Community-University Research for Recovery Alliance
RESEARCH REPORT

The effects of v-notching on reproductive potential in American lobsters (*Homarus americanus*) in Newfoundland

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adapted from
The reproductive potential of v-notched American lobsters (*Homarus americanus*) in Newfoundland: Does v-notching work?
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Introduction

For over 100 years, the American lobster (*Homarus americanus*) fishery has provided a valuable export and significant income for fishers in Atlantic Canada. The fishery has evolved substantially since 1874. Vessels and traps have increased in size over the years and fishers started landing smaller lobsters. These practices have caused an increase in total catch while the lobster stock biomass has decreased. Overfishing of lobster stocks in Atlantic Canada has prompted a variety of conservation measures, including:

- Implementation of lobster fishing areas (LFAs) and closed areas
- Trap limitations
- License limitations
- Implementation of fishing seasons
- Implementation of a minimum legal size
- Implementation of a maximum size limit
- Release of berried females
- V-notching berried females

First suggested in 1899, lobster fishing areas (LFAs) are selected lobster districts in which a unique set of policies apply to address issues specific to that region. For instance, the number of licenses and/or traps may differ from one LFA to another based on the impacts and status of particular lobster stocks. There are currently 15 LFAs (Figure 1) in Newfoundland and Labrador. Some LFAs contain closed fishing areas, which do not allow any type of lobster exploitation, with the exception of scientific research to assess the effectiveness of the closure.

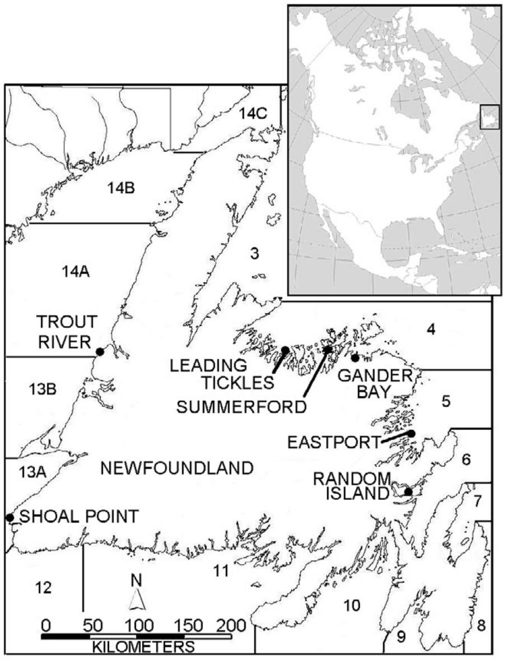

Figure 1. Newfoundland lobster fishing areas (LFAs).

Lobster fishing licenses have been required since 1918, and approximately 2,900 licenses were given to lobster fishers in Newfoundland in 2006. The Newfoundland Fishery Advisory Committee, established in 1977, recommended lobster trap limitations to attempt to bring the effort to a more sustainable level. It was believed that these regulations would help reduce the exploitation rate and eventually increase the abundance of the American lobster in Newfoundland. Other changes involving traps involved the introduction of lath spacing to allow small lobsters to escape. Furthermore, fishing for lobsters using hoop nets and towing gear was prohibited, making traps the only allowable gear with which to catch lobsters.

Fishing seasons for lobsters are coordinated with their reproductive cycle, prohibiting fishing from mid-July to mid-September, since this is the time when lobsters mate, molt, and release eggs in Newfoundland waters. These activities are vital to the survival of lobster populations and this type of regulation protects the lobsters during these important events.

Limitations on carapace length have been implemented in order to help conserve lobster populations. This type of regulation was first applied in 1873, at the same time that the retention of recently molted and egg-bearing lobsters was prohibited. A minimum carapace length (measured from the posterior edge of the eye socket to the end of the carapace, at the mid-line – see Figure 2) was implemented, which meant that lobsters that did not meet this length must be released. Lobsters are measured by harvesters using a preset gauge. This practice increases the chances for lobsters to reach reproductive maturity, possibly improving egg production and overall lobster stock biomass. The current minimum carapace length for lobsters in Newfoundland waters is 82.5mm.

A maximum carapace length policy is implemented in some LFAs in Newfoundland, allowing larger lobsters to be released in order to help maintain a proportion of larger females in the population. It has been shown that larger female lobsters have larger eggs and higher fecundity.


Figure 2. Measuring the carapace length of a lobster using callipers.

Another measure to help preserve the lobster populations around Newfoundland is the mandatory release of egg-bearing (ovigerous) females, also known as berried females. Since this method only protects the females while they have visible eggs, v-notching the females when they are released will protect the female for a few years following release. However, v-notching is voluntary so it is not known how many fishers participate.

What is v-notching?

V-notching involves cutting a notch into the right uropod of a female lobster when eggs are present in order to identify lobsters that are capable of reproducing (Figure 3). This voluntary practice can potentially increase egg production in the lobster population since it prevents these lobsters from being landed even when eggs are not present. The v-notch will disappear due to molting within a few years, but it should remain long enough to allow the lobster to reproduce at least once. Lobsters have a biennial cycle, meaning that they reproduce one year and then molt the next.

V-notching not only allows female lobsters a chance to reproduce, but it also lets them grow to a larger size, further enhancing their reproductive potential since larger females produce more eggs.

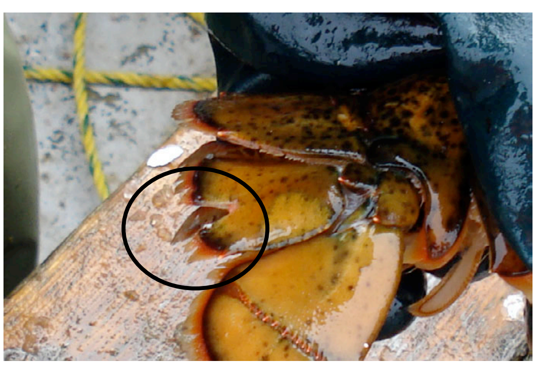

Figure 3. V-notched lobster.

Material and Methods

Data collected by fishers and recorded in logbooks from various LFAs in Newfoundland were used for this research. The data were obtained from the Department of Fisheries and Oceans (DFO). The data came from five LFAs: 4 (Leading Tickles, Gander Bay, Summerford); 5 (Eastport); 6 (Random Island); 13A (Shoal Point); and 14A (Trout River). Figure 1 shows the locations of these LFAs. In 2004, the data were collected by scientists rather than by harvesters. The DFO Science Branch and the DFO Oceans Branch checked the data for errors and inconsistencies before releasing them for use in this research. Variables recorded included carapace length (measured to the nearest millimetre with callipers), sex, and the presence of a v-notch and/or eggs.

Data from male lobsters were excluded. Six categories (Table 1) were used for the females to determine reproductive potential, and they were divided into size classes based on their carapace length. The smallest class size started at 20mm, and each class was 4mm in range. Thirty size classes were present, with the largest size class ranging from 136-140mm.

The size-maturity relationship, the size-fecundity relationship, and the reproductive potential (egg production) of the female lobsters were determined using three different equations (these can be found in detail in the thesis). Spawning frequency was also examined, and a comparison was made between reproductive potential of v-notched lobsters and the total reproductive potential and percent contribution for lobsters with a carapace length between 56 and 116mm.

Since berried lobsters are released regardless of the presence of a v-notch, berried v-notched lobsters were not included in the v-notched reproductive potential.

Table 1. Categories used to calculate reproductive potential for female lobsters.

Category	New Category
Non-berried new v-notch	Non-berried v-notch
Non-berried old v-notch	
Berried new v-notch	Berried v-notch
Berried old v-notch	
Non-berried no v-notch	No v-notch
Berried no v-notch	

Results

A total of 32,066 female lobsters were used from Eastport, Leading Tickles, Random Island, Shoal Point, Summerford, Gander Bay, and Trout River, between 2004 and 2008. The total reproductive potential for these lobsters was 1.94×10^7 eggs. Most lobsters fell within the 80-83.9mm size class, which includes the minimum legal size in Newfoundland of 82.5mm. There are fewer lobsters in the larger size classes and the highest contribution to the reproductive potential comes from the 112-115.9mm size class. Despite the fact that only 347 of the 32,066 lobsters (1.08%) fall into this size class, they contributed approximately 15% to the total reproductive potential. This is a significant contribution by a small portion of the total lobsters analyzed.

Because there were so many size ranges and so many lobsters, it was necessary to narrow down the number of lobsters analyzed to determine the reproductive potential. Leading Tickles, in LFA 4, had the smallest range in carapace length, between 56-116mm, so this is the range that was used to analyze the reproductive potential (Appendix A).

Some of the most interesting results include:

- the highest reproductive potential occurs at a length of 112mm
- the range in size of v-notched lobsters is greater than that of non-v-notched lobsters
- there are more v-notched lobsters in larger size classes than non-v-notched lobsters
- reproductive potential increases as lobster size increases

Discussion

This research shows that v-notching increases the reproductive potential of lobsters in Newfoundland. This finding establishes the science basis for v-notching as an effective sustainability measure in Newfoundland.

Although most lobsters have a biennial reproductive cycle, it has been shown that lobsters with a carapace length over 120mm usually have two spawning sessions within a 3 year period. This means that lobsters of this size reproduce more often than smaller lobsters. In addition, larger lobsters tend to produce more eggs and eggs with a higher energy content. All of these factors imply that the presence of large lobsters in a population contribute significantly to the potential success and longevity of the resource. However, these lobsters must be protected in order for this potential to be realized.

V-notching is a common practice in many lobster fisheries, and has been shown from this research to increase the size range of lobsters. Since it is beneficial to increase the number of larger lobsters in the population, v-notching is an easy and effective way to accomplish this. This practice allows lobsters to remain in the population longer, thus growing larger and potentially contributing to the reproductive potential for a longer period of time. A high reproductive potential could be accomplished with fewer large lobsters than many small ones.

The sustainability of any natural resource requires a balance between conservation and economic contributions for the harvesters. The lobster fishery in

Newfoundland is no different. In this case, an effective way to preserve the reproductive potential of lobster populations in the region while promoting the sustainability of the stocks would be a combination of v-notching together with a slot fishery, where lobsters are taken within a slot defined by a lower limit and an upper limit. Although v-notching females prevents them from providing financial rewards for a harvester this year, allowing these berried females to remain in the population and possibly reproduce again will help grow the population in the long term. Coupling v-notching with a slot fishery will increase the egg production and potentially increase the number of lobsters that recruit to fishable size in years to come.

Appendix A

Table 1. V-notched and total reproductive potential based on lobsters with a carapace length of 56-115mm, separated by location and year. (Total reproductive potential is the total for that particular location and year).

Location	**Year**	**V-notch reproductive potential (eggs)**	**Total reproductive potential (eggs)**
Eastport	2004	7.97×10^5	2.03×10^6
Eastport	2005	3.72×10^5	6.40×10^5
Eastport	2006	1.68×10^5	3.49×10^5
Eastport	2007	4.18×10^4	3.50×10^5
Eastport	2008	2.06×10^5	5.66×10^5
Leading Tickles	2004	5.47×10^4	2.25×10^5
Leading Tickles	2005	1.05×10^5	1.98×10^5
Leading Tickles	2006	1.89×10^5	3.70×10^5
Random Island	2004	1.48×10^5	4.31×10^5
Shoal Point	2004	1.01×10^5	9.66×10^5
Summerford	2004	6.33×10^5	1.01×10^6
Gander Bay	2004	1.50×10^6	2.83×10^6
Trout River	2004	8.06×10^4	3.87×10^5
Pooled	2004-2008	4.39×10^6	1.04×10^7
Average		3.93×10^5	7.96×10^5
Standard Deviation		4.30×10^5	7.84×10^5

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