the Council in the development of this report and includes the following four objectives:

1. The lobster resource and fishery should be sustainable, balancing long-term benefits for all participants and ecosystem conservation.
2. The lobster fishery, including harvesters and processors, and the resource itself should be robust and resilient to natural, social and economic changes.
3. The lobster fishery should create sustained and equitable social, cultural and economic benefits for individual and community participants.
4. Governance of the fishery should be through participatory, inclusive, transparent, effective, efficient, accountable and adaptive decision-making. Rules and regulations should be practical, possible to implement and regularly monitored, reviewed and controlled.

A fishery built around only one of these objectives would be quite different from one that took a more balanced view accounting for all of them. Thus a fishery whose target were to optimize economic return would of course have much greater landings than one whose foremost objective was conservation. Likewise, a fishery designed to maximize the number of jobs would vary greatly from one designed to maximize profit. There has not yet been sufficient discussion in Canada, for lobster or other fisheries, of the objectives of fishing and how best to balance the competing objectives of a carefully considered vision.

Atlantic Lobster. Photograph courtesy of Debbie Martin-Robichaud, DFO, Biological Station, Saint Andrews, New Brunswick

2. Background on lobster fishery

2.1 Lobster in the marine ecosystem

Distribution and migration

Lobsters are found in many areas of the world's oceans. The species found off Canada's east coast, *Homarus americanus*, commonly known as the American lobster or Atlantic lobster, is unique to the northwest Atlantic Ocean. The Atlantic lobster is found from Long Island Sound to the southern part of the Labrador Sea from the waterline out to the edge of the continental shelf. Adult lobster prefers rocky substrates but can also live on sandy and muddy bottoms. Most of the lobster fishery takes place in shallow water, less than 40m deep, but lobster are also found and fished in much deeper water, down to 450m depth.

Lobsters migrate seasonally, primarily in response to the seasonal changes in water temperature. In spring, lobsters move towards shallow waters to moult, reproduce or hatch eggs, returning to deeper water in the fall. There is also some movement along the coast favouring exchange between adjacent populations. Recent science focusing on migration, both in the Gulf of Maine and the Gulf of St. Lawrence, provides new, more detailed information about the scale and seasonality of lobster migrations.

Life cycle

Lobsters are among the largest and longest-lived of the marine crustaceans. Like many other crustaceans, they have a complex life history (Figure 1). Female lobsters brood their eggs externally and larvae once hatched rise to the surface. The larvae develop and drift in surface waters for three to ten weeks depending on temperature. Following metamorphosis, post-larval lobsters (stage IV), which resemble adult lobsters but are about 1 cm in length, dive down from the surface layer and eventually settle to the bottom to begin their benthic existence. Early in their benthic phase, lobsters are cryptic and remain hidden beneath shelter. They shift their behaviour when they reach 40-50 mm carapace size and outgrow their initial shelters. They seek new shelters and forage over wider ranges after leaving the nursery grounds. Natural mortality for lobsters is highest during these periods when they are undergoing a change in their life cycle. Lobster mortality is high for the drifting larvae because of predation, mostly by fish, and currents that carry them to unfavourable locations. Natural mortality is also high when they first develop to their benthic phase and when they leave their solitary shelters. Small

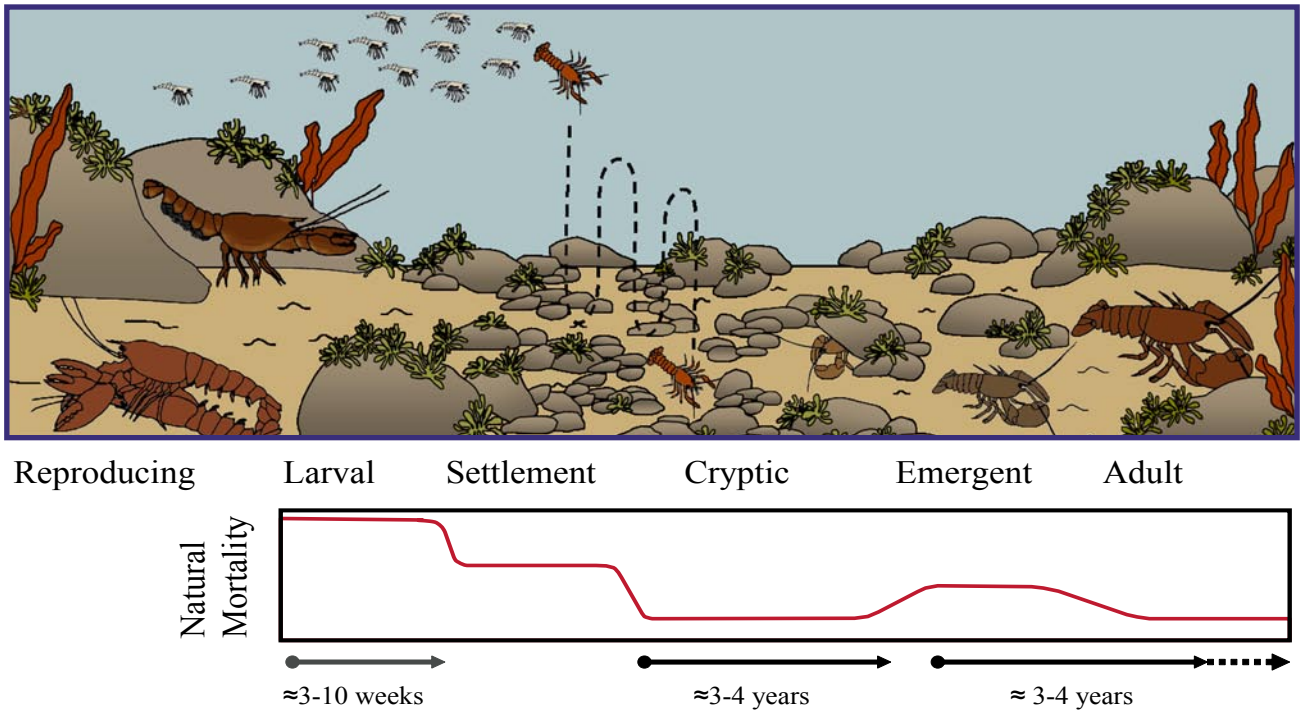


Figure 1: The life history of lobster, which spends many weeks as a planktonic animal, drifting at the surface, before settling to begin its benthic existence. The mortality of lobster is very high during its first few weeks of life. Mortality declines when post-larval lobster find shelter but then generally increases when juveniles emerge from their cryptic phase.

lobsters are prey for many other animals and depend on available habitat for protection. Larger lobsters are also habitat dependent but become less susceptible to predation with increased size.

Growth and reproduction

Lobster moulting is influenced by the size (or age) and gender of the lobster and also by temperature and food conditions. Mature females grow slower than mature male lobsters. In the Gulf of St. Lawrence, it typically takes 15-20 moults for lobsters to reach minimum legal size, over a period of six to nine years. While there are new techniques that may allow aging of lobsters, they have not yet been applied and validated. Mating occurs just after the female moults and spawning occurs roughly one year later. The eggs develop on the underside of the female (berried female) for 9-12 months.

The size at which 50% of lobsters mature ('size at maturity') varies around eastern Atlantic waters. It is estimated at 81 mm (3 3/16") in some areas of Newfoundland, 82 mm in the Gaspé, 79 and 84 mm (3" and 3 3/8") in the southern and northern areas of the Magdalen Islands, 71 mm (2 3/4") in the southern Gulf of St. Lawrence, 94 mm along the Québec north shore and around Anticosti Island, and over 102 mm (4") in the Bay of Fundy and around southwest Nova Scotia. The difference in the size at maturity is an important consideration in setting the legal minimum carapace size. Males mature at a smaller size than do females. Size is important for lobster both in determining mating and in the number and quality of eggs produced. The number of eggs produced by a female lobster increases exponentially with size and multiple spawners are believed to produce eggs of higher quality than first-time spawners. A female lobster with 100 mm carapace length in Newfoundland will produce double the number of eggs of a lobster 82 mm in length. Females generally have a two-year reproductive cycle, spawning one year and moulting the next. As females get larger, they may only moult and mate every three to five years and produce two or three clutches of eggs between each moult.

Egg production and recruitment

Eggs are crucial for the productivity of the lobster resource but the critical minimum number of eggs required for adequate recruitment is not known. Nonetheless, ensuring an adequate supply of eggs is a key goal of many lobster management plans. Larval dispersion is one of the key determinants in the recruitment to the fishery. Environmental factors such as currents, water temperature, food supply and predation, all of which change from year to year and around the region, are key factors regulating recruitment success in lobsters.

Oceanographic studies of larval dispersal, of lobsters and other fish larvae, have revealed the general characteristics of the dispersal in many different regions of Atlantic Canada, yet in-depth understanding is incomplete. For example, while the influence of temperature on larval growth is known, it is not known how temperature conditions in a particular area or season has influenced larval growth and survival there. Likewise, it is known how currents move larvae around but there is not enough information to use winds and currents to explain patterns of larvae in a particular area. There has not been any systematic identification of the sources of larval production nor the range of dispersal that could provide information on the connectivity of the different lobster populations. The tools are available to understand the source-sink dynamics but they have not yet been applied.

Environmental influences on lobster

Lobsters live in an ecosystem that is constantly changing and evolving. Unfortunately, the extent of understanding of the key factors influencing lobster does not provide an explanation of the relative influence of differing environmental factors for a local area in a given year. Directed fishing is the primary way in which humans affect lobster but humans also influence the lobster environment in other ways, e.g. through habitat disruption and the fishing of other species, both predator and prey of lobster. Many examples of environmental influences on lobster were raised during the FRCC consultation process including:

- Habitat disruption, including the effects of bottom contact-fishing activities e.g. scallop fishing;
- Fishing of important prey of lobster e.g. rock crab;
- Kelp/sea urchin cycles and harvesting that influence habitat;
- Predation on lobster;
- Invasive species such as the green crab or the green algae Codium that is disrupting habitat;
- Shell disease;
- Pollution; and,
- Seismic testing.

Some of these influences, such as kelp/sea urchin cycles, are quite widespread, whereas others such as the shell disease may be local. In general, the impact of any of these factors on lobster remains uncertain. For

example, while preliminary studies on seismic testing suggest that it is harmful to both snow crab and lobster, the extent of the impact remains uncertain. In general, the data is lacking to describe the scale of the problem, its effect and the knowledge to understand the relation between any of these factors and lobster.

2.2 Landings in eastern Canada

Lobster has been an important fishery in eastern Canada for more than 100 years. While there has been some scientific study of lobster for almost as long, there are no estimates of lobster stock size in Canadian waters. Lobster landings are generally considered as a proxy of stock size. However, landings also reflect changes in lobster availability, catchability, fishing effort, and fishing efficiency, in addition to changes in stock size. It is generally difficult to estimate the proportion of increased landings due to increased recruitment against the proportion due to increases in fishing effort and fishing efficiency.

Lobster landings, with records dating back to the late 1800s (Figure 2), show a decrease from 40,000t in the 1890s to about 15,000t in the early 1920s. Landings remained less than about 20,000t for the following sixty years or so before they started to increase in the late 1970s early 1980s. Landings have been near or in excess of 40,000t since the late 1980s. In the late 1800s, small coastal vessels, without engines and with few rudimentary traps, landed 40,000t of ≈2kg lobster. Today's fishery is very different. The average lobster landed is much smaller; the vessels are much larger and fish much farther from shore with more, larger and more effective traps. The lobster stock of today is almost certainly much smaller than the stock that was present prior to the start of the lobster fishery more than a century ago.

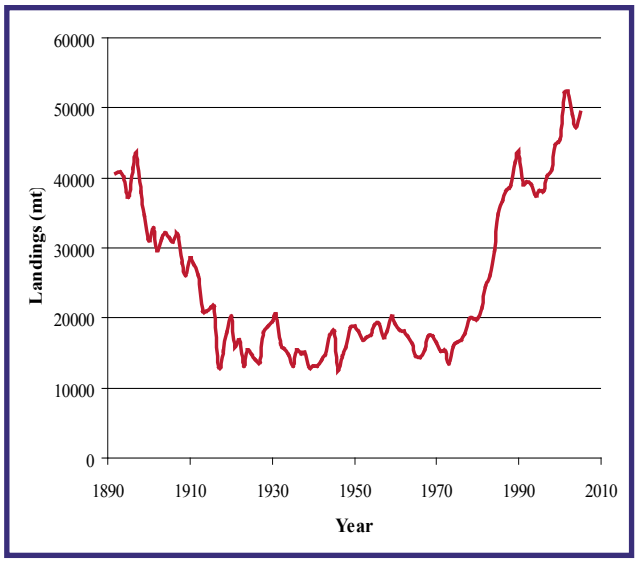


Figure 2: History of lobster landings in Canada. The nature of the fishery has changed substantially over the past one hundred years. In the early years the average size of the landed lobster was ≈ 2 kg, much greater than the average size landed today.

Unfortunately, the number or biomass of lobsters on the bottom is not known. Standard techniques for fish stock assessment, including acoustic and trawl surveys are not readily applicable to lobsters. Indices of stock abundance are generally derived from calculating catch per unit of effort (CPUE) from sampling at sea or from logbooks completed by harvesters, but reliable data is only available for a few LFAs. Without abundance estimates, or predictions of recruitment, knowledge of the state of the lobster stocks is often limited to the results of the fishery of the current year, based on landings and catch composition. The inability to forecast or explain the changes in landings over the past few decades, the ups (LFA 34) and the downs (LFA 25), is clear evidence of the limited understanding of lobster population dynamics and the factors that control them. In recent years post-larval recruitment indices have been developed in several different areas to provide forecasts of long-term trends in the fishery. These indices offer some potential for indicating trends in the resource, however, they have not been applied for a period long enough to establish their utility as indicators of future recruitment.

The landings since 1965 are available from each LFA. The annual landings in the 1960s were less than a third of those from the past decade (Figure 3). After reaching a peak of nearly 50,000t in 1991, landings decreased by almost 10,000t until 1997 and they have since increased. Figure 3 also shows that four LFAs (34, 24, 26A, and 25) have consistently accounted for more than 50% of the total Canadian lobster landings.

2.3 Structure of the lobster fishery

The Canadian lobster fishery has grown to become a mainstay for a large number of eastern Canadian harvesters. Indeed, in some areas, earnings from lobster are the only income for participants. The fishery of today varies greatly from one prosecuted by small inshore vessels to a midshore/offshore fishery conducted by larger, technologically sophisticated vessels. The fishery is most active on the Scotian shelf, in the Bay of Fundy and in the southern Gulf of St. Lawrence. As noted these areas account for more than 50% of the total Canadian landings. Additional fishing activity occurs in the northern Gulf and surrounding Newfoundland.

The fishery is managed through a network of 38 inshore (<50 miles) Lobster Fishing Areas (LFAs) and one offshore LFA (LFA 41) (see map of Lobster Fishing Areas on the back inside cover of the report). Entry to the fishery is limited by DFO and the number of licences issued has been relatively stable for a number of years, although harvesters, through DFO, may transfer licences. The harvesting sector is composed of approximately 10,000 licensed harvesters in the five provinces with each participant restricted to fishing in a designated LFA. Generally, vessels less than 45 feet in length prosecute the inshore fishery. The offshore fishery is restricted to fishing outside of 50 miles off the Nova Scotian coast (LFA 41) and is composed of eight licences.

The non-harvesting sector of the industry is composed of buyers, shippers and processors. According to the Gardner Pinfold - Benchmarking Study on Canadian Lobster, March 2006, there are in excess of 500 licensed buyers in five provinces, about 400 shippers and some 40 processors. While these roles may be combined, most buyers operate independently or are agents for shippers or processors. A large proportion of the lobster caught is shipped directly to the live market, mainly to the northeastern United States with lesser quantities to Europe and the Far East. Much of the landings from the Gulf of St. Lawrence are shipped to the processing sector, principally to Gulf-based plants.

The lobster fishery uses input controls (regulating the number of licences and traps and the duration of the fishing season) and escapement measures (minimum size, prohibiting the landing of berried females). Most other fisheries, groundfish and snow crab for example, implement output controls such as catch limits. The primary regulations in the lobster fishery today are:

- Prohibition against landing egg-bearing females (since the early 1870s);
- Minimum size limits (first implemented in the late 1800s, then re-introduced in the 1930s and 1940s);

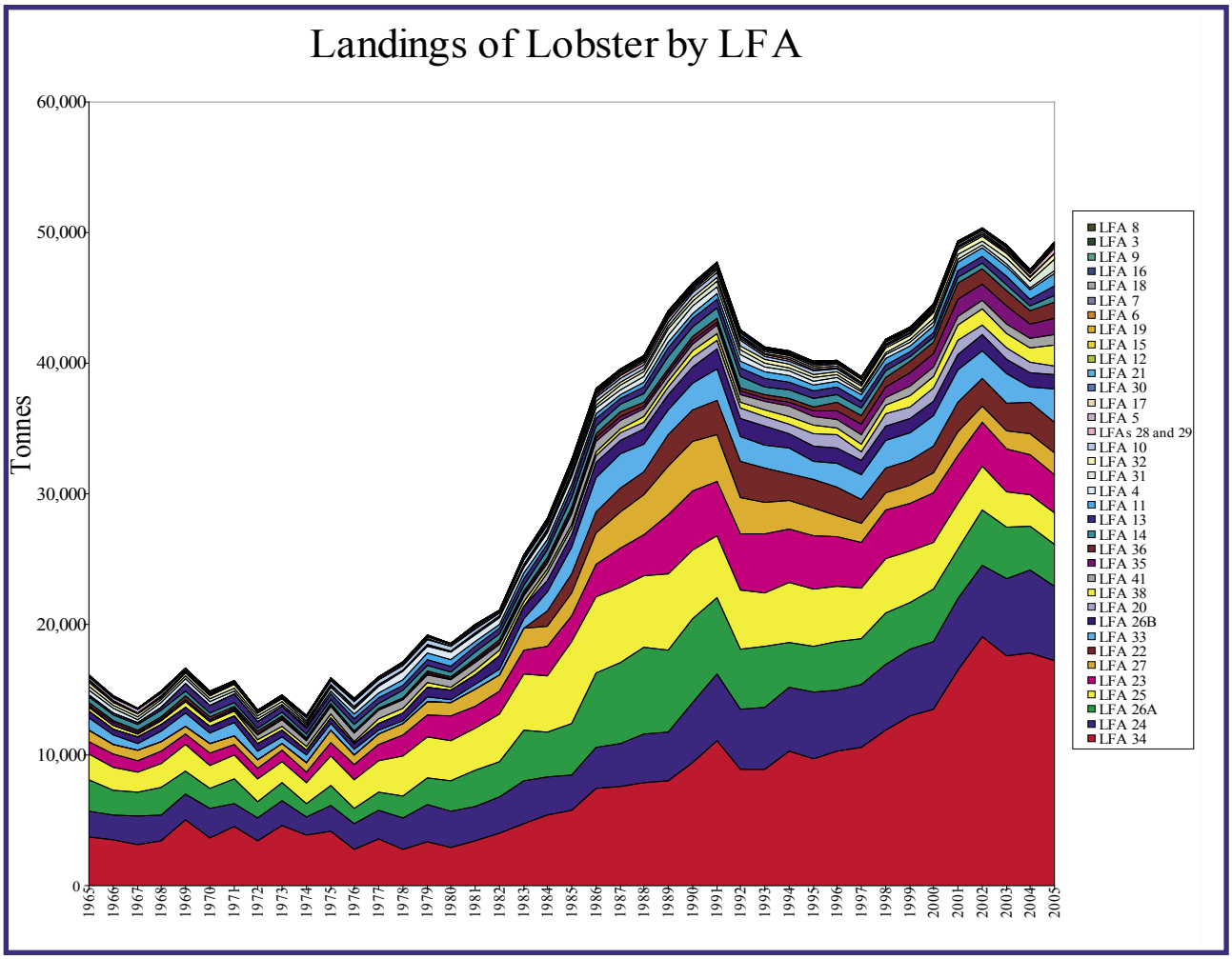


Figure 3: Canadian landings of lobster by lobster fishing area (LFA) presented in decreasing order, from bottom up, of the total landings over the period 1965 to 2005.

- Lath spacing in traps to permit escape of small lobsters (trap selectivity first tried in the late 1940s, but effective implementation did not occur until the mid to late 1990s);
- Licensing of harvesters (limited entry in the 1960s);
- Restriction of gear type (traps);
- Limitation of the number of traps (1960s);
- Division of the coastal area into fishing districts (LFAs); and
- Fishing seasons (since the early 1970s) determined by region and LFA.

The details of these measures vary from one LFA to another. (See Appendix III)

2.4 First Nations and the lobster fishery

Much has changed since the 1995 Report with regard to the Aboriginal people's involvement in the Atlantic commercial fisheries. The 1995 Report did make reference to the Sparrow decision and the resulting priority right to the resource for Food, Social and Ceremonial purposes ahead of other uses, subject to the achievement of conservation goals. Subsequently, in the fall of 1999, the Supreme Court of Canada released its decision in the Marshall case. In essence, the court stated, "*Treaties signed in 1760 and 1761 by Mi'kmaq and Maliseet communities included a communal right to hunt, fish and gather in pursuit of a 'moderate livelihood'*".

The Marshall decision precipitated the acquisition of fishing licences to further the participation of First Nations in the commercial fisheries. As a result of this decision, DFO negotiated interim fishing agreements with First Nations and provided dedicated funding from the Marshall Response Initiative to facilitate the increased presence of First Nations in the commercial fisheries. As outlined in Appendix I, First Nations have acquired 348 commercial lobster licences. The licences represent four percent of the total commercial lobster licences in Atlantic Canada and Québec. In two LFAs, where there are larger native populations, the First Nations people constitute the majority of licence holders. It is noteworthy that no additional harvesting effort has been added to the fishery as a result. All commercial access by First Nations has been through buyouts of existing commercial lobster licences.

2.5 Economic indicators on the lobster fishery

DFO has compiled economic indicators for the lobster fleet by LFA for the Gulf, Québec and Maritimes regions (see Appendix II). The indicators are derived from a survey of costs and earnings performed in relation to the 2004 fishing season. The summary indicates that enterprise average revenues vary greatly ranging from a high of $245,500 in LFA 34 to a low of about $45,000 in LFAs 20 and 25. While there are six areas where average revenues are above $100,000, most areas indicate average gross revenues ranging between $45-70,000 annually. Net income before any return to the owner and before taxes is relatively low in several areas of the fishery. Before returns to the owner and before taxes, the average net income of enterprises ranged between a high of about $79,000 in LFA 34 and a low of $7,700 in LFA 25. In many areas average income to reward the owner and to pay taxes is relatively low, ranging between $7,700 and $18,200.

The economic summary for the lobster fishery indicates that the earnings from fishing are insufficient to cover the costs of fishing and reward the harvester's labour in at least several LFAs. The relatively low average incomes in these areas reflect a risk to economic sustainability for many enterprises in the industry. Sustainability has likely been further compromised in the low-income areas since 2004 as landings trends have declined and costs have generally increased. The LFAs that are characterized by low average income represent over 2,000 licence holders, or approximately 30% of the participants, excluding harvesters in Newfoundland and Labrador. While earnings statistics were not available for the fishery in the Newfoundland region, the low average landings per enterprise in the region indicates the greater diversity of the fishery, but also suggests that on average the income from the lobster fishery is relatively low and is declining for most participants. During 2004, Newfoundland based harvesters averaged 1,508 pounds for each of the 2,923 licences active. Lobster is a small component of the landings for most enterprises in Newfoundland and Labrador and is not the primary fishery for many.

3. Review and update of ecological sustainability

3.1 Introduction

The FRCC's sustainability framework is linked to the definition of sustainability and the vision statement outlined earlier in this report. The primary focus of the discussion, analysis, conclusions and recommendations that follow in this section of the report are linked to ecological sustainability. Ecological sustainability refers to the robustness and resilience of the lobster resource to exploitation and natural changes. Among the key elements that provide robustness and resilience are the availability of suitable habitat and a stock of mature spawning lobsters that is large enough to have a high probability of producing strong recruitment. The FRCC considers that a healthy lobster population would exhibit the following features:

- Large numbers of primiparous females (first time spawners), indicating that the fishery allows sufficient females to reproduce before being harvested;
- A good proportion of multiparous females (second time spawners); and,
- Balanced size-specific sex ratios, meaning that males too are given protection.

Besides minimizing the risk of collapse, strong reproductive capacity should translate into a productive population featuring higher and more stable biomass and sustained recruitment under a range of environmental conditions. Sustainability relates to several important issues: stock abundance, and by extension the exploitation rates, egg production and eggs-per-recruit, size structure and connectivity of the different lobster populations.

The fishing methods and management measures that have evolved over the decades both support and threaten sustainability. The FRCC notes that some lobster resources elsewhere in the world have declined or collapsed (e.g. Scandinavia, Long Island Sound, Rhode Island) indicating that lobster is not immune to fishery collapse. In 1995, the FRCC indicated that Canadian lobster stocks were heavily exploited, and that most of the fishing mortality was on immature animals, resulting in very low eggs-per-recruit production. The Council believed that recruitment over-fishing was a real possibility and concluded "keeping egg production at extremely low levels has to be considered as a very high-risk management regime. It could be too low to maintain high recruitment under average environmental/ecological condition and could lead to recruitment failure under unfavourable conditions."

The 1995 Report organized resource conservation goals into four primary areas:

- Increase egg production;
- Reduce the exploitation rate and effective fishing effort;
- Improve the size structure; and,
- Minimize waste.

For each of these conservation goals, differing conservation measures ('tool kits') were recommended. The intent of the tool kits was to allow different regions / LFAs to select the most appropriate conservation measures to serve the respective areas recognizing the inherent diversity, as noted earlier, throughout the fisheries. Most of these tools were known within the fishery but the 1995 Report laid out their value in a manner intended to guide the industry as to the benefit that might be expected from the adoption of one or more of the tools. The 1995 Report suggested that biologists should work with managers to select the appropriate conservation tools for each LFA and that monitoring should be implemented to evaluate the effectiveness of measures utilized.

Prior to reviewing the implementation of the 1995 resource conservation recommendations and the FRCC's current views on these issues, lobster abundance is discussed in the context of sustainability.

3.2 Lobster abundance

There are no fishery-independent estimates of lobster abundance in Canadian waters and landings are used as indices of stock abundance. There is uncertainty in the interpretation of landings, however, partly because they reflect changes in fishing effort and fishing efficiency. In 1994, when the FRCC began to develop the initial conservation framework for Atlantic lobster, landings were on a decreasing trend. Today, total landings are higher than the 1991 peak. In looking at the overall landings of lobster over the past decade, one could draw the conclusion that all is well with the lobster fishery since landings are much above the historical average. Upon further analysis however, a different conclusion is possible based on a review of landings by LFA.

Analysing the landings in 36 LFAs from 1995 to 2005, 13 have declined, 13 have fluctuated without trend, and 10 have increased (Figure 4).

Many different factors influence landings. There appears to be general agreement that harvesters' ability to catch lobster has improved. Changes in gear, vessels and technology have all enabled greater fishing capability and improved efficiency, leading to an increase in effective fishing effort that is generally unmeasured and unregulated. The distribution of fishing effort has also expanded e.g. expansion in the offshore area of LFA 34. In this context, the status of lobster in LFAs 3-8, 9, 10, 14, 19, 21, 23 and 25, where landings over the past decade are declining, is likely worse than indicated by the landings alone. Stable landings probably indicate decreasing stock sizes in LFAs 12, 13, 15-18, 20, 22, 26A, 26B, 27, 30 and 33 while increasing landings in LFAs 11, 24, 28, 29, 31, 32, 34, 35, 36 and 38 probably over-estimate the increase in stock sizes.

It is likely that the resource status would have deteriorated more, or improved less, if conservation measures had not been implemented in the late 1990s,

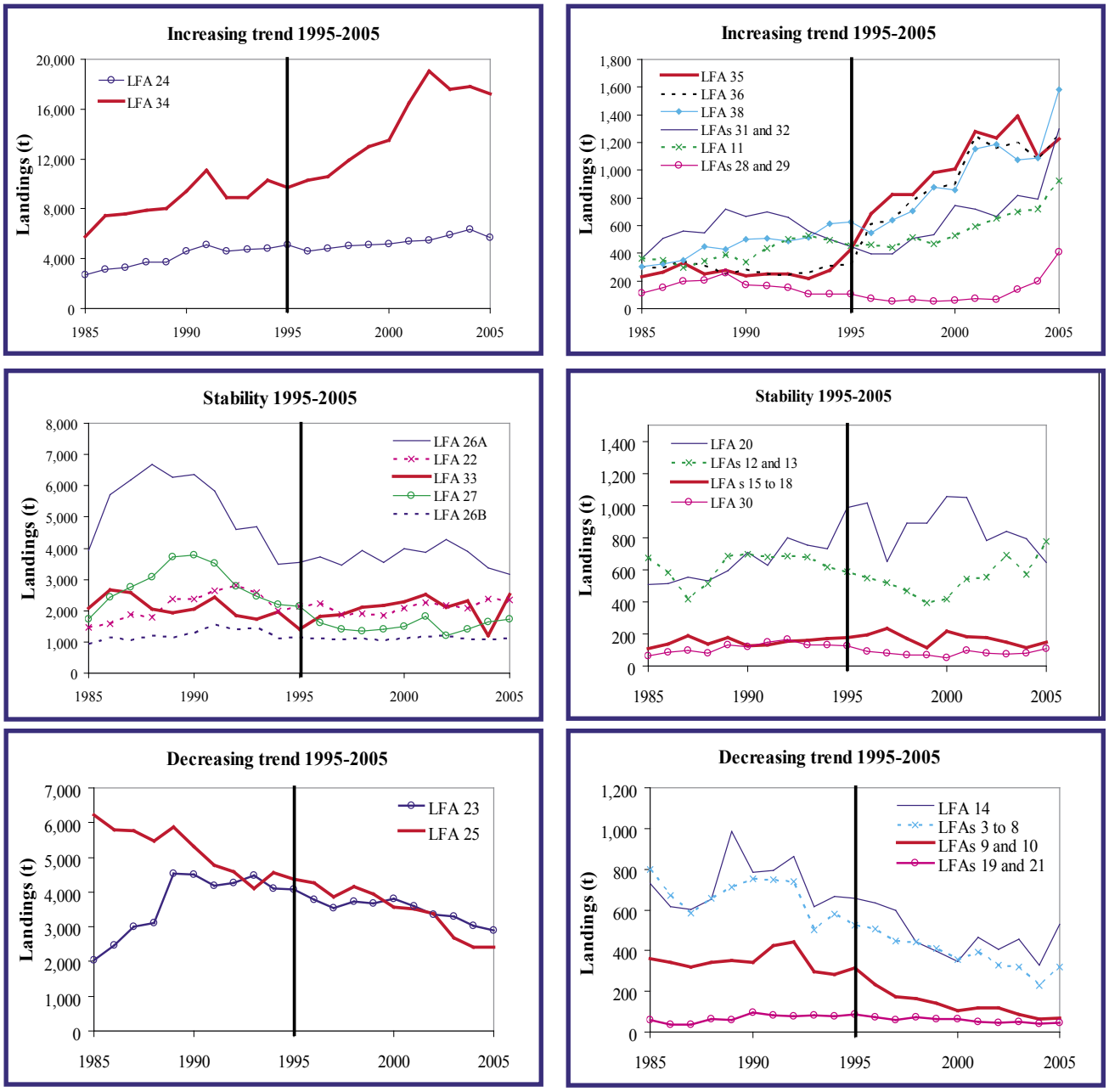


Figure 4: Lobster landings in different LFAs where landings have increased (upper panels), those where landings have remained stable (middle panels), and those where landings have decreased (lower panels). The trends in the text refer to the period from 1995 onward, marked by the vertical line.

but the effect of these changes on the observed trends in landings cannot be quantified.

The FRCC concludes that because landings partly reflect changes in fishing effort and fishing efficiency they may not adequately reflect the status of the resource. There is uncertainty in the interpretation of landings and decreasing landings probably underestimate the deterioration in the status of lobster.

The increase in landings in LFA 34 appears to reflect an increase in recruitment, although this increase may also be related to changes in fishing effort and the distribution of effort. Measurements of the abundance of pre-recruit lobsters, approximately one moult before entering the fishery, show that there has been an important increase in recruitment of lobster to the fishery since 1982 (Figure 5). It is not possible, however, to estimate what proportion of the increased landings is due to increased recruitment and increased effective fishing effort and exploitation rates.

The extent to which management measures implemented over the last decade have affected landings is difficult to determine. Landings could reflect trends in recruitment, which could have occurred independently from the management measures implemented. It is unlikely that the changes made in the last decade to increase eggs-per-recruit had a measurable impact on the recruitment to the fishery, not only because insufficient time has passed, but also because recruitment is influenced by factors other than egg production. On the other hand, the increases in minimum legal size (MLS) should help to ensure more lobster reach maturity, than would otherwise be the case, thereby improving the potential for egg production and recruitment.

The FRCC recognizes the uncertainty resulting from an incomplete understanding of the factors affecting recent trends in recruitment and productivity. LFAs off southwest Nova Scotia, LFA 24 in the Gulf, and LFA 11 in Newfoundland are currently experiencing their highest production, other LFAs that have experienced

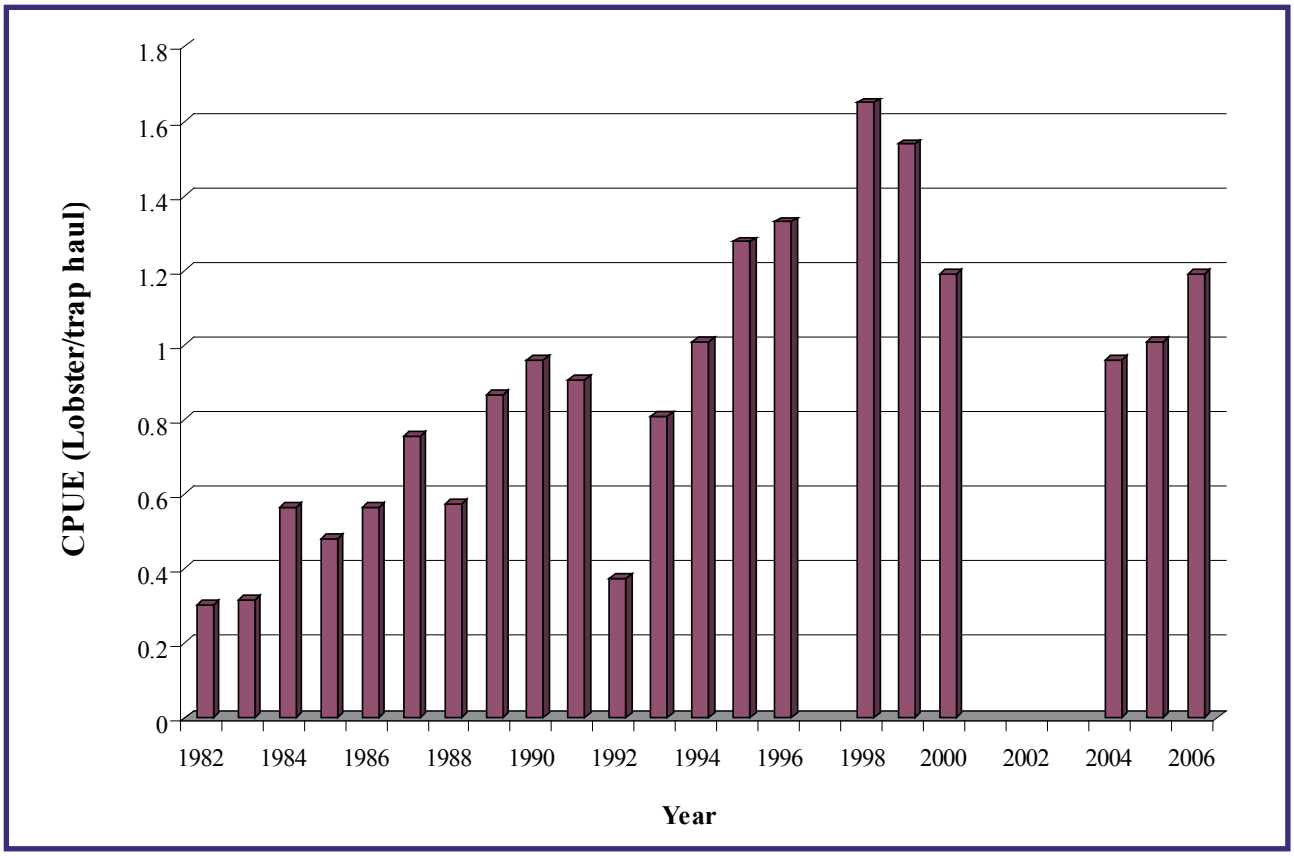


Figure 5: CPUE (lobster per trap haul) since 1982 for one site in LFA 34. The CPUE, in which catches are adjusted for effort, provides an estimate of the availability of pre-recruit lobsters, 77-79 mm. The chart shows a significant increase in the number of lobsters below minimum legal size from 1982 through to 1998. While these data are from a single location, the scientific consensus is that the landings trends over the past decade in this region are primarily driven by increased productivity, leading to recruitment. No data were available for 1997 and 2001-2003.

their highest production in the early 1990s are currently above long-term average production, while other LFAs that experienced their peak production in the 1980s are currently at or below average. It is not currently possible to predict landings or possible trends in landings. Where landings have increased, the FRCC believes that the increases are a result of increased recruitment, increased effective fishing effort, expanded geographic coverage and increased exploitation rates. It is not possible to estimate the proportion of the increased landings due to the different factors.

The FRCC recommends that improved indicators of stock size be developed to enable better understanding of the status of the lobster resource and trends in the fishery. Targets and thresholds in terms of biomass and exploitation rates need to be defined to identify safe biological limits.

3.3 Increase egg production

Central to the 1995 Report, was the objective to increase the eggs-per-recruit. The FRCC recommended that eggs-per-recruit be increased to five percent of that of an unexploited population for all LFAs. Very few LFAs were considered to be close to the five percent target eggs-per-recruit at that time. The Council recognized that the five percent target was somewhat arbitrary and that it was not possible to determine precisely the minimum value of eggs-per-recruit that would adequately reduce the risk of recruitment failure. Increasing the eggs-per-recruit was seen as a precautionary measure and was not offered as an absolute guarantee against a stock decrease or a sure path to an increase in landings. The intent was to provide a buffer against fluctuations in recruitment.

In implementing the FRCC recommendations, DFO chose to modify the target to double eggs-per-recruit rather than aim for the five percent target suggested given the appreciable uncertainties in the estimates of eggs-per-recruit of an unexploited population. It was seen as a first step at reducing risk in the lobster fisheries. This approach meant, however, that those LFAs at greatest risk, i.e. those with the lowest eggs-per-recruit, had less to do to achieve the objective. Also, doubling a very small number does not accomplish much to improve the biological sustainability. Conversely, those LFAs at higher eggs-per-recruit, closer to the five percent target, had less need for improving eggs-per-recruit, but may have had to do more to achieve the target. Many in the fishery were confused by the concept of eggs-per-recruit, and some felt that the expected goal was to increase landings rather than reduce risk.

Seven different tools were suggested in the 1995 Report to increase egg production: reduce exploitation rate, close fishing areas, increase the minimum carapace size, v-notch berried females, apply a maximum size limit, release berried females, and develop trap selectivity mechanisms.

The primary measure that led to the increase in the eggs-per-recruit was an increase in the MLS (Figure 6). The MLS increased in all LFAs by 1 to 7 mm, depending on the LFA. Many LFAs implemented voluntary v-notching of berried females, but compliance with voluntary practice has declined everywhere. Maximum sizes and windows (size ranges that must be released) were introduced in a limited number of LFAs. Some small areas were closed to fishing, e.g. in Newfoundland, but the only large area closed to fishing remains Browns Bank, which has been closed since 1979. These measures were put forward in the different LFAs between 1997 and 2005 (Appendix III) to achieve the goal of doubling eggs-per-recruit or more generally to improve conservation. In 2001-2002, by the end of the implementation of the first three-year conservation plans for lobster, a majority of LFAs together with DFO abandoned the eggs-per-recruit target.

The eggs-per-recruit did increase in all LFAs but the target of doubling was achieved in only eight of the 38 LFAs. Even where the target of doubling eggs-per-recruit has been reached, in some LFAs, it may have represented only a slight increase in eggs-per-recruit, given the initially low values in a number of LFAs. There are a few exceptions however, where the increase in eggs-per-recruit was significant and have translated into an increase in egg abundance. In areas where there was a significant increase in the MLS (6-7 mm), e.g. LFAs 20, 22 and 27 (see Figure 6) and where the MLS increase overlapped with the size of maturity, significant increases in the abundance index of berried females could be detected in the field. Where the increase in MLS still left the lobster catch far below the size at maturity, as for example in LFAs 32, 33, 34, 36, and 38, the small increases in the MLS likely did little to increase the eggs-per-recruit. In most LFAs, the impact of the conservation measures was not assessed or could not be detected, particularly where the MLS only increased by 1-2 mm, and where MLS was well below the size at maturity.

As described above, the concept of eggs-per-recruit played a prominent role in the 1995 Report and in the subsequent implementation of its recommendation by DFO. Eggs-per-recruit is a measure of the reproductive potential of a population and refers to the theoretical number of eggs a female will spawn during the course of her lifetime. One appeal of the eggs-per-recruit concept was that it could be calculated easily for most LFAs. Growth, maturity and exploitation rates had been estimated for most LFAs and reasonable assumptions were made about natural mortality. With this information, it was straightforward to calculate the theoretical egg production of each recruit over their lifetime under different scenarios of selectivity and fishing mortality. Thus, the eggs-per-recruit approach appeared to offer a useful tool to assess the overall lobster fishery performance by integrating fisheries and biological information. It also provided an easy measure to determine the potential impact and relative benefit of different management measures.

One shortcoming of the eggs-per-recruit concept is that it is purely theoretical and that eggs-per-recruit cannot be measured in the fishery. In addition, the calculated eggs-per-recruit is not directly related to the actual egg production on the lobster grounds. Unfortunately, since the publication of the 1995 Report, eggs-per-recruit and egg production have often been used interchangeably. It is possible for the eggs-per-recruit to decrease while the total egg production could actually increase. For example, if fishing mortality increases because of increased efficiency of the traps then the eggs-per-recruit will decrease. However at the same time, if lobster production increases because of good environmental conditions, the lobster stock will be larger and its total egg production will increase. Therefore, doubling (or increasing) eggs-per-recruit does not necessarily mean that the number of eggs in the ocean has doubled, or even increased. If the number of females has decreased despite an increase in eggs-per-recruit, then the overall egg production could have diminished. Although it is the total egg production that matters, maintaining high eggs-per-recruit reduces the risk in situations where the spawning biomass is low.

The relationship between the total number of eggs produced and the subsequent number of recruits that will be able to reach maturity and reproduce is not known for lobster in Canadian waters. Moreover, the number of eggs required for average or stronger recruitment is variable with changes in the environment over longer periods. The egg production at which recruitment failure would occur is unknown and the influence of the physical environment, e.g. temperature and circula-

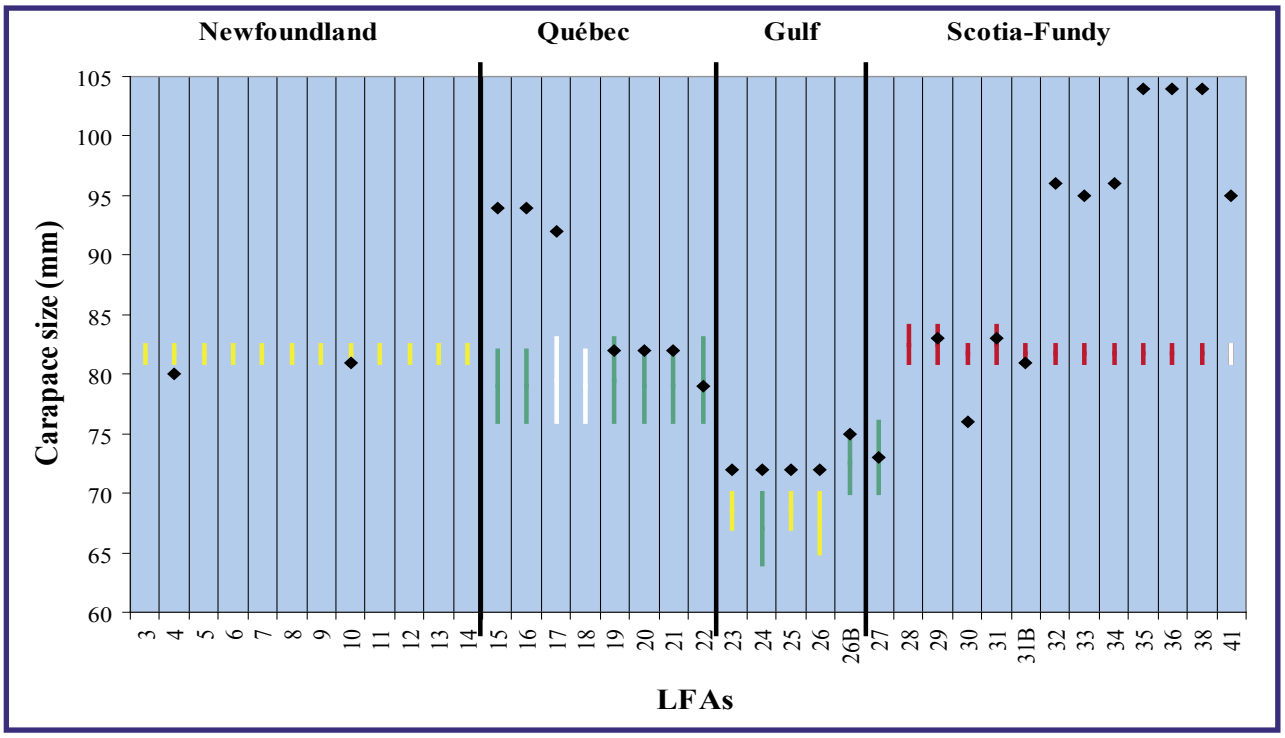


Figure 6: Increase in carapace length (mm) between 1995 and 2006 in each LFA in relation to the size at sexual maturity (dot). Bars in green represent where the doubling of eggs-per-recruit (100 % increase) was achieved, the yellow bars where the eggs-per-recruit increase was ≥ 50 % and red bars, where the eggs-per-recruit increase was < 50 %. White bars show where eggs-per-recruit increase was not assessed because it was not a concern given the low exploitation rates (LFAs 17 and 41) or because of the absence of information (LFA 18).

tion, on future recruitment is generally believed to be stronger than that of the spawning stock. Under good environmental conditions, low total egg production could produce strong recruitment while high total egg production during poor environmental conditions could result in poor recruitment. While continuing to support the goal of increasing the eggs-per-recruit, as a measure to reduce the risk of fishery collapse, the FRCC notes that it is the total egg production that is important. Measures that contribute to increasing eggs-per-recruit will also benefit total egg production.

As mentioned above, the primary measure that led to the increase in the eggs-per-recruit was an increase in the MLS. If the MLS is set at the size of 50% maturity then 50% of the female lobsters will have the opportunity to become mature before being harvested. If the MLS is below the size at 50% maturity, then the farther it is from the size at maturity, the fewer female lobsters that have an opportunity to mature and reproduce.

In areas where there was a significant increase in the MLS (6-7 mm), significant increases in the abundance index of berried females were detected. In the Bay of Fundy, however, the MLS was increased by 1.5 mm to 82.5 mm but remains more than 20 mm below the size at 50% maturity of 104 mm. While such increases may have been somewhat helpful, it is estimated that in the Bay of Fundy, less than one tenth of one percent of the females are allowed to mature before being available to the fishery. The difference between the size at 50% maturity and the current MLS is so high in the Bay of Fundy and around southwest Nova Scotia that increasing the MLS may not be seen as a feasible approach to increase eggs-per-recruit or total egg production. Other measures such as reducing the exploitation rate, closing areas, and implementing size windows, in which lobsters between certain sizes are protected from the fishery, or setting a maximum size that can be landed, are seen as more practical, as long as fishing pressure is low enough to allow lobster to reach the targeted size.

The FRCC recommends that 50% of female lobster be allowed to mature before becoming available to the fishery to reduce the risk of recruitment over-fishing.

Reducing the risks of recruitment over-fishing can also be achieved by protecting larger mature lobsters while limiting exploitation to allow lobster to reach the targeted size. **In LFAs where it is not considered feasible to increase the MLS to allow 50% of the females to mature before becoming available to the fishery, the FRCC recommends that larger mature lobsters be protected and the exploitation rates be decreased to ensure that a reasonable proportion of lobster reach the targeted mature size.**

3.4 Reduce the exploitation rate and effective fishing effort

Following the 1995 FRCC recommendations, measures to reduce the exploitation rates and effective fishing effort have been neither widespread nor effective. Exploitation rates were high in 1995 and remain high today. The 1995 Report suggested options to reduce the exploitation rate and the effective fishing effort. These options are discussed separately in Chapter 6 of this report as they have been identified as a key issue relating to the overall fishing effort in the lobster industry. The discussion that follows will focus on placing the exploitation rates on lobster in context.

Exploitation rates for fishery resources are normally calculated as the ratio of the catch to the biomass of commercial sizes. For lobster in Canadian waters, where estimates of the biomass of commercial sizes are not available, exploitation rates have been estimated from the ratio of successive moult groups in the commercial catch. Lobsters are not assessed in all LFAs and so exploitation rates are not regularly estimated every year (see Appendix III for exploitation rates by LFA). The estimated exploitation rates are higher than 50% in all LFAs except in LFA 17, 18, 28, 29, 30 and 41, with several LFAs having exploitation rates of 75% or higher.

The assessment of Gulf of Maine lobster in the United States uses survey information to calculate total biomass and exploitation rates from an assessment model. The average exploitation rate for 1996 to 2003 from the Gulf of Maine assessment is slightly below 50%. Exploitation rates for the Western Australian rock lobster, a different species, have historically been between 40 and 60% over the years from 1970 and 1998, but are estimated to have steadily declined to about 30% in 2002. By comparison lobsters in the majority of Canadian LFAs are harvested at rates beyond the available estimates of exploitation rates for lobster species. To put these exploitation rates in perspective, the FRCC notes that target exploitation rates in snow crab fisheries, where only males are harvested, are generally less than 50%. Target exploitation rates in the pelagic and groundfish fisheries are typically from 15 to 20%. The FRCC is concerned that these very high exploitation rates pose considerable risk to the sustainability of lobster.

The size distribution in the lobster catch (Figure 7) gives some indication of the high exploitation rates exerted. In an unfished population, there would be lobster of all sizes up to the maximum carapace size of greater than 125 mm (carapace length). For reference it is noted that the average size of lobster caught in the 1890s was roughly 2 kg, corresponding to lobster approximately 130 mm in size (carapace length). In many areas of eastern Canada, the size distribution is such that relatively few lobsters have the opportunity to reproduce even once and even fewer lobsters have the chance to do so more than once.

Reductions in exploitation rates would reduce the risks of over-exploiting the resource and would help improve the economic component of sustainability. Given the very high exploitation rates in this fishery, small changes in the effort will in general tend to have relatively little impact on the resource. Lower exploitation rates would have several positive effects. They would result in increased eggs-per-recruit, improved yield per recruit, enlarge the size structure of the population, and enhance overall sustainability. Exploitation rate reductions can be targeted over the whole accessible biomass or for a particular segment of the population such as mature lobsters.

The FRCC concludes that high exploitation rates pose a threat to sustainability and should be reduced. As a first step, the Council recommends that exploitation rates be estimated and monitored for all LFAs. Reducing the exploitation rate will require substantial reductions in fishing effort in some LFAs (see Chapter 6 for options to reduce fishing effort).

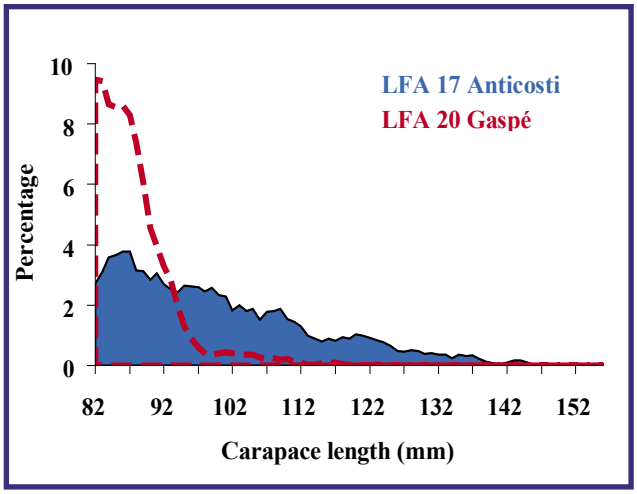


Figure 7: Percentage of lobster of different sizes in LFA 20 (Gaspé) where the exploitation rate is relatively high and in LFA 17 (Anticosti Island) where the exploitation rate is much lower. These curves compare the relative proportion of larger lobster. Where the exploitation rate is much lower, as in LFA 17, there is a greater percentage of larger lobster.

3.5 Improve stock size structure

During the 1995 review of the lobster fishery it was noted that the fishery relied predominantly on newly recruited animals. The FRCC suggested that a broader size range in the population would improve eggs-per-recruit and provide a buffer against changes in environmental conditions and uncertainties in assessment techniques. Two particular tools were suggested to improve size structure: reduce the exploitation rate and protect components of the population using protected areas, maximum size limits and v-notching mature females. As noted above, in the context of the overall industry there appears to have been little initiative to reduce the exploitation rates in the fishery over the period since the 1995 Report. In LFAs where the increase in the minimum carapace size was significant (6-7 mm), a measurable shift in the size structure was detected, however, the size structure remains heavily truncated, indicating high exploitation rates.

Many areas did experiment with v-notching and in some areas v-notching is still generally practiced. However, many of the areas that reported experimenting with v-notching after the 1995 Report, have since given it up. The merit of v-notching, although theoretically effective, cannot be quantified, because its practice is voluntary and is not reported. In recent years, in place of v-notching, some LFAs have developed protection for specific categories of lobster, mostly females - a practice referred to as 'windowing', while other areas have established maximum sizes. For example, in LFAs 23, 24 and 26A and B all females between 115-129 mm carapace length are now released, while in LFA 25 the maximum size is 114 mm (see Appendix III for details on specific measures in all LFAs). The effect of these measures on size structure is still uncertain. The size categories that are released represent a very small fraction of the catch. While such measures help to reduce risk in the fishery, the extent of their impact has not been measured.

As noted above, the FRCC believes that the concept of eggs-per-recruit does not fully characterize the reproductive capacity and health of a lobster population. The actual reproductive capacity of a population depends upon more than eggs-per-recruit alone. For example, new research has highlighted the role of males in the lobster mating, revealing that the size of males relative to that of females is important for successful and sufficient sperm transfer. The depletion of males relative to females could have a negative effect on mating success and egg fertilization. Scientific studies also point to

the larger size and higher quality of eggs and larvae produced by multi-spawner (multiparous) females, compared to first-time spawners (primiparous).

The FRCC continues to have concern about the size structure of the lobster resource and recommends that exploitation rates be reduced and maximum size limits be implemented as per the 1995 Report in order to improve the size structure, increase the number of multiparous females and maintain balanced sex ratios. These measures will improve the resilience of the stock and reduce the risk of stock and fishery collapse.

3.6 Minimize waste

All fisheries should seek to maximize the sustainable benefit to be derived from the resource. The benefit to be extracted includes the landings but consideration should also be given to the economic benefit, for harvesters, producers and communities, all of whom rely on the resource. Three measures were suggested in the 1995 Report to minimize waste: target lobsters at "optimal" size, target seasons when lobsters are at their best and application of a code of practice. It would appear that little progress has been made on those suggestions.

During its consultation process the FRCC was provided reports of poor handling practices and the landing of dead lobsters. For example, it was estimated in one submission that in excess 560,000 pounds of dead lobsters, valued at over $3 million were landed in LFA 34 during the first five days of the fall 2005 lobster fishing season. This is an appalling waste of the resource. Ironically in the same LFA, some harvesters had taken the initiative to add wet fish holds to improve the landed quality of lobsters. The quality of the fish landed is of growing importance in the market place and the industry needs to focus on ensuring that quality is maximized to realize the economic benefits from the resource.

Industry members advise that the resource waste is caused by poor fishing and handling practices and is fuelled by competitive pressures and the need to offset high investment among some enterprises. While handling practices on the whole appear to be satisfactory, there remains room for improvement. One approach to improving the quality would be to adjust the timing of fishing to coincide with the harvest of lobsters when they are in prime market condition. This can be achieved either by fishing at different times within seasons or by changing the dates of seasons. In certain areas, for example, fishing seasons appear to coincide with the lobster's moult cycle, which results in less value from the resource than is otherwise reasonably attainable.

The FRCC recommends that the industry and DFO develop protocols and adjust fishing seasons to improve the quality of lobster landed.

Minimizing waste is also related to the objective of deriving the fullest sustainable benefit from the resource. At low fishing mortality, the yield (fishery productivity) increases as the fishing mortality increases. In any fishery, there should be consideration given to maximizing the yield-per-recruit. The increases in minimum landing size have contributed to an increase in yield-per-recruit, but analysis suggests that a major reduction in exploitation rate would be necessary to significantly improve yield-per-recruit. At present lobster populations are still subject to growth over-fishing, which occurs when lobster are harvested at a size that is smaller and at an exploitation that is higher than those at which the yield, the landed weight, per recruit is maximized.

3.7 Linkages between lobster populations

There are many similar biological and environmental characteristics between adjacent LFAs. The 1995 Report noted this similarity and suggested that conservation should be considered at a larger scale that was referenced as a Lobster Production Area (LPA). The 1995 Report recommended the establishment of seven LPAs based upon physical and biological data provided by DFO scientists. The FRCC expected that further work would be required to define and refine the proposed LPAs. The Report argued that these areas define lobster populations that have common biological characteristics (growth, maturation) and which live in an environment that has common or comparable characteristics - temperature, substrate. Because of the relatively homogeneous characteristics within the LPAs, it would be easier to match management regulations with the conservation of the resource. In addition, certain conservation measures adopted within the LPA would benefit all harvesters equitably. In contrast, some LFAs that have made little contribution to improving sustainability are benefiting from changes adopted in adjacent LFAs where participants have made substantial contributions to enhance conservation objectives. This dilemma was highlighted on several occasions during the public consultation process. While the LPAs would be used to establish conservation strategies, it was expected that detailed management regulations would still be applied for each LFA.

DFO did give formal consideration of this recommendation in the years following publication of the 1995 Report. Several meetings were held to review the general recommendation and to consider the seven LPAs suggested by the 1995 Report. While there was disagreement with the particular LPAs suggested by the 1995 Report, the concept and utility of LPAs were widely recognized. DFO developed an operational definition of an LPA as "one or more self-sustaining lobster populations that were linked by sufficient interchanges so that the catch, recruitment, and abundance of these populations influenced each other."

While the key characteristics required to define LPAs have been considered, concerted effort to resolve a number of unanswered questions remains to be completed. In attempting to determine what would need to be done to define and evaluate LPAs, six key criteria have been identified: (1) mapping the location of breeding females and recruitment; (2) estimating exchange rates based on adult migration; and standardizing methods for (3) size-at-maturity, (4) larval survival, (5) juvenile survival, and (6) larval drift models.

Recent modelling in the Gulf of St. Lawrence does provide clear evidence of the connections between LFAs. These models simulate the circulation fields in the ocean, including both the wind forced and tidal components of the circulation, with simplified models of lobster development, in which the lobster develop as a function of the temperature. Lobster larvae are simulated as particles in the surface layer of the ocean. For example, a simulation performed on the north coast of PEI with the 2001 temperature and wind conditions suggests that very few of the larvae that are produced in this region actually settle there (see Figure 8). Most of these larvae settle on the west side of Cape Breton Island. The model was also used to determine the source for settling larvae in the same region, from the temperature and wind conditions in 2000. In this simulation, almost 20% of the larvae settling on the north coast of PEI came from LFA 23. These model simulations clearly show how winds and currents can move lobster larvae from one area to another.

Lobsters of neighbouring LFAs clearly do have much in common, and may move from one LFA to the other. Present lobster assessments already include some consideration of the shared environmental characteristics but do not include consideration of the source-sink dynamics of lobster populations. How should we account for the movement of lobster from one area to another and at what scale should the population dynamics of lobster be considered? While the 1995 Report recommended the determination of LPAs it is no longer clear that these LPAs can be set geographically with any great certainty and that they will not change in shape and scale over time. It may be more important to simply include consideration of the lobster resource at scales larger than the LFA. Connectivity is now a key characteristic of marine populations that scientists are seeking to resolve. Greater understanding of the population connectivity between LFAs would help management in interpreting population cycles and developing appropriate management plans. While such work could lead to the determination of geographic zones such as LPAs,

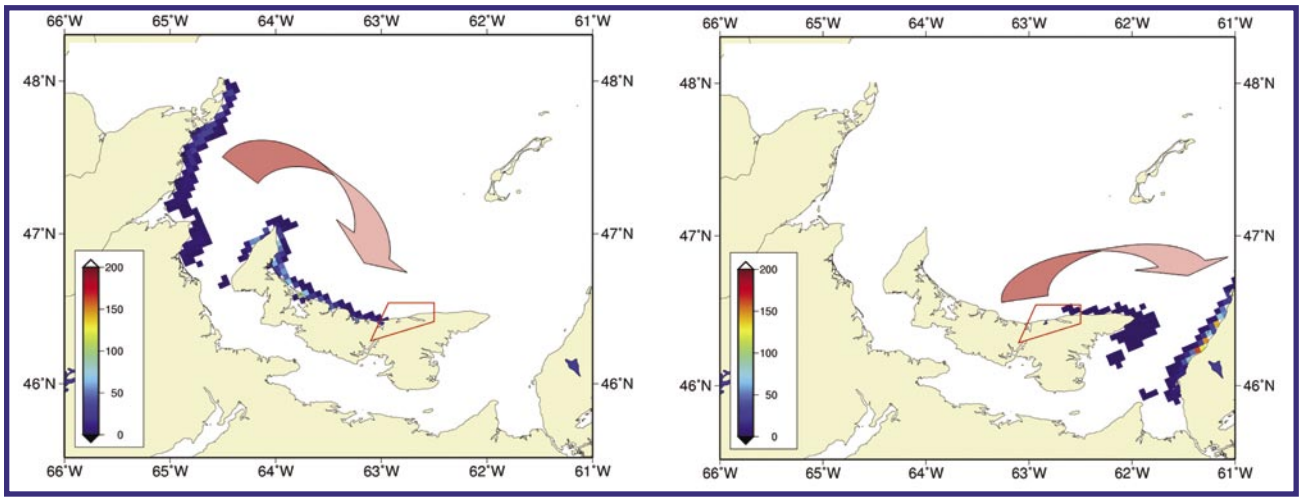


Figure 8: Results of a numerical model for the drift of lobster larvae. Left Side: Simulation showing the origin of larvae that settles in the selected box, on the north shore of PEI. All of the larvae come from the west. Over 20% of the larvae come from Area 23. This particular example is for temperature and wind conditions in 2000 (J. Chassé and R. Miller – personal communication). Right side: One thousand larvae are placed in the box on the North shore of PEI and then tracked until the point of settlement, typically tens of days. Almost all of the larvae settle outside of the starting box, with most of the larvae settling on the western shore of Cape Breton. This particular simulation is for the temperature and wind conditions in 2001.

the more important goal for management should be the development of better information about the scale at which lobster populations influence each other and how environment and fishing influence lobster populations.

The FRCC recommends that lobster management plans should explicitly recognize that biological and environmental changes occur at scales much larger than those of a LFA. Such recognition should provide for greater consistency in the application of conservation measures among interdependent LFAs.

Consideration of the movement of larvae between LFAs, and the connections between lobster populations will require more scientific studies to gain a comprehensive understanding of source-sink dynamics and population connectivity for lobster.

4. Knowledge for Improved Management

4.1 Introduction

From its first regional consultation meeting with DFO through to the workshop, the FRCC was made aware of the apparent lack of consistently collected, analysed and interpreted data on lobster and on the fisheries exploiting it. Harvesters, scientists and managers all raised concerns about the lack of information on lobster, each group identifying different gaps. Large amounts of data have been collected at various times and places but often the data came from short-term projects and the sampling protocols changed over time. Sampling and surveying for lobster appear to have been conducted on an opportunistic basis, and not as part of a systematic plan. This is in stark contrast with other fisheries where independent surveys and logbooks have been utilized for decades to evaluate relative changes in stock size. The lack of consistently collected data is no doubt related to the management system in place for lobster, to the reluctance of harvesters to provide detailed information on their fishing activities, and to the lack of financial and human resources within DFO. The Council notes, however, that some progress has been made since the 1995 Report.

As indicated earlier, due to the lack of data, it is not possible to assess the changes in landings resulting from changes in productivity, distribution of the resource, expansion of the fishing grounds, increases in fishing efficiency, etc. Similarly, it has not been possible to evaluate with confidence the results of changes in management measures. It may be possible to continue to manage the lobster fishery with limited data collection, but such an approach would be highly risky. Harvesters, scientists and managers expressed their need and desire for more knowledge and information. The FRCC also believes that such limited information inhibits the industry's ability to adjust and manage change.

During consultations harvesters expressed concerns about how information is used and how decisions are made based upon analysis and interpretation. Many feel disassociated from the information and suggest that there are too few opportunities to contribute to decision-making. The FRCC has structured its discussion of the issues identified above around three key questions related to information on lobster:

1. What information is required?
2. How should the information be collected? and
3. What should be done with the information?

4.2 What information is required?

The minimum information required includes reliable information on landings, on the spatial and temporal distribution of the landings and the fishing effort, and on changes in fishing efficiency. This information is incomplete or not available for most LFAs. Besides being important for management, this information is required to assist in determining stock status and trends in population abundance. An index of the rate at which the resource is harvested is also required. A list of potential indicators for the key features of the fishery and the lobster population is provided in Appendix IV.

Information on the demographic and reproductive capacity of the lobster resource including size composition, abundance of berried females, the distribution of primiparous and multiparous females, mating success, size specific sex ratios is systematically collected in only a few LFAs. Yet this information is necessary to understand resource productivity. Understanding stock productivity is important for providing guidance about trends and forecasts of the resource. Most direct estimates of stock-productivity, including the pre-recruit catch rate, settlement densities and the spawning aggregations, are limited to small studies or scientific research. There is an initiative underway, building upon a comprehensive program in the United States that does offer potential for providing some of the information required to evaluate stock productivity. As indicated earlier, it is also necessary to understand the linkages between the various LFAs, where the recruits are coming from and where they are going.

As fisheries management moves towards preliminary forms of ecosystem-based management (see Chapter 5) a broader set of indicators must be used to monitor the ecosystem and the environment. Temperature is one of these indicators that can be relatively easy and inexpensive to collect and there are ongoing monitoring programs that provide this data. There is growing information available on habitat and many different groups are collecting data in the coastal zone. Indicators of lobster habitat quality could be developed, as part of broader benthic habitat studies. Bycatch and other species interactions associated with the lobster fishery require attention due to issues related to endangered

and threatened species and the enactment of the *Species at Risk Act*. Circulation modelling offers the potential to provide information on an annual basis about the changes in the key forces that affect benthic settlement and in the connectivity between different components of the lobster ecosystem (see Figure 8 in Chapter 3).

4.3 How should the information be collected?

Under appropriate institutional arrangements harvesters should collect much of the information related to the fishery. They are on the water and have direct access to information. Most of the fishery data could be obtained from confidential logbooks. Efficient collection and analysis of these data remains a challenge but perhaps the greatest impediment is convincing harvesters to accurately and regularly complete the logbooks. This could be facilitated if the introduction of an electronic logbook simplified the process for the harvesters. The reliability of the indicators derived from the data is intimately related to the quality and reliability of the input.

Collecting information should be much easier than it was even a decade ago. New technology, on vessels and onshore, makes the collection of fishery data both more practical and less costly. Sounders, computers and GPS navigators are all now common at sea. Many harvesters have made substantial investments in their vessels allowing for the potential of data collection for their mutual benefit and for the overall benefit of the resource. As one example, the FRCC heard that some harvesters were pooling the data from their sounders to collect their own much more detailed bathymetric database. Such innovative sharing of data was not only impossible a short time ago but difficult to contemplate.

Obtaining reliable information on landings has proven a challenge and needs to be improved. Pilot projects are underway in the southern Gulf of St. Lawrence and these could show the way to improve monitoring of the landings. Tagging of lobster is another approach that could offer new information on the migration dynamics and distribution of lobster. DFO has been successfully conducting acoustic tagging, similar to what has been done for groundfish in the southern Gulf of St. Lawrence. Such an approach, perhaps combined with more traditional tags that involve cooperation with harvesters, could be very valuable for scientific study and for management purposes, in particular to assess the exploitation rate and mixing rates.

The information obtained from fishing operations provides data on the portion of the population targeted by the fishery, as fishing is seasonal and performed with selective traps. There is a need to gather information on other components of lobster populations to develop indicators of their dynamics, productivity and the exploitation rate they experience. Such information requires at-sea sampling programs independent from fishing activities. This type of information needs to be conducted on specific grounds, at differing times of the year and using fishing gear with specific selectivity. It is not practical, or even desirable, that all data should be collected by the department. DFO does not have the financial or human resources to collect and manage all the data required for a fishery, particularly one as large and diverse as the east coast lobster fishery.

The solution to improving knowledge and understanding lies in forming new partnerships and in particular to ensure that all stakeholders contribute to information gathering and interpretation. Groups such as the Fishermen & Scientists Research Society (FSRS), in Nova Scotia, offer one successful partnership model between DFO and industry for the collection of fishery data but also for the collection and analysis of reliable scientific data obtained through specific research activities. In Prince Edward Island, the provincial government, working with volunteer harvesters, has an ongoing data collection program that collects information on the lobster population and distribution. Some LFAs have started their own initiatives. The Nova Scotia Bonafide Fishermen's Association and St. Francis of Xavier University are partners that study lobster predation and trap catchability. The FRCC supports these local initiatives and encourages further sharing of knowledge.

The 1995 Report did appear to stimulate lobster research. There were two major research programs on lobster that were conducted between 1996 and 2001 (Canadian Lobster Atlantic Wide Studies I and II), but since then there has been no large scale, regional effort directed towards lobster. Relatively little lobster science activity takes place within the academic sector although there are research programs associated with the Atlantic Veterinary College and the work associated with the FSRS in Nova Scotia. Both groups are doing productive and useful research, however, the Council noted the general lack of research being done by DFO and industry; particularly, given that lobster is the highest valued fishery in the region.

The FRCC recommends that logbooks, or their electronic equivalent, be made mandatory to collect information on the catch, its location and size, the effort deployed and the gear used.

The FRCC recommends that DFO, harvesters, processors and academia expand scientific study of lobster to address key conservation issues, e.g. recruitment dynamics and population connectivity.

The FRCC recommends that DFO develop new Atlantic wide research initiatives to address conservation and ecosystem questions that require partnerships including industry and science.

4.4 What should be done with the information?

The data collected from and about the lobster resource and fishery should be made widely available with the principles of confidentiality and transparency underlying all data collection to encourage sharing and trust. Much has improved over the past years but the lack of data sharing remains an impediment to the expansion of new joint programs that will ensure that the data required is obtained. The need for more open and transparent information flow is growing, as broader more diverse data is required to fulfil the adaptation to ecosystem-based management. This is a goal of all stakeholders in the lobster fishery.

The FRCC heard concerns from harvesters about the present scientific review and decision-making processes. The Council itself participated in some lobster Regional Assessment Processes (RAP) and found them to vary in efficiency, completeness and inclusiveness. The RAPs also vary as to purpose and approach by region and there appears to be no clearly defined guidelines to allow for active participation by industry representatives. The FRCC believes that the scientific review and decision-making processes could be substantially improved, however, this may require adjustment to existing institutional arrangements. Effective dialogue with the industry is an important component of information management. Meetings such as the RAPs could serve as a forum to share and review information that is gathered by various industry associations.

The FRCC recommends that DFO, together with harvesters and industry, review and redesign the Regional Assessment Process to ensure that it is more efficient and provides a better opportunity for dialogue and discussion.

Under existing processes, assessment discussions could be improved through the development of clear guidelines to interpret the trends and status of indicators as required to determine the status of lobster i.e. a healthy state or a poor state. The lack of clear guidelines means that similar sets of data could lead to different conclusions. Clearer quantitative guidelines for interpretation and decision-making would be helpful. The identification of targets and limits would establish a more objective, rules-based approach to providing advice to management and for making management decisions.

The FRCC recommends that guidelines be developed for resource indicators that could determine the status of lobster.

Lobster fishing in Placentia Bay circa 1956. Photograph courtesy of Clayton Halfyard.

5. Ecosystem Considerations for Lobster

5.1 Introduction

The FRCC was requested to include in its report ecosystem considerations for the lobster resource and fishery. Although the ecosystem approach to fisheries management was not frequently discussed at consultations, harvesters routinely raised fishery and species interactions. The Council believes that for fisheries management to be successful, it is necessary to consider the fish in the broader context of the marine ecosystem and the effects on the ecosystem of human activities. The FRCC's vision of sustainability makes explicit reference to other marine species and the ecosystem upon which the resource and the fishery are dependent. Several countries, including Australia, Iceland and Norway, are now applying an ecosystem approach to fisheries management. While the need to move towards ecosystem considerations is widely accepted in Canada, the practical steps for implementation remain undefined and the Canadian fisheries management system, with rare exceptions, has yet to implement an ecosystem approach.

5.2 Ecosystem-based fisheries management

Lobster harvesters are well aware of species interactions and the influence of the physical environment, on the presence, behaviour, catchability, and quality of lobster. Harvesters also understand that targeted fishing of one species can influence other fish and the ecosystem. They also suspect the influence of other human activities, such as aquaculture, tourism, transportation, dredging, and oil and gas exploration on lobster. During the FRCC's consultation process, some harvesters expressed the desire to adapt lobster fisheries management to include other species and fishery interactions. Without such broader considerations, it is felt that single species management will be unsuccessful. The implementation of the concept, however, may be both difficult and controversial. Sceptics consider that failures in single-species management suggest that increasing the complexity by adding consideration of other species is unlikely to be more successful. It is the FRCC's view that one of the fundamental weaknesses of single-species management has been its narrow focus and that an ecosystem approach to fisheries management is in fact likely to solve some of the problems experienced with this approach.

An ecosystem approach will involve defining the ecosystem from the perspective of the lobster. Where do lobsters fit in the ecosystem and what ecosystem components are most important to them? Once identified, these ecosystem components should receive primary consideration.

In its most comprehensive form, an ecosystem approach to fisheries management includes, in a sustainable development context, consideration of the cumulative effects of all human activities on ecosystem components and the interaction between different components, including humans. Ecosystem-based fisheries management recognizes the four components of sustainability (ecological, economic, social and institutional) as described in the introduction. Although a comprehensive ecosystem approach to fisheries management is highly desirable and should be a long-term goal, present institutions and decision making mechanisms have not been designed for implementing such an approach. While such a fully integrated approach is not presently practical, it is possible to make progress on the ecological component of sustainability.

Implementing the ecosystem approach to the ecological component of sustainability means taking a broader view of the species in its environment. It means developing a broader conservation framework that could be centered on three main goals:

1. Maintain productivity;
2. Preserve biodiversity; and,
3. Protect habitat.

In general, maintaining productivity means that human activities should not cause an unacceptable reduction in the productivity of the ecosystem so that key components maintain their historical role. Preserving biodiversity means that human activities will not cause unacceptable reductions of biodiversity so as to preserve the overall balance, structure and natural resilience of the ecosystem. The protection of habitat is intended to minimize habitat changes in order to safeguard key underlying structural features that support ecosystem function.

Specifically for the lobster fishery the three ecological goals could imply the following:

1. **Productivity** - Lobster population productivity would remain a primary concern, as in the single-species approach. However, additional elements such as temperature and circulation on lobster production would also be considered. Accounting for other fisheries that

remove predators of lobster or prey and total removals from the system could be considered since there is a generally accepted view that some maximum net system productivity cannot be exceeded.

2. **Biodiversity** - Protecting biodiversity could mean considering the directed and incidental mortality of all key connected non-targeted species, the role of lobster predation on species diversity, the geographic distribution of lobster fishing mortality, as well as by age and size because uneven distribution of fishing mortality can have implications for population biodiversity.
3. **Habitat** - Lobster habitat may be one of the more important ecosystem considerations, since lobster rely on bottom habitat for most of their lives. Disruption of relevant habitat features should be minimized, the introduction of contaminants into the system should be strictly controlled and limited, and gear losses should be minimized. Seismic testing and mining could also have considerable effects on lobster and on lobster habitat and would require careful study. Potentially damaging activities should have to be proven as non-detrimental or be able to be mitigated before being permitted.

Each of these key characteristics - productivity, biodiversity and habitat - would require careful consideration. Indicators to measure the status of the key characteristics and reference points to identify a desirable combination of indicators would be required as for single-species management.

5.3 Practical steps towards an ecosystem approach

While there is a conceptual gulf between the ecosystem approach to fisheries management and present-day management, it is possible to make progress incrementally. The ecosystem approach is not about managing the ecosystem but about including consideration of the ecosystem in management of fisheries. The first steps toward the implementation of an ecosystem approach in the lobster fishery would be to determine the key ecosystem factors that influence lobsters, to select the most important and then develop quantitative understanding of the importance of each factor. Currently there is enough knowledge to begin the process, and as the approach develops, more information, and greater understanding of the linkages can be incorporated as they become available. The information required will depend on the complexity of the management structure and will become clearer as the ecosystem approach to fisheries management progresses.

Key factors for lobster may include habitat quality, abundance of predators, temperature and availability of prey that are important during certain phases of the lobster life cycle (Figure 9). Information exists on these factors but it is not presently known how to account for these features in an ecosystem-based management framework. For example, temperature is known to influence the distribution of lobster, and its catchability, but less is known about how temperature changes could influence local productivity and recruitment. Key predators of lobster in their early benthic stages are relatively well known, but there is no adequate monitoring of these non-commercial species that could indicate temporal trends in predation. Rock crab is an important prey for lobster but the strength of lobster's dependency varies by life stage as well as geographical area and what abundance would be critical for lobster are not known. Incorporating these general concerns into an ecosystem approach to lobster fisheries management would require a selection of these factors and studies to quantify their role.

The effects of bycatch in the lobster fishery and the effects of other fisheries on lobster would require consideration in an ecosystem approach. Considering such fisheries interactions explicitly in the management plan would mean that they could be regulated to some degree and considered before they became an environmental concern or had to be considered under SARA.

The FRCC recommends that DFO establish processes to consult with stakeholders to develop an ecosystem approach to lobster fisheries management that identifies key ecosystem issues and means to monitor and assess management measures that address these issues.

Since the ecosystem approach to fisheries management is likely to require additional information, the FRCC recommends that DFO, harvesters, and processors develop new approaches to the economical and effective collection of information on lobster and their key ecosystem characteristics.

Some progress has already been made to take ecosystem considerations into account in lobster fisheries management. The lobster fishery provides at least three examples:

1. Scallop dredges can destroy lobster habitat, or the gear may harm, kill or catch lobster.

Field experiments have shown varying results, because local conditions of spatial overlap of scallops and lobster as well as the seasonal patterns of abundance were variable. However, based on available knowledge, it is likely that scallop dragging has significant, harmful effects, at the local scale, on lobster populations and habitat. In certain areas, to minimize the negative impacts of the scallop fishery on lobster, areas and times when lobsters are in high concentrations or are soft-shelled are protected from the scallop fishery through depth zoning. In the Gaspé area for example, as lobster move offshore in the autumn, the depth limit for scallop dredging increases, decreasing the probability that scallop fishing activities overlap with the lobster population. Concerned that scallop dredges could damage the habitat used by lobsters during their fall migration to greater depths, lobster harvesters in some areas have bought and retired scallop licences, thereby reducing the potential risk of harm to lobster from scallop fishing.

2. The predator – prey interaction between lobster and rock crab is considered in the management plans of the rock crab fishery in the Québec region. Rock crab is a major prey for lobster throughout the lobster's life cycle, even from the earliest larval stage. The interaction between the two species was considered sufficient to justify a very cautious development of the rock crab fishery to prevent any negative effect on the lobster. Management measures have been designed to protect the integrity of rock crab productivity in order to minimize the risk of disrupting the trophic links. The reproductive potential of the rock crab is protected through exclusion of females from the fishery and the establishment of a minimum legal size on males well above the size at sexual maturity. Exploitation rates on rock crab are intentionally kept low to moderate through catch and effort regulations to ensure that the number of large males, potentially important for the reproductive success of large females, remains relatively high. Rock crab is landed as bycatch in the lobster fisheries. This became more of an issue as the market and price for rock crab increased and a directed rock crab fishery was developed. A quota manages this fishery and

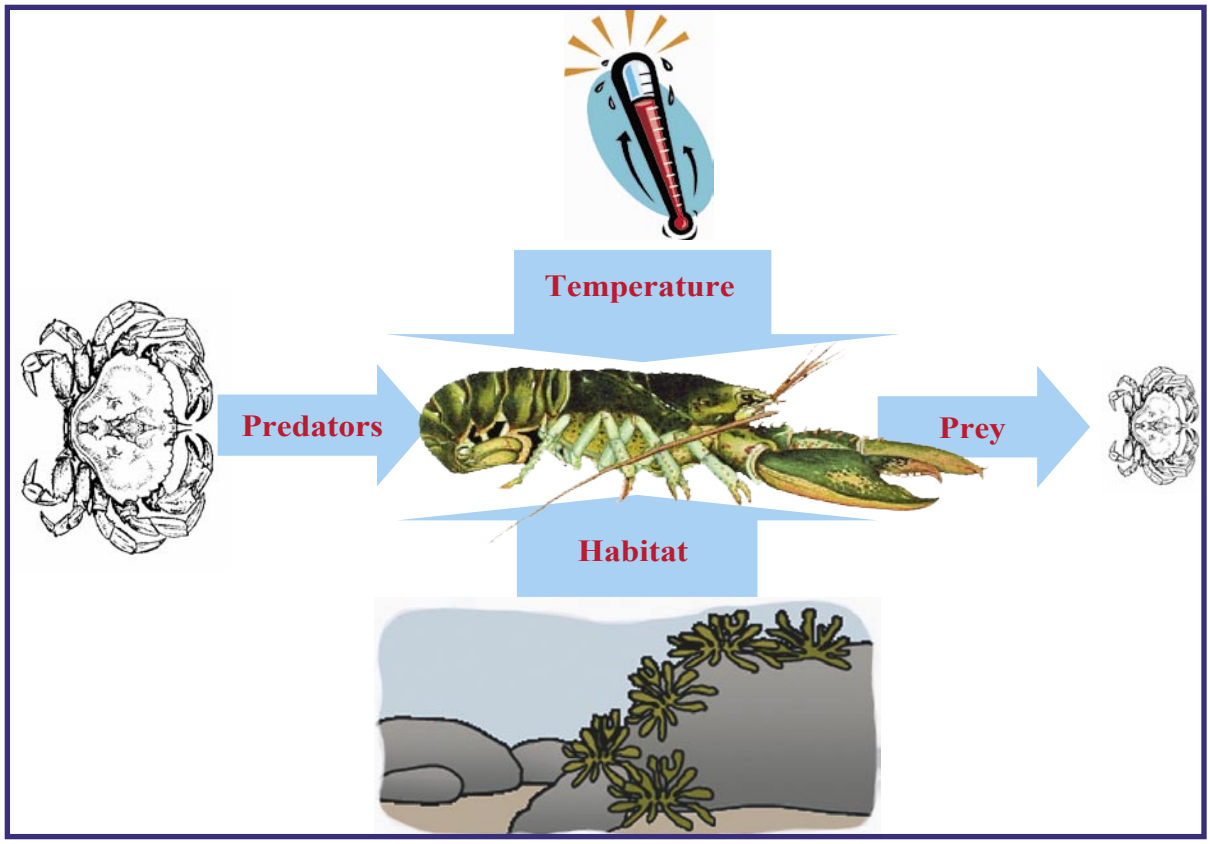


Figure 9: The first practical step in the development of an ecosystem-based approach to lobster would be to consider the key ecosystem factors that influence lobster. Four obvious ones are their key predators and prey, the habitat available for lobsters and the water temperature that strongly influences growth and distribution.

the bycatch of rock crab in the lobster fishery is included in quota management. This measure controls exploitation rates but requires that the crab landed as bycatch in the lobster fishery be well documented, currently the monitoring of bycatch requires improvement. The bycatch of lobster in crab fisheries can also be an issue and efforts to modify the traps to reduce the catch of lobster are ongoing.

3. Fixed gear in general, and lobster traps in particular, are often considered to have smaller negative effects than mobile gear with heavy bottom contact. This does not mean, however, that the effects are non-existent, and at least two concerns have been raised: the entanglement in lobster lines of right whales, a species at risk, and the bycatch of species, commercial, rare, or at risk of extinction. In the case of right whales, the 2006 fishing season in the Bay of Fundy was delayed to allow right whales to leave the main fishing areas. For bycatch species, the concern is that the accumulated bycatch mortality may lead to declines or extinctions.

For these examples, the common link to management is the need first to recognize the issue and second to assess the effect based on available information. In many cases the effect is difficult to quantify and management decisions must therefore be based on risk analysis that various actions or lack of action would incur. The examples discussed above demonstrate that consideration of a species in the environment can be a practical exercise. Likewise, the development of an ecosystem approach to lobster management can be a logical and pragmatic undertaking. Existing fisheries management plans will need to be modified to address the objectives of an ecosystem approach to the lobster fishery and the examples noted above highlight how management plans can be adapted to reflect the risks to lobster and the ecosystem upon which it depends.

5.4 Benefits of ecosystem management

The present approach to management in the lobster fishery has been in place for many decades. Why move to an ecosystem approach and what would be the benefits? First, the ocean is changing and, although the management of the lobster fishery seems to have worked reasonably well in the past, there is no guarantee that it will continue to do so in the future. In addition, there is evidence that oceans undergo changes on time-scales of decades that can restructure marine ecosystems (so-called regime shifts). Moreover, several invasive species have been detected among which green crabs and the green algae Codium have invaded prime lobster habitats. Technology is allowing harvesters to extend their range and to fish on grounds and at times not previously possible. There are also many new ocean users from tourism to offshore development. Eco-certification is a developing issue in fisheries worldwide. All of these issues have yet to be considered in management plans.

In a modern context it is no longer possible to think of a species without consideration of its environment. The ecosystem approach to management requires the collection of new data on the ocean and on fisheries. It provides a context in which this data can be analysed and discussed. Such discussions will direct attention to key issues influencing lobster that would otherwise not be considered adequately. There have been important lessons from the unfortunate experiences in other fisheries. There are many examples that fishing and other human activities can have significant and lasting effects that have caused persistent changes in the marine ecosystem, e.g. the collapse of many groundfish species off eastern Canada. A framework is required to address the most important ecosystem factors for lobster.

While posing challenges, the ecosystem approach to fisheries management will account for the important factors that influence a fishery. It will require collaboration and cooperation, much more than the existing management regime, but potentially offers greater rewards.

5.5 Refugia

Over the past decades the fishery has expanded to cover the full range of lobster off eastern Canada, from the shore out to the edge of the continental shelf. The only large area that could act as a buffer in the event of severe depletion is off southern Nova Scotia – Brown's Bank. This area is closed to lobster fishing. Some at consultations urged that the closure of Brown's Bank not only continue but that it should apply to all forms of fishing. Many harvesters see the closure, which has been in place for several decades, as an important source of lobster productivity in southwest Nova Scotia. The uncertainty around the sources of productivity in this region appears to support the need to maintain this refuge.

The FRCC recommends that the closure of Brown's Bank to lobster fishing be maintained.

While uncertainty provides justification to support the maintenance of the closure, at the same time, uncertainty about the impact of other fishing on Brown's Bank limits support for the expansion of the closure to include all types of fishing.

Organisms that are relatively immobile, such as lobster, make good candidates for reserves since it is possible to protect the adults, giving them an opportunity to reproduce. The FRCC believes that for such species refugia could provide a buffer to mitigate the limited knowledge that is available to management. Any new reserves should be developed with the input and development of all stakeholders. The process of reserve selection should be open, inclusive and transparent, with the goal of optimizing the ecological productivity and enhancing sustainability.

Following the 1995 Report, small refugia were established off the northeast coast of Newfoundland. Most of the refugia developed have been small making it difficult to quantify their effect outside of the refuge. While there is general agreement as to the potential benefit of refugia, there has not yet been enough proven benefit to encourage management and harvesters to support such restriction on a larger scale or as a more general approach. While refugia could provide a buffer to mitigate the limited knowledge of the factors that control lobster production, the establishment of new refugia is likely to be challenging, as it would require support and involvement of all stakeholders.

As a buffer to protect against the unintended consequences of management decisions based upon imperfect information, **the FRCC recommends that DFO work with all stakeholders to develop a network of reasonably sized and spaced reserves to enhance the sustainability of lobster.**

Flagg Cove in Grand Manan is a different type of refuge, which is now closed to aquaculture development because of the effect of several aquaculture sites that were established there in the late 1980s. The cages used for aquaculture appeared to impact berried females, displacing them from their habitat. Following an assessment of this effect, the removal of the cages allowed berried females to recover and again occupy their preferred habitat. This area is now closed to a specific activity that was found to be harmful to lobster.

5.6 Ecosystem enhancement

In recent years, there has been a renewed interest in enhancement of lobsters in Atlantic Canada. Resource enhancement efforts were quite common more than a hundred years ago. Rearing larvae is expensive, estimated to cost $1-3 per juvenile, and reared larvae are not generally as robust as wild animals. The rearing of lobster eggs to larvae and post-settlings stages (stage IV) began in Canada in the late 1890s and by 1903, 15 hatcheries were established. During their operation, millions of larvae were released in the ocean but most hatcheries closed by the 1920s. By 1980, all Canadian lobster hatcheries were closed with no evidence that hatchery-reared lobster enhanced the natural population.

Resource enhancement and protection is technically feasible and while it should not replace good management it could offer a form of insurance against management errors and uncertainty in resource productivity. A cost-benefit analysis is necessary to evaluate if active enhancement measures, such as seeding, could contribute to a sustainable fishery. Support for measures that would be large enough to have a substantial impact will require greater confidence in the benefit to be derived from limiting access to the resource or putting substantial effort, and money, into active enhancement. Monitoring and evaluation are essential to determine the effectiveness of any type of enhancement.

Expansion of enhancement activities should await further testing and study to determine the potential conservation benefit and to assess the cost and scale of the effort that would be required to be effective. Experiments should be carefully monitored and assessed to determine their potential benefit.

5.7 Climate change and lobster

Another factor that fisheries management will have to consider in the coming years is the potential effects of climate change on ocean resources. The United Nations' Intergovernmental Panel on Climate Change's most recent report in 2007 offers clear evidence for the growing confidence in the impact of greenhouse gases on the warming that the planet has been experiencing over the past century. While detailed forecasts of future change remain uncertain, it is expected that warming, particularly at high latitudes, will continue and that sea level will continue to rise. Over the next century, the global temperature and sea level are forecast to increase significantly. There is also a direct impact of rising carbon

dioxide on organisms in the ocean through increasing acidity that has already been linked to declines in coral reefs and is suspected to influence many other organisms in the ocean. It is not known how lobster or its prey and predators will respond in a changing climate further adding to our uncertainty about the resource. How best to account for this uncertainty is a further challenge for fisheries management.

6. Fishing effort

6.1 Context

Three general approaches are used to manage fisheries: 1) input controls such as limits on the effort that can be applied in the fishery by adjusting the number of participants, the amount and type of gear that can be used, and when and where the fishery occurs; 2) output controls such as limits on the amount of resource that is extracted through direct control of the catch either through global or individual quotas; and 3) escapement measures such as size limits (minimum, maximum) and prohibition of landing certain categories of animals. Most lobster fisheries in Atlantic Canada and Québec use 'input controls' and escapement measures, except for the offshore lobster fishery in LFA 41 where individual transferable quotas (ITQs) are used.

The input controls used to manage the lobster fisheries in Atlantic Canada and Québec include limits on: fishing seasons, the number of licences, the number of traps per licence, the size of the traps and vessel size. Escapement measures include: minimum and maximum carapace sizes, protection of 'berried' females and in some areas v-notched lobsters. Protection of smaller and larger lobsters is provided through technical measures defining the size of escape hatches and entry hoops.

Although the current management strategy was designed to control fishing effort and constrain exploitation rates, there remains considerable scope to increase fishing effort (and exploitation rates) through technological advancements, changes in vessel size, increases in the frequency of trap hauling and deployment, etc. As a consequence, the current 'input controls' are not adequately controlling fishing effort, and without checks, systematic increases in exploitation rates over time are to be expected, resulting in predictable over-exploitation of the resource. It is a characteristic of most input control fisheries management systems that fishing effort has to be periodically adjusted down.

The FRCC concludes that although the lobster fishery is described as an input controlled fishery, this equates to control of the nominal fishing effort (number of licensed harvesters and number of licensed traps). The effective effort, which relates to the behaviour of the harvesters, the actual effort deployed and efficiency of the fishing gear is neither monitored nor regulated by management. A demonstration of the change in efficiency over time is depicted in Figure 10.

During the early 1990s Canadian lobster landings declined from a peak in 1991. Following the decline the Minister of Fisheries and Oceans requested that the FRCC develop a strategic conservation framework for the lobster fishery. The 1995 Report concluded that the risks to the lobster fishery were substantial because fishing effort was high and generating very high exploitation rates resulting in too few lobsters being allowed to mature and reproduce.

6.2 Lobster conservation framework review

With respect to fishing effort, the 1995 Report recommended – "that substantial effort reduction is required to produce a real impact on the exploitation rate when effort levels are very high, as in the present situation with lobster." At that time the FRCC proposed a number of initiatives to reduce fishing effort:

1. Reduce the number of licences and/or the number of traps per licence;
2. Reduce the number of trap hauls;
3. Shorten the season;
4. Reduce the number of fishing days;
5. Reduce illegal fishing by improved enforcement; and,
6. Limit the transfer of licences; limit the reactivation of inactive licences.

Since the 1995 report, changes have been made in each and every LFA. These changes are outlined in Appendix III to this report and are discussed briefly in the following section. The lobster fishery is diverse and there are stark differences from one area to another, particularly in the numbers of harvesters, the size of the fishing areas, the timing and length of seasons, the

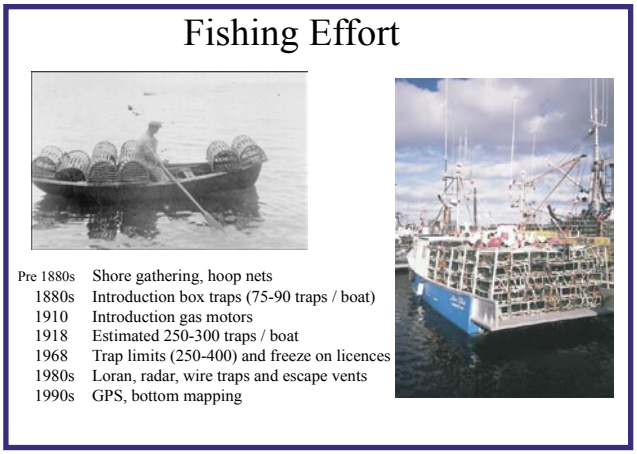


Figure 10: The pictures and highlights show the developments in the lobster fishery over the period since the fishery began. Black and white photograph courtesy of the Haystack Photograph Collection - Memorial University, colour photograph courtesy of Doug Pezzack, DFO.

size and capability of vessels, and the nature of the fishing enterprise. As a consequence, it is not surprising that the various LFAs have adopted a different suite of measures.

Participation

In the Newfoundland Region, the number of licences in LFAs 3-8 decreased from over 2000 in 1995 to 1396 in 2006, in LFA 9, the number decreased from 45 to 36 and in LFAs 10-14C, the number of licences decreased from 2011 to 1469. These licence reductions resulted primarily from the buyout of groundfish enterprises following the collapse of the groundfish industry and the removal of licences from the industry following the retirement of harvesters. Reductions in traps limits occurred in all Newfoundland LFAs and seasons were shortened in LFAs 3-8 and 10-14C. In addition, the fishery was closed during the 1998 to 2000 fishing seasons in St. Mary's Bay.

In the Québec Region, between 1995 and 2006, the number of harvesters decreased from 83 to 76 (46 active) in LFAs 15-16, increased from 23 to 24 (19 active) in LFAs 17-18, decreased from 221 to 213 in LFAs 19-21 and remained stable at 325 in LFA 22. The industry adopted trap size limits smaller than those allowed in the regulations, lower trap limits, a single hauling of traps per day, a shorter fishing season, and rectangular escape vents that have increased from 43 mm to 46 mm height to adjust to the new MLS. Traps were reduced from 250 to 235 in the Gaspé and a 10-year plan has been adopted to continue to reduce the number of traps in LFA 22 (see box for further details on the measures taken in Québec region).

In the Gulf Region, the number of harvesters has remained relatively stable between 1995 and 2006. In all LFAs, effort measures include: maximum trap size smaller than allowed in the regulations, limited trap hauls per day and there are multiple traps per line. Maximum hoop sizes of 152 mm have been adopted in LFA 23, and 25, escape mechanisms of 40 mm have been adopted in LFA 23, 25 and 26A. Other voluntary measures include no night fishing and encouraging fishers not to fish every day.

In the Maritimes Region, the number of harvesters has either remained stable or decreased marginally between 1995 and 2006. Other measures vary by LFAs and include: maximum hoop size; prohibition on landing v-notched females, maximum legal size limit for females; and, the prohibition on harvesting of females with one or both claws missing.

Québec Initiative

The responsiveness of industry and DFO in Québec to the 1995 Report deserves special mention. Harvesters on the Magdalen Islands and in the Gaspé started to implement recommendations of the 1995 report even before DFO requested that eggs-per-recruit be doubled. The perseverance of their associations, supported by DFO, lead to the adoption of restrictive but progressive conservation measures, with the over-arching objective being to ensure a decent and stable livelihood from the fishery over the long-term. Measures were implemented gradually to minimize the immediate impact on individual harvesters while ensuring a significant impact on exploitation over time; compliance was high (attitude is "if I can't cheat – you can't cheat…"), and both the local fisheries association and DFO had a will to improve lobster stock conservation.

Having reached DFO's target of doubling the eggs-per-recruit through an increase in minimum legal size of 6-7 mm over 7-8 years, harvesters also increased the average weight of lobsters landed by 25 %. This improved the per unit market value from the resource significantly. More recently harvesters and DFO are going further, starting in 2006, the potential increase in fishing effort was limited by restricting trap size and reducing the number of traps per licence (a reduction of three traps per licence a year for each of the next ten years in the Magdalen Islands and an immediate decrease from 250 to 235 traps in the Gaspé, in addition to a self-rationalizing of the fishing fleet through a buy-back program). Moreover, in the Magdalen Islands, the daily fishing time was restricted to between 5:00 am and 9:30 pm. These measures were added to already existing measures of reduction of fishing effort put forward in the past such as banning fishing on Sundays and eliminating large traps.

As in many other LFA's, the fishery in Québec, especially in the Magdalen Islands has increased its efficiency in the 1980s and 1990s through technological improvements and the use of larger vessels. Reducing the number of traps, and limiting the size of traps, the number of traps per line, and the length of lines, as well as reducing fishing time per day, forcing a single hauling per day were seen as ways to limit potential increase in fishing effort. These measures were intended to contribute to equity among harvesters using both large and small vessels and decrease the incentive to over-capitalize by acquiring even bigger vessels. Both the industry and DFO recognize that much remains to be done to further enhance the sustainability of the fishery.

Industry views on fishing effort

Unlike the input received by the FRCC in 1995, one of the dominant themes expressed throughout the recent consultation process was the need to reduce the fishing effort in the lobster fishery. Most participants hold the view that there is too much fishing effort. Dependence on the lobster resource is high and harvesters indicate there are limited opportunities to diversify their fishing operations. Harvesters link the economic returns from the lobster fishery to the conservation of the resource. In a few areas economic returns are high and landings are at or near peaks. The view of many harvesters, particularly in economically depressed areas of the fishery, is that increasing fishing effort is currently jeopardizing resource conservation or will have an effect on sustainability of the fishery. In the LFAs that are yielding low average landings harvesters are forced to exert more and more pressure on the resource in attempts to maintain their involvement in the fishery. There are areas that are considered to be no longer sustainable, particularly from an economic perspective. As noted previously in this report, the FRCC views economic sustainability as an essential element in achieving overall sustainability for the lobster fishery.

During the FRCC consultation process some harvesters from the LFAs that have reasonably high landings advised the FRCC to leave the fishery as is. At the same time other harvesters fishing the same areas advised that there is too much fishing effort being directed at the resource. Even in areas where the landings have been relatively high there was an underlying anxiety among participants concerning the high effort and what it may mean for the future direction of the fishery. The investment by harvesters has increased significantly in some fishing areas and this high investment has further increased the risk to the economic sustainability of the fishery.

Response to 1995 Report

The overall response to the 1995 recommendations to reduce exploitation and fishing effort has been limited. The number of active licences in the principal areas of the fishery has remained relatively unchanged; technological improvements have continued to increase effective fishing effort; effort is also up due to the impact of capitalization through investment in larger, faster and more efficient vessels as well as increases in the frequency of trap hauls, and hoop and trap size increases. The institutional structures that manage the controls on the lobster fishery are generally static and inflexible relative to the dynamic nature of the fishery.

The FRCC considers that with a few exceptions, the current system of 'input controls' is in fact not capable of controlling the increase in exploitation rate. It is neither proactive nor reactive in most LFAs. The exploitation rate is related to the effective fishing effort. Many other fisheries have demonstrated that increasing fishing effort creates a pervasive pressure on the resource and decreases the ability of management to achieve sustainability objectives.

The FRCC in its 1995 Report recommended significant reductions in both exploitation rates and effective fishing effort. There is little evidence that fishing effort has declined and there is no protocol to define or measure effort in the lobster fishery. The FRCC believes that reductions in exploitation rates and fishing effort are necessary to reduce the risks to the sustainability of the fishery. Reductions can be made progressively over a reasonable period of time. The extent to which reductions are necessary varies from area to area. Reductions in exploitation rates and fishing effort would reduce the risks of over-exploiting the resource and would help improve the economic component of sustainability.

The most common measure of fishing effort for fisheries such as lobster is to measure the catch and number of trap hauls that yield the catch. In the case of the lobster fishery, trap hauls are not generally recorded nor are the landings adequately measured. It is therefore not possible to evaluate the significance of fishing effort reductions where they were implemented, but the reductions have generally been so small that it is unlikely that they have been useful in reducing exploitation rates.

The 1995 Report also suggested that shorter fishing seasons could be helpful in reducing effort in LFAs where the season is relatively short provided that the shortened period occurs during the time when fishing is most productive i.e. at the beginning of the season. In addition, the report suggested that large reductions in fishing time (50%) would be in order in areas where seasons were lengthy (Nova Scotia south of LFA 32). In reviewing the changes adopted since the 1995 Report it is apparent that no material change has occurred in the fishing seasons that would have reduced fishing effort.

The 1995 recommendation to reduce the number of fishing days was implemented in a number of LFAs. For example, the fishery has been closed on Sundays in some areas. Harvesters report that one of the effects of this daily closure has been an expansion of fishing by non-licensed harvesters in areas where commercial harvesters have agreed to not haul their traps. There is

no evidence to suggest that the other 'tools' to reduce fishing effort proposed by the FRCC in 1995, as outlined above, have been utilized or implemented.

In summary, the FRCC concludes that the fishing effort reduction measures recommended in the *1995 Conservation Framework for Atlantic Lobster* have not generally been implemented. There has been no material reduction in overall fishing effort, except as noted above in the Québec region that has taken initiative to restrict fishing effort.

The FRCC recommends that measures of effective fishing effort be defined and monitored for the lobster fishery, e.g. catch per trap haul.

6.3 Fishing effort drivers

In light of the lack of response to the 1995 proposed initiatives to address increasing fishing effort in the lobster fishery and the current concerns of harvesters on the matter, the FRCC has reviewed the primary factors that are causing the continuing increases in fishing effort in the lobster fishery.

Competition

One of the most significant factors that drives fishing effort in the lobster fishery is competition. Under the 'input control' structure as currently exists, competition among harvesters is intense as each enterprise is motivated to harvest the greatest number of the available lobsters as fast as possible during the fishing season. The harvester that employs more fishing effort i.e. fishes harder, is usually rewarded with higher landings and higher economic return as compared to his neighbour who employs less fishing effort. An example of how fishing effort has increased in the southern Gulf of St. Lawrence is depicted in Figure 11.

Generally, the lobster fishery is characterized by very intensive fishing, particularly during the early days of the season, as landings are usually highest at this time. New recruits to the fishery are for the first time generally available and as the days and weeks of the season progress less and less of the resource is available to the traps and landings per trap haul decline. Competition among harvesters for the available resource is characterized by:

- The 'rush to fish' – traps in the water as fast as possible on the most productive grounds;
- The increase in the number and size of traps;
- The increase in hoop size to exploit the larger animals in the stock;
- The investment in larger more capable vessels;
- The increase in fishing time (hauling traps); and,
- Improvement in the technology, e.g. GPS, sounders, bottom imaging, etc.

These competitive characteristics are evident to varying degrees in all LFAs and in many are becoming more and more pronounced. As a harvester was recently quoted in the *l'Acadie Nouvelle* newspaper: "*we use to fish what the sea would give us. Now harvesters want to catch everything. They have radars, GPS. Lobsters have no chance.*"

The competitive pressures in the lobster fishery cause harvesters to reduce their rest time and operate in sea conditions that increase the risks during the most productive fishing periods i.e. initial days and weeks when landings are highest. The competitive pressures appear consistent with increasing non-compliance in the fishery and the need for increased monitoring. Based on the frequency that harvesters expressed concerns related to the increasing instances of harvesting undersized lobsters, berried females, v-notched lobsters, and the numbers of illegal traps being fished, it would be reasonable to conclude that these activities are largely being driven by the increasing competition for a limited resource.

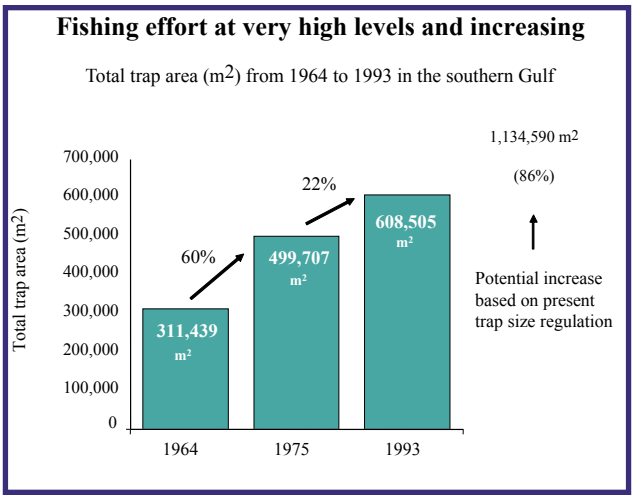


Figure 11: The bar graph shows the increase in total trap area in the southern Gulf of St. Lawrence during the period 1964 to 1993 and the potential increase in trap area that could occur based on trap size regulations. Figure provided by DFO Science, Gulf Region.

Over-capitalization

Each season innovation and additional fishing effort causes ever increasing exploitation on the lobster resource. In years when recruitment is low, harvesters are motivated to take further risks to maintain their income and pay the higher carrying costs on their larger, more capital-intensive enterprises. The only means for an enterprise to maintain or increase its landings is to fish harder than its counterpart or use the best and latest technology available. As one enterprise invests in a larger or faster vessel, or a new more efficient trap, to increase its landings, its competitors are forced to do likewise. If a harvester experiences a lower 'take' from the fishery then they adapt/invest to expend more effort to remain competitive. This situation leads to further increases in investment and per unit costs to harvest an ever-declining share of the landings over time. This inevitably results in an erosion of at least two of the four components of sustainability as the resource becomes over-exploited and the fishing enterprises become unprofitable. Currently the lobster fishery in a number of LFAs could be categorized to be in this situation.

Figure 12 demonstrates that when landings improve there is generally new investment that occurs in the fishery. In LFA 34 there has been a significant improvement in landings since 1985 while at the same time fleet replacement and increases in vessel engine power have changed materially.

Under situations where input controls are not effective in controlling the fishing effort, effort would increase to a point where the increased investment and cost of operation begins to outweigh the incremental revenue that the enterprise can derive from the resource. At this point both the resource and the enterprises depending on it, experience significant declines and sustainability is compromised. Eventually, harvesters will be forced to adjust the size of their investment and reduce the operating costs of their enterprises.

Unfortunately under the current fishing strategy there is little motivation for participants to ensure that the economic value derived from their fishing efforts is maximized other than by landing more lobster. Resource wastage, poor fishing practices, and high relative costs result.

Employment Insurance

In theory, the number of active licences should decrease when fishing yields low catches and enterprises are unable to provide a reasonable livelihood to participants. In practice, often licences will remain active even if the licence holder is not making a profit from the fishery because it provides access to the Employment Insurance (EI) system. EI acts as a buffer to enable harvesters to maintain their presence in the fishery, particularly in periods of resource decline. The book *Political Environmentalism: Going behind the Green Curtain*, (by Terry Anderson, Hoover Institution Pres, 2000) notes that during the period of the decline and collapse of groundfish stocks, the fishery experienced increases in fishing effort despite the fact that earnings from fishing were sharply in decline. As dependence on EI as a portion of overall income increases, it contributes to maintaining or increasing fishing effort that would otherwise be forced by economic circumstances to decline or depart the fishery entirely. It is clear that

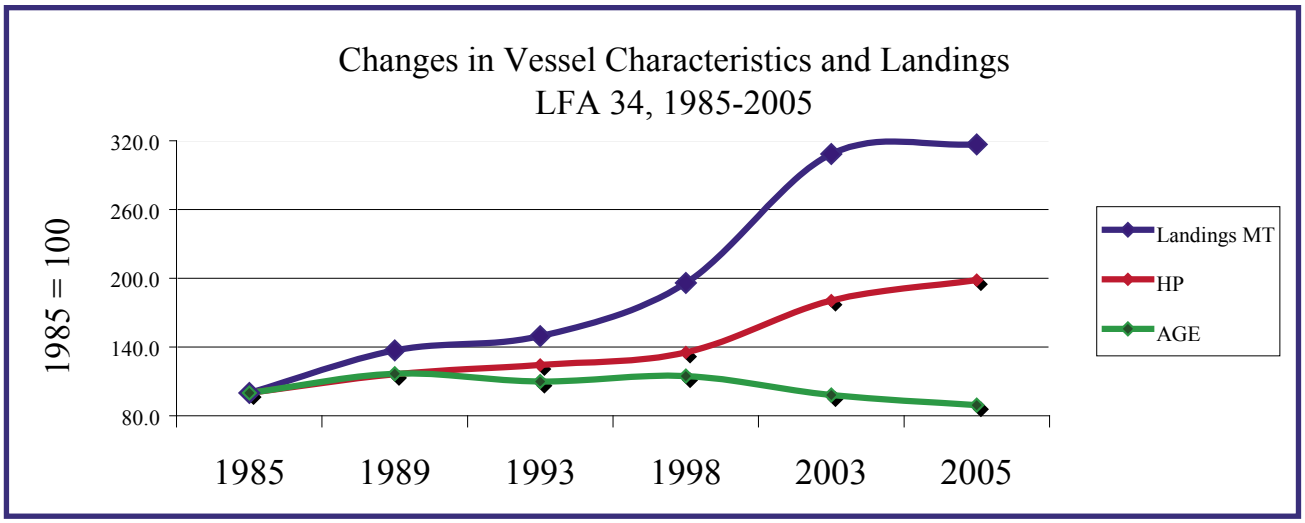


Figure 12: Trends in vessel age (green), vessel power in brake horsepower (red) and landings in LFA 34 (blue) for the period 1985 to 2005. Landings have significantly increased over the period while the other indicators show that investment in new vessels with higher engine horsepower have also increased.

the combination of limited employment and EI benefits has contributed to maintaining many harvesters in the fishery who would have otherwise left if alternative employment were available in the community.

Qualification for EI benefits is based on a threshold of the harvester's income as measured in dollar value, irrespective of the time the enterprise devotes to the fishery. This inherent flexibility enables those dependent on the resource to arrange their efforts to maximize benefits from the EI system. In some situations, EI benefits become the harvester's only real personal income from fishing. The end result is that the resource can be experiencing sharp decline and no longer able to sustain the fishery in an area while at the same time the number of participants and the fishing effort continue at an unsustainable level for prolonged periods. This situation can lead to an even further increase in exploitation on the resource and prolong the period for resource recovery.

Although the FRCC has noted the negative effects that the EI program may have on resource sustainability, it is not making a value judgment on the program in the lobster fishery. The program is an integral part of harvesters' income, as it is in other seasonal industries in Canada. Under certain conditions, when economic returns from fishing are reasonably satisfactory for those who participate, the EI benefits can limit exploitation on the resource for additional income.

Conclusion on fishing effort

By nature, the efficiency of the fleet increases season after season; therefore, as efficiency increases so does resource exploitation in the absence of other measures to restrict fishing effort. The more the exploitation increases the lower the number of lobsters left to reproduce in future years. High exploitation makes the lobster fishery increasingly dependent on new recruits. To prevent exploitation rates from becoming unsustainable, the current effort control structure requires that management adjust measures to counteract the increasing fishing effort. In order to accomplish lower exploitation rates, bold measures must be taken to significantly reduce the fishing time allowed or reduce the number of traps deployed. Other measures that could be introduced to reduce exploitation under the current input control structure include increasing the minimum carapace size limits. In any case input control fisheries must reduce fishing effort periodically to counteract the ever-increasing efficiency and to preserve the reproductive potential of the resource.

One of the challenges with targeting effort reduction is that there is currently no measure of effective fishing effort nor of how much fishing effort has increased over the past years. The number of trap hauls relative to the catch has not generally been measured in the lobster fishery. Without objective baseline measurements it is not possible to accurately determine the increase in fishing effort that has occurred even though harvesters appear unanimous in the view that fishing practices have changed and their effort continues to be more and more efficient. It is noted that fishing effort on lobster has increased in recent decades due to the decline in availability of groundfish; increases in vessel size; larger and more powerful vessels; the expansion of fishing grounds to include offshore areas; the targeting of larger size lobsters in certain areas; increases in trap size; multiple trap hauling per day; advances in technology; the need to compensate for increasing fishing costs e.g. fuel; and the need to maintain landings in the face of declines in catchability or abundance in some areas.

The FRCC concludes that, except in those areas (e.g. LFA 20–22) where explicit management measures are in place to reduce fishing effort, the current fisheries management strategy is resulting in steadily increasing fishing effort and exploitation rates. The FRCC believes that steadily increasing exploitation rates will progressively increase the risks to the sustainability of the resource and to the sustainability of the fishing enterprises. Although the resource may be more resilient than previously believed, many fishing enterprises are not. Any significant changes in one of the factors affecting economic viability - resource abundance, cost of fishing, decreases in prices, etc. could place a number of fishing enterprises in considerable economic difficulty.

The FRCC recommends that for each LFA, DFO and industry establish mechanisms to adjust fishing effort to achieve ecological and economic sustainability objectives.

6.4 Options to reduce fishing effort

One of the most significant challenges for stakeholders in the fishery is sustainability. Sustainability is often compromised because fishing effort and resource exploitation are not in reasonable balance with the available resource. Often high fishing exploitation does not generate revenues sufficient to provide reasonable economic returns to participants. The challenge is to establish mechanisms that allow the fishery to adjust when resource abundance and economic conditions change. There is a need for a dynamic institutional

system that periodically reduces fishing effort rather than allowing it to steadily increase as the current static system does. While there are several options that could be considered to reduce fishing effort in the lobster fishery, the FRCC has chosen to limit the options to those concepts that were raised through its review and consultation process. They are as follows:

1. A buyout of excess capacity and a permanent retirement of licences;
2. A significant reduction in the length of the seasons and/or significant reduction in the number of traps per licence;
3. The implementation of quotas with a transferable component;
4. The implementation of territorial use rights; or
5. The implementation of a transferable effort system.

Harvesters often disagree on the measures that should be taken to ensure sustainability and generally there is no consensus on how to address the increases in fishing effort. Individual harvester's views on how to reduce fishing effort are often phrased in the context of what can best work from their personal perspective. In most cases the perspectives varied within the same LFA. As one harvester stated "*When you are here as yourself, you are not always thinking of the collective good and this may cause problems in the future. Sometimes as harvesters we have strong feelings on what should be done but it may not always be practical*". Due to the large number of harvesters (usually hundreds) within most LFAs it is unlikely that under the current competitive structure that consensus could be reached as to how best to reduce fishing effort. This characterization is by no means universal. As described earlier participants in Québec have initiated measures to restrict and reduce fishing effort. From a management perspective it may not be practical to contemplate further division of the LFAs as occurred in Québec due to the high number of licences relative to the overall size of many LFAs and the inter-provincial issues that affect many areas of the Gulf of St. Lawrence. The options that follow are presented for consideration and certain elements of the various options may be useful in combination in some LFAs. They are not meant to be mutually exclusive.

Buyout

During the FRCC consultation process many harvesters suggested that the Government of Canada through DFO should initiate and fund a licence buyout program. The aim of the program would be to significantly reduce the number of licences in the lobster fishery. Harvesters indicated that there is widespread over-capitalization in the lobster fishery and that there is no consensus of support among participants for significant changes to input controls that would reduce the fishing effort. Many of the harvesters and representative harvester groups that expressed views on the fishing strategy indicated little or no support to transition from the 'input control' structure of the fishery to other structures that could more readily realize effort reduction.

Industry participants indicate that the excess capacity in the lobster fishery may be as high as one-third or more, depending on the LFA. It is also apparent that in some areas the reduction in licences would have to be well above this threshold to significantly reduce the fishing effort and have the desired affect of enhancing sustainability while in other areas the reduction would not have to be as high. In some LFAs, measures are already in place to control and reduce fishing effort.

A buyout of capacity would be very costly as lobster licences are highly valued in most LFAs. Even in LFAs where the average landings are low, the cost to acquire a fishing licence is relatively high. This is in part due to the income from EI that is directly linked to the revenue derived from the licence. Considering the overall number of lobster licences, the cost to reduce capacity significantly would likely be excessive. What is perhaps more important at the conceptual stage is the potential usefulness of a licence buyout. Primary consideration must be given to several factors.

Initially, a large buyout program would significantly reduce the fishing effort in the fishery. The scale of a buyout would have to be very significant to have a lasting effect. It would also have to be coupled with other restrictions or adjustment mechanisms in order to neutralize the competitive nature of the fishery and the other 'drivers' discussed above. Otherwise, there would be a tremendous motivation for those remaining in the fishery to immediately respond to the opportunity to capitalize on the resource left available by those who exit the fishery. Over the short-term harvesters would have an added incentive to invest in vessels and equipment that would increase their efficiency. In the absence of controls on effort, harvesters would fish 'harder' and landings would quickly increase to yield a harvest similar to that prior to the buyout. The cycle of over-capitalization would begin anew.

A buyout of lobster licences could also cause a significant shift of fishing effort directed at other limited resources that are already fully exploited, unless those who participate in a buyout are not allowed to continue

in any fishery. Indeed, some of the increased effort in the lobster fishery has resulted from the decline in groundfish resources. The licence buyout programs in the groundfish industry did little to reduce the overall fishing effort. Following the groundfish collapse of the early 1990s, the overall fishing effort did not decline substantially as enterprises shifted their fishing efforts into other fisheries, particularly shellfish. Therefore, a buyout option can only be effective when combined with other measures to restrict fishing effort or mechanisms that allow for self-adjustment within the industry itself.

The primary responsibility for adjustment should rest with the industry. The industry in Québec has already taken the lead in controlling and reducing fishing effort. Some believe that if you do nothing to balance effort with the available resource and enhance sustainability then the government will at some point bail out those that do not act responsibly.

The FRCC supports options that involve self-rationalization within the industry. The FRCC concludes that a government-funded buyout of licences is not an effective means to deal with the over-capacity in the lobster fishery. If it is decided that a buyout is preferred then it should be done in conjunction with other mechanisms that will ensure that the fishing effort is not allowed to increase following a buyout.

Fishing seasons and/or trap limits

The option to reduce fishing effort by reducing the fishing seasons/days and/or reducing the trap limits was proposed by the FRCC in its 1995 Report. As previously discussed there was minimal response to the recommendations related to reductions in fishing effort for most LFAs, except for areas in Québec. Prior to 1995, steps had already been taken in Québec to sub-divide LFAs to create smaller areas that enabled participants to work more closely. This development appears to have facilitated a favourable response to all aspects of the 1995 Report in the region. In the context of the large number of participants in most fishing areas it is very difficult to reach a consensus on how to reduce fishing effort through shortened seasons: depending on the natural distribution / migration of the resource and a number of local factors. The effects of any decisions are likely to be unevenly distributed amongst harvesters. Therefore, changes aimed at restricting fishing effort that require the consensus of a large number of harvesters are difficult to achieve.

The FRCC concludes that in large LFAs with numerous participants, reductions in the duration of the fishing seasons are likely to have unequal consequences for the participants. In addition, it is conceivable that in a recruitment fishery, a shorter season would further exacerbate the over-capitalization problem in the fishery, as participants would be driven to land their catch in a shorter timeframe. Should reductions in the duration of the fishing seasons be considered, it would be a challenge to develop additional measures to ensure that the intended effects of the reduced fishing seasons are not negated by increased efficiencies through other means.

It may be easier to achieve consensus on reducing the number of traps per licence. Such a trap reduction strategy could be implemented over a period of years e.g. ten traps per year over five years. This would have an equal affect on all enterprises in an area. Such a strategy would require enhanced measures to enforce the trap limits and safeguards to ensure that the intended effort reduction is not compensated by increases in the number of trap hauls or by increasing the volume of the traps, etc. While it may be possible to design and implement such measures, it will require the introduction of monitoring systems that are currently not part of the controls in place for the lobster fishery. In Québec, harvesters in conjunction with DFO management have implemented time of day restrictions to inhibit 'creep' in fishing effort by increasing the frequency of trap hauls that is made possible by harvesters spending more time at sea. The incentives that are created by the current competitive fishing strategy require incremental measures to ensure that fishing effort does not increase to negate the effort reductions intended through trap reductions.

The current fishing strategy is most effective when harvesters take an active role in establishing the restrictive measures and demonstrate a commitment to comply, and have others comply, with the intent of the measures rather than undermine them. This requires an ongoing engagement and monitoring of results to achieve the overall objectives.

The FRCC recommends that harvester groups within LFAs that choose to maintain the 'input control' structure implement measures to monitor, reduce and restrict fishing effort. The measures introduced should be monitored and include trap reductions, reductions in the fishing seasons, reductions in licences, restrictions on the frequency of trap hauling and the time of day that fishing can be conducted.

Output controls – individual quotas

A fisheries strategy that provides quotas to individual harvesting enterprises is one of the most common structures implemented to remove the undesirable effects of highly competitive fisheries. One of the biggest challenges to implementing individual quotas is establishing how the initial Total Allowable Catch (TAC) will be distributed among participants. Most quota-managed fisheries require data on the size of the biomass to determine how much of the resource should be exploited by the fishery, but this is not an absolute necessity. The initial setting of a TAC for a lobster area would be difficult to establish because the biomass is generally not known and there is little fishery independent scientific data to objectively set a TAC. Depending on the specific circumstances in each given LFA, a conservative TAC could be established based on conservative estimates of exploitation and expected future changes in stock sizes. The TAC would require monitoring to ensure that the landings are sustainable. The allocation of the TAC to individual fishing enterprises could be on the basis of: 1) the landings history for an agreed number of years; however, that information may not be available or reliable for all LFAs; 2) by equally dividing the quota among participants on the proportionate number of traps licensed; 3) by sharing the quota on some other agreed basis among harvesters; or 4) some combination of the other three. The challenge is to share the quota in a fair and equitable manner. One of the concerns with dividing a quota based on landings relates to the degree of non-compliance that could cause inequity. For example, IQs based on landings could reward those that have exceeded the trap limits.

Although individual quotas (IQ) will not eliminate the 'race for fish' it is possible that the intensity of competition in the lobster fishery will adjust and result in a more dispersed landing pattern. In a well-managed IQ fishery, the incentive is expected to shift from 'chasing the resource the hardest' to seeking to maximize the value of one's landings. Even though lobster is one of the most valuable resources in the Atlantic fishery, it is often wasted and loses considerable value under the current fishing strategy. Because harvesters would be penalizing their own enterprise financially if they wasted the resource, there would be no incentive to continue poor fishing practices under an IQ structure.

An IQ system would not reward excessive fishing effort. Instead, it would cause harvesters to reduce their costs to the minimum. As an example, if an individual quota could be harvested by deploying only 60% of the traps currently in use to capture the same seasonal landings, then the harvester would naturally reduce fishing costs accordingly. Both capital and labour would be optimized to achieve the greatest return from the limited IQ assigned. There would also be an incentive to improve the quality of landings and harvest the resource when the market return is highest. A more measured pace to the fishery could be fostered, which would significantly reduce the costs of handling, transporting, processing, marketing and financing the fishery in comparison to the current 'glut' in landings that occurs at the beginning of each season. To the extent that the catchability of lobster declines through the season, some of these benefits may not materialize.

An IQ system will require increased controls to ensure each harvester's landings are within that assigned to the licence. The control commonly used to monitor individual quotas is an independent dockside monitoring of landings. The cost of monitoring would be higher than at present, but would likely remain low relative to the high value of the lobster fishery. Indeed, it is likely that the incremental costs to monitor and control landings would be much less than the incremental value derived from higher per unit market returns that can be achieved under a quota structure. Increased monitoring and controls at sea are also necessary under a quota system as there is a strong incentive to maximize the value of the landings. However, high-grading is not seen as an issue in the lobster fishery, because regulations require a form of mandatory high-grading by returning undersized lobster to sea. The increased control and monitoring of landings that would result from a quota system would however, enhance the quality of data derived from the fishery and be of value to scientists/managers who study the trends in landings, analyse catches, and assess and advise on the status of lobster stocks.

To the degree that effort reduction is required quota transferability will be necessary. There can be variations to quota-based structures that can foster self-rationalization and limit the extent to which any one licence can increase its individual quota. The over-capitalization in the lobster fishery can be addressed through an ITQ structure that incorporates transferability among participants. Quota transferability facilitates stewardship and establishes a sense of ownership in the future yield from the resource. Such a change would allow the industry to achieve self-reliance as the combining of quotas would yield increased revenues while at the same time it would reduce harvesting costs. Therefore, economic viability would be sustained and the system would have a mechanism to self-adjust to changing resource

availability and changing economic conditions. **While there is currently little interest on the part of industry to adopt an individual quota structure, and there are a number of challenges that would have to be addressed to implement IQs, the FRCC believes that the introduction of IQ/ITQ management systems could be useful to enhance the sustainability of the lobster fishery where harvesters have the desire to take the initiative.**

Territorial use rights fisheries (TURFs)

The concept of territorial use rights fisheries (TURFs) is used in near-shore coastal fisheries where larger management areas are subdivided into smaller and more specialized zones. Exclusive fishing rights to these autonomous zones are then granted to a designated group of enterprises. The harvesters form a representative organization that is responsible, in consultation with fisheries managers, for developing and implementing, agreed management measures tailored to local conditions. Such measures must respect the overriding conservation requirements such as minimum legal size, berried females, etc. but more local issues such as seasons, start/end dates, number of traps per licence, trap size, etc. are determined by the local management group for their exclusive zone. Such a system provides a decentralized co-management system whereby harvesters can address items that are of concern to the collective group in their fishing area without having an effect on others outside the zone. Indeed, some LFAs could be composed of many of these smaller zones if agreement could be reached with respect to the spatial dimensions. In one particular example where this system exists the local harvester management group has created centralized offloading/storage facilities, focused marketing, local seeding and enhancement projects, and even the pooling and sharing of income from the fishery.

One of the strongest components of these systems is the use of peer pressure as a tool for enforcement of the rules through a committee that reviews breaches of the rules and determines remedial measures. While there are administrative costs associated with such a concept, TURFs are effective because the participants have a sense of ownership and are prepared to make individual sacrifices and participate in a system that can reap benefits for the entire group. It is a concept that could work in parts of the Atlantic lobster fishery. As noted earlier, similar arrangements, although less formal already exist in some parts of Québec. TURFs would allow the harvester management groups to establish thresholds and restrictions on fishing effort that would maintain balance with the available resource.

For a TURF to be most useful the participants would have to consist of a homogeneous group and be able to form an organization that is truly representative and capable of managing within the local geographic area defined. Some of the challenges that would be faced relate to the relative high number of participants in certain LFAs and the overlap that occurs between fishing areas that depend on resource migration. The TURF concept would also be a challenged to manage in situations of resource decline or where the economic viability of participants was jeopardized. Such situations require mechanisms whereby adjustments are required to the number of participants that can reasonably be sustained by the fishery in an area.

The FRCC recommends that TURFs be considered where appropriate and the characteristics of the area are such that the option can enhance management within the LFA. Some of the existing LFAs could be divided to create collective rights within some harvester groups that are like-minded and willing to take on co-management responsibility. The TURFs structure could readily be adapted to formalize the existing structure within some areas of the Québec fishery.

Transferable effort allocations

Transferable effort structures exist in a number of input control fisheries internationally. Fishing strategies under these structures have highly regulated input controls. Input measures in the fisheries that employ such structures are similar to the measures presently in place in the lobster fishery. The input controls include trap limits, trap size and construction, escapement mechanisms, protection of reproductive females, minimum and maximum carapace size limits, established seasons, vessel size restrictions, etc. The development of transferable effort structures for such fisheries resulted from the difficulties experienced due to competitive forces and the inherent inability to adequately restrict fishing effort and capacity over time, despite the multi-faceted controls on input.

Transferable or tradable effort systems assign participants access to the resource by regulating the number of traps each enterprise is licensed to fish while allowing enterprises to trade or transfer traps to other licensed harvesters within a defined area. The primary control

and compliance feature of such a system places emphasis on ensuring that the number of traps utilized is within the established regulations. Compliance is monitored through trap tagging and seasonal verification of the number of traps by independent control processes. As noted above, the current monitoring and control of trap limits would have to be significantly enhanced to be effective under such a system.

Transferable trap structures are best utilized when the regulator implements overall effort reduction programs by reducing the number of traps per licence over a period of years. When such a structure was implemented in Florida trap reductions of 10% per year for four years were implemented. A transferable trap system can enhance sustainability as compared to the current static structure by providing flexibility for harvesters to acquire traps from other enterprises. In this way harvesters that wish to maintain their fishing capacity (number of traps on their licence) have an incentive to acquire traps from other participants. Providing for trap transferability allows the flexibility for industry to self-rationalize. Such rationalization reduces the number of participants and reduces overall capacity. Excessive capital is removed from the fishery and the unit costs of harvesting are reduced. Therefore, economic viability is enhanced while at the same time the exploitation rate can also be reduced. One such idea that was proposed during the FRCC public consultations was to allow the harvesters acquiring the trap permits from another to only add one-half the number purchased. In other words, if a harvester acquired 100 traps from another that harvester would only have the right to increase his/her trap limit by 50.

A transferable trap system also requires monitoring of baseline targets to monitor resource status. Most often the baseline measures include the monitoring of catch per trap haul. For such a structure to operate in Canada's Atlantic lobster fishery steps must be implemented to control and monitor landings relative to the effort i.e. number of trap hauls. The overall objective of the system is similar to other fishing strategies that seek to ensure sustainability. The weakness of this type of structure is that the competitive 'drivers' remain and periodically steps have to be taken by the regulator to reduce 'effort creep'. This presents the same challenge as discussed under the existing structure in that it is very difficult to get consensus on the measures to be taken to reduce fishing effort. The structure also falls well short of maximizing the value of the resource that would otherwise accrue under a more efficient fishing strategy.

The FRCC recommends that transferable trap systems be considered as an option in some LFAs where there is the need to improve economic sustainability of fishing enterprises or where over-capacity is threatening resource conservation.

6.5 Summary

In summary, the FRCC emphasizes that the current fishing strategy has no mechanisms to control fishing effort. Given the competitive effort drivers described earlier, effective fishing effort and exploitation rates are expected to increase steadily. This puts the ecological sustainability of the resource base, the economic sustainability of the fishing enterprises, and the social sustainability of fishing communities at considerable and increasing risks. The risks may be difficult to perceive by many participants in productive LFAs where harvesters have experienced increasing landings such as in LFA 34, but those in less productive LFAs are fully cognizant of the risks. The steady increases in landings are at least partially due to increased resource abundance but also to increased fishing effort and improved efficiency. The stability of these high landings should be cause for concern as the fishery by nature is subject to much variation.

Over-capitalization is currently threatening the economic viability of many fishing enterprises as average landings have declined to yield low average returns to harvesters in a number of LFAs. In addition, landings trends indicate that resource abundance is declining in many areas of the fishery. The current strategy is weak in that it encourages excessive fishing effort and over-capitalization while it has no mechanism to adjust to the dynamic nature of the fishery. The EI system is also exacerbating the fishing effort effects that naturally result from such a strategy.

It is also important to note that while the excessive fishing effort can be reduced by various other strategies, such reductions will not enhance sustainability if the underlying 'drivers' that create the high exploitation in the first place are not fundamentally addressed. The industry must take charge and reduce fishing effort where necessary in order to advance sustainability. The industry must also accept that if it insists on maintaining the *status quo* then it must also be expected to live with the undesirable outcomes that result. DFO must be attentive to the desire of those harvesters that have the best long-term interests of the fishery in mind.

The FRCC concludes that it is unreasonable to expect that sustainability can be achieved under the current fishing strategy in many LFAs. At some point, in the absence of concrete measures by industry, intervention will be necessary in the overall public interest to significantly curtail fishing effort so as to conserve and protect the lobster resource from an ecological perspective. The FRCC recommends that harvester groups and their representative associations review carefully the options outlined by the Council and develop options to manage/reduce fishing effort within their respective LFAs.

7. Management and compliance

7.1 Management of the lobster fishery

The 1995 Report

The 1995 Report concluded that harvesters "*...want to fully participate in conservation and management decisions...*" The FRCC recommended at that time that harvesters partner with DFO to develop detailed fishing plans that are most suitable to their individual fishing areas and that they be more actively involved in the development, implementation, and evaluation of science projects.

Some progress has been made on these recommendations. In the Magdalen Islands, cooperation between DFO and the industry led to the implementation of progressive management measures that have resulted in improvements such as doubling of eggs-per-recruit, increased average size, increased landings, and an increase in the value of licences. There are also interesting initiatives on the west coast of Newfoundland, the eastern shore of Nova Scotia, and on the Gaspé where harvester groups have worked closely with DFO and are beginning to take an active role in the management of the lobster fishery. In Nova Scotia a joint industry/DFO scientific initiative, the Fishermen & Scientists Research Society (FSRS) has been successful.

Despite these isolated instances, the management structure currently in place in most areas consists of an advisory process that provides a forum for providing views and opinions on various matters. These fora are useful for informational purposes and sometimes for industry input but do not provide for meaningful participatory management. Both DFO and industry must share responsibility for the lack of institutional progress as industry in most LFAs has been resistant to change and DFO has not demonstrated a willingness to involve industry in decision-making. The success in the Magdalen Islands is based on strong association leadership and support by DFO. There have been no institutional initiatives aimed at enhancing the role of industry in the management process.

First Nations

The First Nations people of the Atlantic coast are now important stakeholders in the commercial lobster fishery and wish to further expand their involvement. As indicated in the 1995 Report, communication between Aboriginal and non-Aboriginal groups, is an important factor of integration and relationship building. Although a few incidents have temporarily hindered progress, the FRCC believes that communication amongst all industry participants remains an essential ingredient to ensure cooperation and sustainability of the fishery. As commercial harvesters, First Nations people are required to comply with conservation plans currently applicable to all industry participants.

As more recent commercial participants in the modern fishery, there are still improvements that can be achieved through training and experience for First Nations people. To this end, DFO, in partnership with the Aboriginal People of Atlantic Canada, have introduced the At Sea Mentoring Initiative, a program consisting of the recruitment of native and non-native experienced commercial harvesters to teach new entrants the skills of commercial lobster fishing. The FRCC sees the interaction through training and communication with non-native harvesters as an important progression towards cooperation among industry participants. Today, most Atlantic native communities are involved in the harvest of lobster for Food, Social and Ceremonial needs. It is estimated that the fishery directed to these purposes, results in a harvest of less than 0.16% of total lobster landings annually. While some non-native participants maintain that some practices under the Food, Social and Ceremonial fishery are of concern, it is very unlikely that the harvest is significant enough to be material to resource sustainability.

The 1995 Report noted that the non-native commercial lobster harvesters have raised concerns over the sale of lobsters caught outside the commercial season. Non-native harvesters continue to maintain that they would prefer that First Nations people's participation in the food fishery be confined to the same season and regulatory system as the commercial fishery. This issue has been the subject of discussions between First Nations and DFO and has been resolved in some areas. In some areas, there remains a lack of respect of food fishing rights by non-natives and as a result, some vandalism of fishing gear is occurring.

The FRCC repeats its 1995 recommendation that communication between aboriginal and non-aboriginal communities be improved in order to clarify the respective positions and to improve the relationship.

Industry role

Generally, the industry remains discontent with its limited role in the fisheries management decision-making process. During consultations, as they did in 1995, harvesters expressed a desire to participate more in management of the fishery. DFO was often criticized for its lack of effort to integrate harvesters in the fisheries management process in any meaningful way. Harvesters want to be more than merely consulted. They want to participate in policy formulation, decision-making and they want the process to be transparent. In some areas, harvesters noted that decisions are made far away in regional centres of DFO power or in Ottawa.

Despite fairly widespread discontent with the lack of progress on key issues facing the fishery, there was a surprising reluctance to make any significant change. Harvesters appear reluctant to support changes such as quota management, black boxes, dockside monitoring, quality measures, waste reduction, or enhanced resource conservation initiatives e.g. carapace size increases. Some harvesters expressed the view that any new measures should be delayed until past changes have been analysed and evaluated. They noted that changes made subsequent to the 1995 Report have not been adequately monitored and evaluated.

The advisory committee process does not provide a mechanism for real participation in fisheries management. There is no sharing of authority and the system often suffers from a lack of transparency. There is little room for an institutionalized active role for harvesters in the management process. DFO cites (with some validity) the current legislative structure as an impediment to structural change. The proposed *Fisheries Act,* 2007 contains provisions that would provide a framework for a more structured and meaningful role for harvesters. These provisions are worthy of review to ensure that they respond to the requirement for a modernized, participatory approach to fisheries management.

Some harvesters feel that the sheer size of management zones and numbers of harvesters discourage collective action as it is difficult to get consensus on issues on an area wide basis. They urge the creation of smaller zones with a manageable number of participants that could make decisions and implement measures to benefit the local fishery. Clearly, this is only possible in LFAs where the zones have a degree of homogeneity and where the results of measures implemented could be measured. Any measures proposed must be consistent with or complementary to those taken in the broader context of the adjacent fishery or the basis of LPAs if they are to be identified.

The FRCC recommends that industry and DFO establish smaller groups of like-minded harvesters where appropriate in order to foster stewardship and promote the development of area-wide compatible measures for local lobster fisheries.

Empowerment of harvesters

Effective harvester organizations are a necessary prerequisite to cooperative initiatives. Unfortunately, the lobster fishery is not unlike many other fisheries along the Atlantic coast. It suffers from a lack of representational capacity on the part of harvesters. Lobster harvesters by nature are independent individuals. They are hard working, entrepreneurial, and are proud of their community contribution; however, these qualities make it challenging for them to work together in a focused collective way. In some LFAs, industry leaders lament the difficulty in developing organizations that are capable of representing significant numbers of lobster harvesters in order to address the many issues facing their industry.

There seems to be a collective inability of associations and DFO to come up with an action plan that focuses on joint, cooperative approaches. Often the status quo serves the wishes of many, despite the fact that it is clearly not in the collective long-term interest of the fishery. The success of harvesters in the Magdalen Islands in developing two subsequent ten-year management plans has been a challenge that most harvester groups in other LFAs have not been able to achieve. It requires strong leadership and effective communication to adapt to changing circumstances and realize the benefits of progressive new measures.

The lobster industry must better respond to evolving challenges in fisheries management. The impact of globalisation, a more complex regulatory environment, and various market forces require a greater focus and coordination among harvesters. The ability of industry to respond to these challenges and plan in an intelligent and organized manner is crucial to the advancement of the industry and important to sustainability. Recent thrusts toward international certification processes and their link with market access will also require a focused, coordinated response.

Professional harvesters' organizations or unions have had a relatively long history and varied success in Atlantic Canada and are a key capacity building vehicle for industry. The problem arises when a significant number of direct stakeholders, who participate in and affect a fishery by their actions, refuse to join and support organizations that pursue benefits for all. These individuals, who may exist in significant numbers, enjoy free benefits but undermine the collective will and solidarity of the industry. Unfortunately, governments have a low threshold of tolerance to unrest in fisheries matters and they often respond to the most intense pressure point instead of focusing on the long-term approach promoted by well-informed organizations. Such an approach often undermines credible organizations and discourages leaders who try to take a long-term strategic approach to the fishery.

Provincial governments have recognized this problem and have developed legislation in response to the desire to create greater strength in numbers for harvesters. All provinces involved in Atlantic fisheries have legislation supporting industry organization. Such legislation provides a framework that industry leaders and harvesters can use to create effective organizations through formalized certification, recognition, or accreditation mechanisms. Potential organizations can apply and will be measured against criteria regarding geography, membership numbers, sector participation and registration or incorporation. Once an organization is certified for a geographic area, harvesters are usually required to make mandatory dues payments to that organization, although harvesters in some provinces can choose to reject the mandatory requirements.

The degree to which legislation has facilitated organizational development varies from province to province. In Newfoundland and Labrador and Prince Edward Island there are comprehensive legal frameworks and large provincial organizations representing harvesters. In other jurisdictions there is a combination of legislated bodies, volunteer organizations and individuals unbound by legislation pursuing their own regional or community interests with varying success. While legislation facilitates organizational capacity, the real change has to come from the desire of harvesters to be involved collectively and organizationally.

As noted above, there appears to be a growing desire in most areas to pursue increased coordination and a managerial role in science, fisheries management and conservation that may extend to other industry initiatives. However, progress will be slow unless industry and governments take steps to maximize participation and make legislative changes to enhance organizational capacity. Ultimately sustainability will be dependent on and affected by the degree of organization capability and cooperation in various regions.

The FRCC recommends that, in provinces where organizational capacity is lacking, governments review their legislation to ensure it is practical and able to respond in assisting harvesters to organize in a comprehensive and effective manner.

The FRCC recommends that harvesters organize into effective associations representing common interests (with local chapters where appropriate). The industry associations should be well funded and capable of providing an effective voice for their concerns. Governments should facilitate capacity building within the industry by providing human resources to assist in organizational development and governance.

7.2 Compliance

1995 Report

During consultations relating to the 1995 Report, the FRCC frequently received comments on illegal activities including fishing out of season, fishing for personal use, the setting of illegal traps, the sale of undersized lobsters and the possession of egg-bearing females. The 1995 Report recommended: (a) that enforcement visibility be enhanced by increasing the time fishery officers spent in the field as opposed to the office; (b) the publication of offender's names; (c) the promotion of "Community Watch" or "Oceanwatch" programs; (d) more involvement of stakeholders in enforcement actions; and (e) increased penalties and sanctions. Since the 1995 Report there appears to have been progress on the first two items. DFO now regularly publicizes lists of convicted offenders and as discussed below fishery officers do spend considerable time on enforcement. However, few advances have been made in getting the industry more involved in enforcement activity and the severity of penalties has, if anything decreased with the loss of licence sanctions due to court challenges.

Industry views on compliance

As noted earlier, the FRCC was often advised during consultations of the diversity within the lobster fishery. While the Council acknowledges that the following issues and recommendations may not be applicable to all LFAs, the issues discussed are believed to be problems

in the majority of areas and the solutions offered would go a long way to improving the overall state of the lobster fishery. The FRCC has framed its analysis in the context of the risk to sustainability.

The industry's perception of non-compliance has not changed much since 1995. One of the constant themes heard during the 2006 consultations was the incidence of illegal activity in all lobster fishing areas, albeit more widespread in some than others. The illegal activity was characterized as follows: 1) poaching, usually during the closed season; and 2) illegal activities by commercial harvesters during the fishing season. Out-of-season poaching was alleged to be rife in some LFAs and consisted of fishing lobsters both for personal use and commercial sale. Since lobster seasons and minimum legal sizes vary from LFA to LFA, it is normal for buyers to have lobsters of varying sizes on hand. Thus, even though the season may be closed in a particular LFA, holding facilities in the area will still have lobsters in their establishment. It appears clear from comments heard during consultations that unscrupulous buyers have no reservations about purchasing illegal undersized lobsters from poachers.

While poaching out of season is a serious issue, the illegal in-season activity of commercial harvesters in the view of many industry members is much more insidious. It is usually characterized by the landing of short, berried and, where applicable, v-notched lobsters, the over-fishing of trap limits and fishing in adjacent LFAs. One of the most harmful actions is the use of illegal traps as the product that is landed conforms in all respects to size and other controls but has been acquired in an illegal manner. It was suggested to the FRCC that some harvesters set as many as 50% more traps than the allowed limit.

In general harvesters lay the blame for the continuing illegal fishing practices on DFO, the perception being that the department is not doing its job of enforcing the rules. Some suggest that if the current regulatory regime was enforced, there would not be a problem in the lobster fishery. There appears to be a degree of resignation on the issue leading to concerns that progressive harvesters may be discouraged from advancing new approaches to deal with the existing situation.

Critics cite various reasons for this perceived gap in enforcement including a lack of funding and personnel, a poor strategic approach and the absence of serious penalties. Some feel that fishery officers spend more time in their offices on administrative duties than in the field enforcing the regulations.

A NEW APPROACH

On the issue of compliance, the FRCC examined the perception that DFO is not doing its job of enforcing the rules in the lobster fishery. The enforcement effort on lobster is small relative to DFO's total enforcement budget; however, the department spends considerable time and financial resources on the issue. A review of DFO lobster enforcement efforts shows that officers spend a significant amount of time on patrols, stakeouts, observations, investigative activities and court related duties. While the time spent in the enforcement office seems significant, duties such as planning, preparing reports, dealing with prosecutions, etc. are necessary components of compliance activity (see Figure 13). Patrols and investigations are by nature low profile and not discernable by the industry and the public.

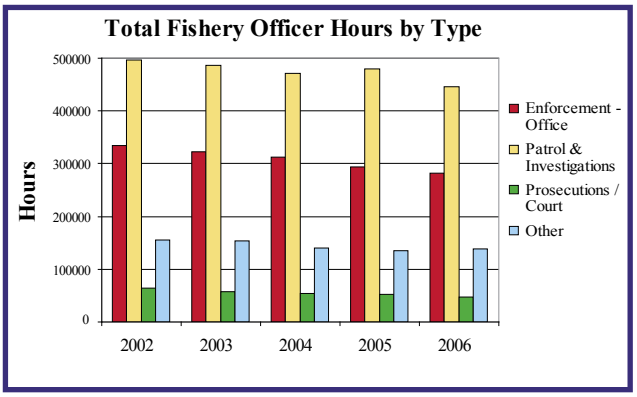


Figure 13: The bar chart shows that fishery officers spend considerable time on patrols and investigations and other compliance related activities.

A greater presence of fishery officers on the water and at dockside would have a deterrent effect; however, the FRCC is not convinced that more enforcement activity by fishery officers alone is the most effective approach to non-compliance. The nature of some of the illegality makes it a difficult task for any enforcement agency. The long, often secluded coastlines and out-of-the-way places that poachers utilize make it difficult to have more than an occasional impact on the problem. In addition, the volume and frenzy of activity during the early weeks of the commercial fishing season in some LFAs is such that only limited coverage is achievable.

There appears to be an opportunity for change and perhaps a shift in strategic approach. The 1995 Report recommendation to involve the stakeholders in enforcement activities seems to have been ignored. The industry has to take charge of its fishery and become more active in its management and control. In the end, this is a question of monitoring and controlling human

activity. What could be more appropriate than to charge the people involved in the industry with the task of managing and controlling their own behaviour for the collective good? **The FRCC concludes that there needs to be a more comprehensive approach taken to reduce illegal activities, one that involves all the participants in the fishery, from sea to market.**

7.3 Attitudinal change

During consultations, the FRCC was impressed by the initiative and commitment of industry in many areas of the lobster fishery. Furthermore, the majority of participants are dedicated professionals that devote considerable time and attention to the best interests of the resource. There are, however, participants that show little respect for the resource or toward the collective desires of the industry.

The FRCC was fortunate to have responsible harvesters come forward and openly discuss attitudinal issues within their respective LFAs. Most participants are greatly disturbed by the apparent frequency and nature of the illegal activities occurring in some LFAs. The lack of conservation ethic among some participants is discouraging to all interested in sound fisheries management. For those industry members who have no respect for the regulations, there clearly needs to be a change in mentality. Behavioural change is difficult to achieve, as it relates to values, principles and the common sense to recognize right from wrong. It means accepting responsibility and sacrificing personal gain for the collective good.

There appear to be five realities in the lobster fishery leading to unacceptable behaviour:

1) There is a substantial financial incentive to cheat. Setting traps beyond the limit reaps immediate economic gain. All the landings from illegal traps can be sold as legal product;

2) There is an apparent market for short, v-notched and berried lobsters;

3) Participants feel that there is a small chance of getting caught. Much of the activity is conducted at-sea and the monitoring at dockside is sporadic at best;

4) The penalties are relatively low and are easily offset by the value of the illegal activity; and

5) Finally, there is often little community outcry when offenders are brought to justice.

Given these unfortunate realities, it is little wonder that illegal activity appears rampant in some LFAs. The challenge is to identify the motivational factors that will change these realities and cause participants to act in a responsible manner.

A start to changing attitudes should be a brief, focused information session aimed at harvesters, buyers and processors. Such a cooperative information session should outline proper handling practices and the effects of illegal and irresponsible practices on biological and economic sustainability. Local workshops could be scheduled prior to the start of a season to facilitate the delivery of information and seek solutions to current challenges. There is useful material available on the subject that has been developed by harvesters' groups and related agencies. While some harvesters will disregard such sessions, these initiatives will help to sensitize participants to some of the critical issues in the industry. One thing appears clear - unless and until the attitudes change in some areas, it will be difficult to make progress on improving compliance in the fishery.

The FRCC recommends that, prior to the commencement of fishing, workshops should be held to provide information on issues such as proper handling practices, enforcement, management issues and the effects of illegal behaviour.

7.4 Cooperative approaches to compliance

The enforcement of regulations in the lobster fishery is in the best interests of sustainability and should involve all stakeholders. It appears, however, that the view among most industry members is that enforcement of the rules is the exclusive responsibility of DFO. This is no longer an acceptable approach. It is time for the entire industry to address its own behaviour in the lobster fishery. There are roles for all participants and they should be required to contribute to the orderly conduct of the industry. All participants must step up and be held accountable for their activities and mechanisms need to be established to facilitate participation.

Much of the illegal activity relates to the harvest of undersized, berried and v-notched lobsters – all of which are easily detected by visual inspection. It is difficult and very expensive for fishery officers to monitor at sea due to the logistics of boarding large numbers of vessels. Such inspections would be much more effective

and efficient if conducted at dockside, in processing plants and in holding facilities. A monitoring program would greatly reduce the incidence of illegal lobsters entering the marketplace and increase the effectiveness of enforcement initiatives. No longer should it be acceptable for a harvester or a buyer to be in possession of undersized or v-notched lobsters in an area where they are prohibited unless they are able to produce documented proof that such lobsters have been obtained in the normal course of the fishery. The onus should be placed on the industry participants to ensure that lobsters are harvested and processed in compliance with the regulations. An ideal approach requires complementary federal and provincial regulations in areas of jurisdictional overlap. This can be readily accomplished with will and cooperation.

The FRCC is of the view that a shore-based monitoring program should be developed, administered and financed by industry. There are many gaps that could be filled by such a program apart from the detection of illegal lobster. As noted earlier in the report, there is a need for more information to better understand the resource and assist in the management of the fishery. Comprehensive data gathering mechanisms at dockside and at buyer/processor facilities could fill this obvious gap. In addition, the program could be used as a means to enhance quality should industry decide to improve its return from the marketplace. The monitoring should be conducted by authorized agents at dockside, not by fishery officers whose time should be spent on more complex issues such as monitoring at-sea activities. Such a program would be an example of industry taking charge and acting in a responsible and accountable manner. Lobster is the highest valued fishery in the Atlantic region with a landed value of approximately $600 million. The costs of such a program would be relatively small as compared to the total revenues and other benefits that accrue to the participants.

The development of a shore-based program is not without complexity and will require considerable planning. The logistics of the lobster fishery as currently structured pose a challenge; however, similar programs are in place throughout other Atlantic fisheries e.g. snow crab. An even-paced, incremental timetable could be developed to provide for adjustment and transition. In the end, the FRCC is of the view that the payback from such a program would be well worth the effort required.

Illegal activities while fishing are obviously more difficult to resolve. The redirection of fishery officer's priorities as noted above should help but again, the most practical approach is to engage harvesters in the process. Many harvesters referred to the "guardian program" which was used in Prince Edward Island (see Appendix V) as an example of cooperation between harvesters and DFO that was apparently effective in curtailing a serious problem in that region during the 1980s. Harvesters were clear during consultations that they know what is going on and often know the individuals involved. Efforts should be made to implement a structured program that engages harvesters in the process. Clearly, all such initiatives should be approved by DFO but there is no reason that harvesters cannot play a hands-on role in the process. Such an initiative would send a clear signal to offenders that their illegal activities would not be tolerated in the community.

The FRCC recommends that a comprehensive shore–based monitoring program be implemented at dockside and at buyer/processor facilities. The program should include provisions to monitor illegal lobster, gather reliable landings data and other information to assist science and management for lobster. The program could include quality-based initiatives identified by industry.

The FRCC recommends that the monitoring program be conducted by authorized contract personnel and be funded and administered jointly by industry and DFO. The savings in fishery officer time and resources should be re-directed toward monitoring at-sea measures such as trap limits.

The FRCC recommends that, where not already in place, provincial governments should enact regulations to control the possession of illegal lobster at dockside, in provincially licensed facilities and during transport.

The FRCC repeats its 1995 Report recommendation that DFO involve stakeholders more directly in enforcement activities through the development of structured Community Watch and Oceanwatch programs.

7.5 Penalties and sanctions

The 1995 Report welcomed the introduction of a new sanction program, which was being implemented by DFO at that time. Unfortunately, that initiative ran into legal problems and was discontinued. There is currently no licence sanction program to punish licensed harvesters who breach fisheries regulations.

The absence of effective penalties in all fisheries has been an issue for far too long. It is a gap that has been noted by numerous reports on the fishery for many years. There is a strong consensus among harvesters and processors in all provinces on the issue. They have pleaded with government to fill this obvious gap and put 'teeth' into regulatory programs. To date, government has been slow to react.

The criminal courts are not the place to adjudicate cases in such a highly regulated industry and that it is time for the development of a special process to deal with breaches of fisheries regulations. The provisions of a Canada Fisheries Tribunal as outlined in the proposed *Fisheries Act,* 2007 are a very progressive initiative and the FRCC urges industry participants to review it thoroughly and provide feedback through the parliamentary consultative process currently underway. It is conceivable that the revised *Fisheries Act,* 2007 may not pass into legislation. Should that be the outcome of the current legislative process, the FRCC urges DFO to proceed in another manner to establish an administrative mechanism to effectively deal with fisheries offences.

The FRCC recommends that a legislatively based, arms-length administrative penalty tribunal be established to adjudicate breaches of the Fisheries Act and its regulations.

Industry can contribute to the administration of the current judicial process or a tribunal process. Industry participants can clarify for judges or adjudicators the effects of illegal and irresponsible behaviour. In some areas, cooperation between prosecutors and harvesters has resulted in industry making impact statements, including recommended sanctions to the court when addressing penalties. These statements can have an effect on the severity of the sanction, especially if the statement comes from a representative organization and is presented in a professional manner. Industry participants need to become more involved in the sanctions process.

The FRCC recommends that industry participants and associations contact prosecutors and develop a process for the preparation of effective impact statements, including recommended penalties to be used during the sentencing process in courts or tribunals.

7.6 Compliance summary

It will be an ongoing challenge to find the motivational tools to persuade all participants in the fishery to comply with regulations. First and foremost among those tools should be incentives for good behaviour and penalties for bad behaviour. In conclusion, it is about eliminating the realities outlined above:

- A more focused monitoring program will minimize the opportunity to cheat and benefit the resource; industry participants will be the beneficiaries;
- The risk for offenders will be increased with a focused program;
- More severe penalties and licence suspensions will act as a deterrent for current and potential offenders; and
- Enhanced focus on convicted offenders as a result of publishing details of their offences (provided for in the proposed *Fisheries Act*, 2007) should create a social stigma in the community.

8. Conclusion

Having completed a thorough review of the 1995 Report, the FRCC has concluded that the 1995 framework provided a solid plan to enhance the conservation of the lobster resource. The key issues addressed in the 1995 Report concerned low eggs-per-recruit, poor stock structure, high exploitation rates and poor compliance. Unfortunately, these same issues are just as prominent or are of greater prominence in 2007. Overall, the risks to sustainability in the lobster fishery have increased over the period since the last report for most areas. There have been too few initiatives taken by industry and DFO to lessen this overall risk.

Landings have improved in some areas while at the same time they have remained stable or declined in most. A period of relatively high productivity appears to have contributed to the recent trend in landings. Fishing effort continues to escalate and there has been no reduction in the high exploitation rates that characterize the lobster fishery. In addition, the percentage of the lobster population that matures before contributing to reproduction is low in many areas and this further increases the risk to sustainability. Many in industry refuse to recognize the high risk in many areas and reluctance to change continues, as landings have been high in recent years. It is clear however, that if resource productivity declines or exploitation reaches a turning point, the consequences will be very significant. Unfortunately, this harsh reality is present in a number of LFAs, for example, LFA 25 and LFA 10.

The fundamental conclusion of the FRCC is that the risks to sustainability are too high in the lobster fishery and that the time has come for the industry to take charge and mitigate these risks. The time of doing nothing has past. The Council heard much reasoning for doing nothing. Some suggested that DFO should enforce the current measures before implementing new ones; others indicated that it made no sense to conserve in their area as the larvae produced there drift into the adjacent area, and in some areas DFO was reluctant to implement change due to vocal opposition from some harvesters. Despite the validity of the arguments, the FRCC has witnessed initiatives where industry and DFO took a leadership role and made sacrifices to enhance resource conservation to sustain individual livelihoods, businesses and communities. They are to be commended.

The FRCC also met many stakeholders that share a dedication and commitment to do their part to improve the fishery for the future. This was evidenced through over 80 written briefs and the high participation at public consultations. Unfortunately, a minority sometimes paralyses the interest and efforts of many. They neither have foresight nor are they prepared to make the short-term sacrifices required to enhance the longer-term prospects for their industry.

The Council is advancing many recommendations that will meet criticism. The choice to implement or not will remain largely one for key stakeholders. For those areas that have already made significant progress, they may wish to stay-the-course to implement their current plans and continue initiatives that can further assist them to achieve their goal of sustainability.

The Council would like to see a process established by which industry and DFO would advance the multi-dimensional conservation and management of the lobster fishery, and embrace the vision outlined in this report. The FRCC also recognizes the responsibility of the Minister of Fisheries and Oceans, in the knowledge that certain aspects of the report will force an ultimatum at some stage in the future in those areas that continue to stall or forego meaningful change. Following the 1995 Report, many harvesters chose to do nothing; this approach is neither an acceptable alternative nor is it sustainable for an industry that is the backbone of so many communities along Canada's east coast.

APPENDICES

Appendix I - First Nations participation in the commercial lobster fishery

First Nations Commercial Lobster Fishing Licences 2006				
Region	**LFA**	**Total Licences**	**First Nations Licences**	**First Nations Participation Rate %**
NL	11	320	2	1%
	13A	148	1	1%
	13B	172	1	1%
Québec	15	66	2	3%
	16	10	2	20%
	17B	15	4	27%
	18D&H	5	2	40%
	20A	107	3	3%
	21	12	11	92%
Gulf	23	759	60	8%
	24	639	33	5%
	25	843	88	10%
	26A	764	26	3%
	26B	247	5	2%
Maritimes	27	483	18	4%
	28	16	8	50%
	29	67	2	3%
	32	162	3	2%
	33	711	7	1%
	34	985	28	3%
	35	95	12	13%
	36	178	14	8%
	38	136	16	12%
	LFAs with no First Nations Participation	**2,899**	--	--
	Total	**9,839**	**348**	**4%**

Source: Fisheries and Oceans Canada

APPENDIX II - FINANCIAL PERFORMANCE INDICATORS BY LFA

Lobster Fleet – Financial Performance Indicators by LFA Maritimes, Gulf and Québec Regions for 2004			
Region	**LFA**	**Total Fishing Revenue[1]**	**Income[2]**
Maritimes	27	$51,957	$16,059
	28-32	$55,817	$18,167
	33	$61,467	$15,838
	34	$245,479	$79,046
	35-36	$162,435	$54,945
	Weighted Ave.	$111,891	$35,261
Gulf	23	$55,065	$7,874
	24	$108,507	$50,731
	25	$45,063	$7,679
	26A	$57,029	$12,959
	26B	$66,364	$29,140
	Weighted Ave.	$61,430	$17,733
Québec	17	$128,365	n.a.
	20A3-A10	$70,611	n.a.
	20B1-B4	$59,783	$14,145
	20B5-B8	$45,474	$9,801
	21	$50,236	$15,064
	22 (Diversified)	$137,904	$50,052
	22 (Specialized)	$110,402	$40,835
	Weighted Ave.	$82,570	$26,083

1. Gross revenue based on value of landings
2. Income before taxes and return to the owner
   n.a. Not available

Source: Fisheries and Oceans Canada

Appendix III - Measures taken in each LFA since 1995 - Newfoundland & Labrador, Québec

Region	LFA	Min. legal carapace size 1995	Min. legal carapace size 2006	Harvesters 1995	Harvesters 2006	Exploitation Rate 1995	Exploitation Rate 2006	Status in doubling Eggs-per-recruit (as of 2004)	Other Management Measures Taken Since 1995 Report
Newfoundland	3-8	81	82.5	2007	1396	85%	Range from 80-94% in LFA 5	50%	Voluntary v-notching, establishment of closed areas, continuation of trap limit reductions, continuation of shortened seasons.
	9	81	82.5	45	36	85%	Not Available	50%	Voluntary v-notching, closure of fishery for 3 yrs ('98 '00) in St. Mary's Bay, trap limit reductions.
	10-14C	81	82.5	2011	1469	85%	Range from 87-97% in LFA 11 and from 82--95% in LFA 14B	50%	Voluntary v-notching, establishment of closed areas, trap limit reductions, continuation of shortened seasons, continuation of maximum size limit of 127mm in LFAs 13A-14C.
Québec	15-16	76	82	83	76 (46 Active)	N/A	75%	100%	Trap limits : 250 standard traps 92 x 61 x 50 cm or 175 large traps 124 x 92 x 50 cm. Rectangular escape vents 47 mm high. Maximum trap size generally smaller than allowed in regulations.
	17-18	76	83	23	24 (19 Active)	N/A	25% in 17; N/A in 18	N/A	Trap limits : 300 (LFA 17) or 250 (LFA 18) standard traps 92 x 61 x 50 cm or 210 or 175 large traps 124 x 92 x 50 cm respectively. Rectangular escape vents 47 mm high.
	19-21	76	82	221	213	70%	85%	100%	250 traps. Trap size limit 92 x 61 x 50 cm. Rectangular escape vents 46 mm high. Maximum trap size generally smaller than allowed in regulations. Limiting number of hauls per day (one). v-nothing (voluntary). Licence buy-back program managed by the fishers Reduction in the number of traps from 250 to 235. Reduction of the fishing season from 71 to 69 days.
	22	76	83	325	325	60%	75%	100%	No fishing on Sundays. 300 traps. Trap size limit 81 x 61 x 50 cm. Rectangular escape vents 47 mm high. Reduction in the number of traps from 300 to 297 (reduction of 3 traps a year from 2006 to 2010). Minimum of 7 traps per trawl. Maximum of 8 fathoms between traps.

Source: Fisheries and Oceans Canada

Appendix III - Measures taken in each LFA since 1995 - Gulf

Region	LFA	Min. Legal Carapace Size 1995	Min. Legal Carapace Size 2006	Harvesters 1995	Harvesters 2006	Exploitation Rate 1995	Exploitation Rate 2006	Status in doubling Eggs-per-recruit (as of 2004)	Other Management Measures Taken Since 1995 Report
Gulf	23	67	70	765	759	80-85%	75% ('03)	≈100%	Release of females between 115-129 mm. Maximum escape mechanism height of 40 mm beginning in 2005. No night fishing. Maximum hoop size of 152 mm. Creation of artificial reefs and stocking with stage IV lobster.
	24	64	70	639	639	80-85%	75% ('03)	100%	Release of females between 115-129 mm. Maximum escape mechanism height of 40 mm beginning in 2005. No night fishing. Voluntary hauling of gear 6 days a week instead of 7.
	25	67	70	887	843	80-85%	75 ('03)	≈100%	Release of females between 115-129 mm in 2003. Maximum size limit of 114 mm for females since 2004. Maximum escape mechanism height of 40 mm beginning in 2005. No night fishing. Maximum hoop size of 152 mm. Release of males between 129-145 mm in 2004.
	26A	65	70 71.5 76 71.5	773	764	70-75%	70% ('03)	≈100%	Release of females between 115-129 mm. Maximum escape mechanism height of 40mm beginning in 2005. No night fishing. Voluntary hauling of gear 6 days a week instead of 7. In addition in the location where 76 mm is the MLS escape mechanism of 41 mm. In addition in the location where 71.5 mm is the MLS voluntary maximum trap size smaller than allowed in regulations. In addition in the location where 71.5 mm is the MLS voluntary placing multiple traps per line.
	26B	70	75	255	247	80-85%	75% ('03)	100%	Release of females between 115-129 mm. Maximum escape mechanism height of 42 mm beginning in 2007. MLS 76 mm in 2007. No night fishing. Voluntary hauling of gear 6 days a week instead of 7.

Source: Fisheries and Oceans Canada

Appendix III - Measures taken in each LFA since 1995 - Maritimes

Region	LFA	Min. legal carapace size 1995	Min. legal carapace size 2006	Harvesters 1995	Harvesters 2006	Exploitation Rate 1995	Exploitation Rate 2006	Status in doubling Eggs-per-recruit (as of 2004)	Other Management Measures Taken Since 1995 Report
Maritimes	27	70	76	490	483	60-70%	53-78% north and 23-45% south (2004)	100%	Some areas of voluntary trap reductions; prohibition on landing v-notched females.
	28	81	84	17	16	60-80%	N/A	20-30%	Maximum hoop size of 15.2 cm (6"); prohibition on landing v-notched females.
	29	81	84	71	67	60-80%	23-45% (2004)	20-30%	Maximum hoop size of 15.2 cm (6"); prohibition on landing v-notched females.
	30	81	82.5	20	20	50-70%	29-45% (2004)	20-30%	Maximum legal size limit of 135mm for females; prohibition on landing v-notched females.
	31A	81	84	73	73	60%	50% (current)	40%	Release of females between 114-124 mm.
	31B	81	82.5	72	72	60%	50% (current)	20%	Each license v-notches and returns 50 kg of mature females annually; prohibition on landing v-notched females.
	32	81	82.5	163	162	72%	60% (current)	35%	Each license v-notches and returns 50 kg of mature females annually; prohibition on landing v-notched females.
	33	81	82.5	729	711	75-85%	63-70% (2004)	25%	Prohibition on harvesting of females with one or both claws missing; voluntary v-notching; prohibition on landing of v-notched.
	34	81	82.5	983	985	70-85%	66-71% (2006)	23-35%	Prohibition on harvesting of females with one or both claws missing; voluntary v-notching; prohibition on landing of v-notched.
	35	81	82.5	96	95	70-85%	53-70% (2001)	17-28%	Prohibition on harvesting of females with one or both claws missing; voluntary v-notching; prohibition on landing v-notched females.
	36	81	82.5	178	178	60-85%	53-70% (2001)	17-28%	Prohibition on harvesting of females with one or both claws missing; voluntary v-notching; prohibition on landing of v-notched.
	38	81	82.5	134	136	60-85%	53-70% (2001)	17-28%	Prohibition on harvesting of females with one or both claws missing; voluntary v-notching; prohibition on landing of v-notched.
	41	81	82.5	8	8	15-25%	less than 20%	N/A	Prohibition on harvesting of females with one or both claws missing; prohibition on landing of v-notched females.

Source: Fisheries and Oceans Canada

APPENDIX IV - INDICATOR TOOLBOX FOR CONSERVATION AND MANAGEMENT

Key features of the fishery and the lobster population	Indicators (examples)	Information Source
Fishing Pressure	Nominal fishing effort	Logbooks, Index-harvesters, data on trap hauls
	Fishing efficiency	Logbooks, Index-harvesters, interviews with harvesters on evolution of fishing technology and fishing strategy through time
	Exploitation rate	Logbooks, Index-harvesters, size data from at-sea or dock sampling, seasonal catch rate data, fishery-independent survey
	Spatial changes in effort	Logbooks, Index-harvesters
Population Abundance	Landings	Sale slips, Logbooks, Dockside monitoring
	Catch rate (Catch-per-unit-of-effort, CPUE)	Logbooks, By-catch in other fisheries (scallop, groundfish), at-sea sampling, trapping surveys
	Spatial Distribution	Logbooks
	Abundance (density and biomass)	Trawl surveys, dive surveys
Catch Composition and Reproductive Capacity	Size structure, Proportion of each group of recruits, Mean Size	Dockside monitoring, at-sea sampling, fishery-independent surveys
	Abundance, distribution and condition (Primiparous and multiparous) of berried females	Index-harvesters, logbooks, at-sea sampling, fishery-independent surveys (trapping, trawling and diving)
	Size at sexual maturity / Fecundity	
	Mating success	At-sea sampling, fishery-independent surveys
	Size-specific sex ratios	Index-harvesters, logbooks, at-sea sampling, dockside monitoring and fishery-independent surveys
	Egg production and Eggs per recruit	Data analysis and modelling
Stock Productivity	Pre-recruit catch rate (Catch-per-unit-of-effort, CPUE)	Logbooks at-sea sampling, trapping surveys (modified traps)
	Pre-recruit abundance (density and biomass)	Trawl surveys, dive surveys
	Settlement densities	Dive surveys
	Spawning Aggregation	Dive surveys and Video Surveys
Environmental Characteristics	Temperature	Coastal monitoring
	Circulation	Numerical modelling
	Habitat characteristic	Benthic habitat mapping
Ecosystem Considerations	Incidental species by-catch	At -sea sampling
	Predators-preys-invasive species	Multispecies surveys, fishery-independent surveys (trapping, trawling and diving).
	Biological oceanography (plankton, trophic fluxes)	Multidisciplinary surveys

Appendix V - PEI conservation and protection Guardian Program (1978 - 1983)

Objective:

- Enforce existing measures to reduce poaching through co-management with DFO (Harbour committees hired guardians and staff and managed the program. DFO trained the guardians).

Staff:

- Ten guardians, one coordinator and one administrative support person.

Duties:

- Work with DFO in carrying out patrols, checking landings at dockside, on vessels and at buyer stations, conducting habitat patrols, issuing warnings, assisting in preparation of court briefs and testifying in court.

Training:

- Law enforcement principles, fisheries regulations and public relations.

Costs:

- Wages and travel expenses, equipment, uniforms, and office supplies cost.
- $55,000 in 1978 and increased to $159,000 in 1983 (funding provided by DFO).

Pros:

- Fostered stewardship, education and changing attitudes of harvesters, more acceptance of regulatory measures, poaching decreased significantly (≥60%) in problem areas, better compliance, five years into the program, harvesters had indicated a will to fund progressively up to 50% but had no way of raising the funds.

Cons:

- Sporadic distribution of enforcement efforts, created adversaries among harvesters, difficult to achieve full harbour committee involvement.

Appendix VI - Glossary

Assessment, stock assessment: The process of determining what the status of a stock is in relation to exploitation.

Bathymetry: The depth of the water.

Benthic: Bottom-living; juvenile lobsters become benthic when they settle on the bottom after the planktonic larval phase.

Berried females: An egg-bearing female lobster in which the eggs are visible on its underside. Under regulation, berried females must be released.

Carapace size restrictions: The back, or carapace, of the lobster is measured using a preset gauge. Depending on area, lobsters at a certain specific carapace length have common characteristics regarding maturity, number of moults, etc.

Catchability: The efficiency with which animals are captured by a given level of fishing effort. Mathematically, catchability is expressed as the proportion of the stock captured by one unit of fishing effort.

Distribution, spatial: Patterns in space, e.g. numbers of lobster over and around a bank.

Distribution, temporal: Patterns in time, e.g. changes in the numbers of lobster with time.

Effective effort: A measure of the effect of the effort that is applied, that is directly related to fishing motality.

Effort, fishing effort: The amount of fishing used to obtain the catch; can be expressed in numbers of traps, hours etc. (See also effective effort.)

Egg production: The total number of eggs produced by the population of a specific area.

Eggs-per-recruit: An estimate of the number of eggs that one female recruited to the fishery would produce over her lifetime.

Escape mechanisms: Escape mechanisms are installed in traps to allow small lobsters to escape before being hauled to the surface. Sizes of lobsters released by the escape mechanism are related to the dimensions of the escape mechanism.

Exploitation rate: The percentage of lobsters vulnerable to the fishery which are harvested in a given year. Exploitation rate is another way of expressing fishing mortality.

Homarus americanus: American lobster.

Growth/ recruitment overfishing: Growth overfishing occurs when individual lobsters are caught before they can provide the maximum meat yield per recruit. Fishing too early results in a yield waste. Recruitment overfishing on the other hand, occurs when fishing reduces the stock to a level where subsequent recruitment is lowered. It is related to total egg production.

IQ/ITQs: Individual quota / Individual transferable quotas. Annual quotas assigned to fishing enterprises that set a limit on how much of the resource the enterprise is permitted to catch. Transferable refers to quotas that can be readily transferred from one enterprise to another.

Limited entry: A management tool whereby the number of licensed vessels or harvesters in the fishery is restricted or capped.

Limits on trap size: Lobster traps can catch more than one lobster at a time and increasing the size can, in the view of many harvesters, increase efficiency. Harvesters in individual Lobster Fishing Areas have agreed to maximum sizes for lobster traps and in some areas to equivalency criteria relating the size of trap to the number of traps that can be set.

Lobster Fishing Area (LFA): An area within which specific lobster management regulations apply.

Lobster Production Area (LPA): An area within which the production characteristics of lobster are more or less homogeneous.

Model: A simplified description of phenomena allowing a practical analysis. Mathematical models involve a set of relationships to quantify those phenomena; they are commonly used in assessments of the status of fish stocks.

Minimum Legal Size (MLS): The minimum carapace length of lobster that can be legally landed.

Multiparous lobsters : Lobsters spawning for the second or more time.

Nominal fishing effort : The number of licensed harvesters and number of licensed traps.

Overfishing: The situation when a stock is being exploited beyond its long-term productive capacity; put simply, when the capital is being reduced rather than when the interest is being cropped. Two kinds of overfishing are often considered: growth overfishing, when animals are caught at a size where more growth would provide better production (fishing at too young an age results in yield waste); and, recruitment overfishing, when fishing reduces the stock to a level where subsequent recruitment is lowered; it is related to total egg production.

Planktonic: Drifting in midwater; many marine organisms such as lobster have a planktonic larval stage (contrast with benthic).

Primiparous lobsters: Lobsters spawning for the first time.

Recruitment: The process of becoming vulnerable to the fishery. For lobster and many other species, recruitment is generally associated with attaining legal size, but this can occur with movement into the fishery area.

Seasons: Times in the year when a lobster fishery can occur. Seasons vary from one area to another.

Stakeholders: All those who have an interest (a stake) in a fishery.

TURFs: Territorial use rights fisheries.

Trap limits: A limit per vessel of the number of traps that can be set in a Lobster Fishing Area.

Trophic level: The position that an organism occupies in a food chain, determined by what eats it and what it eats.

V-Notching: Egg-bearing females (or any other group of lobsters targeted for protection) can have a shallow notch cut into an element of the tail fan; once marked, a regulation (or voluntary program) would be necessary to ensure that the animals would be released if recaptured.

Yield per recruit: The fishery yield obtained, on average, from each animal which recruits to the fishery (becomes vulnerable to the fishery). It is estimated from models including growth, mortality and size at recruitment; maximum yield per recruit is used as a reference point in considering whether a fishery suffers from growth overfishing.

Appendix VII - Briefs received

Thomas Whittle - 2006-010-00008
Allan G. Nolan - 2006-010-00009
Kenneth Picco - 2006-010-00010
Rodney Blanchard - 2006-010-00012 / 000107
Bruce Poole - 2006-010-00015
Rodger Taylor - 2006-010-00016
Harry Brown - 2006-010-00017
Lloyd Fudge - 2006-010-00029
Edward A. James - 2006-010-00030
Gordon Caines - 2006-010-00031
Kenneth Sheppard - 2006-010-00036
L'Association des pêcheurs du quai de Ste-Marie-St-Raphaël - 2006-010-00038
Ernie Smith - 2006-010-00039
O'neil Cloutier - 2006-010-00040
Yvon Arseneau - 2006-010-00041
Martin Mallet - 2006-010-00042
L'Association des Pêcheurs Propriétaires des Iles-de-la-Madeleine - 2006-010-00043
Le Comité de Survie de l'Association des Pêcheurs de l'Ile de Miscou Inc. - 2006-010-00044
Fishermen & Scientists Research Society - 2006-010-00049 / 00085
Carl Parsons - 2006-010-00059
Guysborough County Inshore Fishermen's Association - 2006-010-00061
Prospect Area Full-time Fishermen's Association - 2006-010-00067
Bay of Fundy Inshore Fisherman's Association & LFA 34 Management Board - 2006-010-00070
Nova Scotia Fish Packers Association - 2006-010-00071
LFA 34 Management Board - 2006-010-00072
Maurice Shand - 2006-010-00073
LFA 34 Lobster Fish Harvester - 2006-010-0074
L. Wayne Spinney - 2006-010-00075
Wilford Smith - 2006-010-00077
Chris Corkett - 2006-010-00079
Maritime Fishermen's Union (MFU) - 2006-010-00082 & 00104 / 2007-010-00009 & 00020
Jerry Ennis - 2006-010-00083
Wade Turner - 2006-010-00084
Rendell Ledwell - 2006-010-00086
Gerard M. Leonard - 2006-010-00091
Fish, Food and Allied Workers (FFAW) - 2006-010-00092
John Boyd - 2006-010-00093
Gulf NS Fishermen's Coalition - 2006-010-00094
Stuart J. Beaton - 2006-010-00095
D. McCastle - 2006-010-00096
Charlie McGeoghegan - 2006-010-00097
Michael J. McGeoghegan - 2006-010-00098
Prince Edward Island Fishermen's Association - 2006-010-00099
AVC Lobster Science Centre (Jerry Amirault) - 2006-010-00100
Gregory Day - 2006-010-00101
John Fitzgerald - 2006-010-00102
Victor Leblanc - 2006-010-00105
Patrick Brewer - 2006-010-00106
Omer Duplessis - 2006-010-00108
Marcel Richard - 2006-010-00109
Maritime Aboriginal Peoples Council - 2006-010-00110
Keith Paugh - 2006-010-00111
Sheldon Barlow - 2006-010-00112 & 00134
Ron Cormier - 2006-010-00113
Georges Martin - 2006-010-00115
Grand Manan Fishermen's Association Inc. - 2006-010-00118
Jeffery Parsons - 2006-010-00121
Keith Paugh - 2006-010-00122
Clearwater - 2006-010-00123
Donald Martin - 2006-010-00124
David Burke - 2006-010-00125
Gordon Beaton - 2006-010-00128
Eben Elliott - 2006-010-00129
PEI Agriculture, Fisheries, and Aquaculture - 2006-010-00130
Unama'ki Institute of Natural Resources - 2006-010-00131
Mi'kmaq Rights Initiative - 2006-010-00132
Nova Scotia Fisheries and Aquaculture - 2006-010-00133
Mark E. MacNeill - 2006-010-00135
James R. MacDonald - 2006-010-00136
Kenneth Lane - 2006-010-00137
Gary O'Hanley - 2007-010-00001
Leslie Burke - 2007-010-00002
Northumberland Fishermen's Association - 2007-010-00017
Gulf NS Bonafide Fishermen's Association - 2007-010-00018
Paul Kehoe - 2007-010-00019
Eastern Shore Fishermen's Protected Association (ESFPA) – 2007-010-00021
Peter Connors – 2007-010-00022

Appendix VIII - FRCC membership

Council

Current members

Jean Guy d'Entremont, Chairman
Gabe Gregory, Vice Chairman
John Angel
Gerard Chidley
Omer Chouinard
Guy Cormier
Shelley Denny
Brad de Young
Douglas Johnston
Jean-Jacques Maguire
Donald Walker

Former members

Donald Delaney
Ken Fowler
Louis LaPierre

DFO Ex-officio

Andrew Cooper
Louise Gendron
Barry Rashotte
Marc Vachon

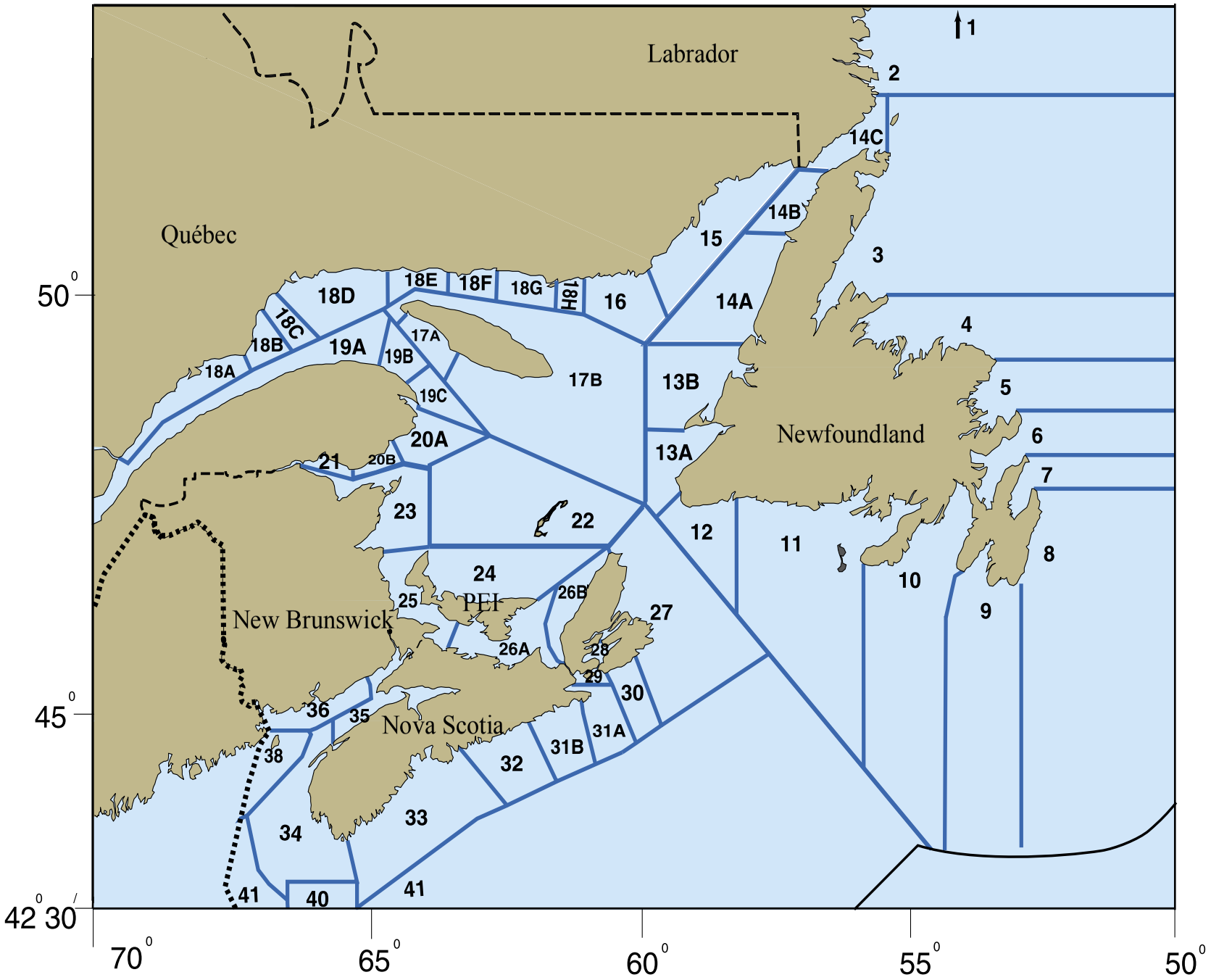
Provincial delegates

Tom Dooley
Yvon Forest
Joseph LaBelle
David MacEwen
Clary Reardon

FRCC Secretariat

Arthur Willett, Executive Director
Helena Da Costa
Tracey Telik

Map of Lobster Fishing Areas (LFA)



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