

RANDOMIZED CLINICAL TRIAL TO ASSESS POTENTIALLY HARMFUL ENVIRONMENTAL CONDITIONS FOR A LOBSTER POPULATION

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Lobster harvests in a localized area of Colville Bay, near the entrance to Souris Harbour, Prince Edward Island, Canada, have historically been very productive. However, in recent years, there has been an apparent decrease in productivity of the area with decreased total harvests and greater frequency of lobsters which were weak or had abnormally developed legs, deformed claws, and marks on the carapace and shell. The observed effects were very localized to this one specific area and nearby fishing was at normal catch levels and lobster health seemed to be unaffected outside of this area.

The primary objective of this study was to determine if there exists a detectable difference between the health and survival of lobsters that experience the environmental water quality found around the area of Colville Bay (specifically near the Souris seafood processing plant outflow) and the lobsters that experience the environmental water quality found in a comparable but different area considered “normal” by local fishers. The assessment was in the form of a randomized, clinical trial using the environment as the randomized variable and maintaining blinded evaluations of lobsters through individual lobster identification.

Materials & Methods

All of the lobsters selected for inclusion in the study were caught by a single fisherman whose home port was Souris. The lobsters were obtained from traps in an area considered to have a lobster population which was not showing any detectable signs of low productivity, unusual lesions, or irregularities in development of limbs or shell. Although not within the suspected area of Colville Bay, the lobsters were harvested from a similar area to Colville Bay in depth and bottom characteristics. Only legal-sized lobsters less than 1.5 pounds were eligible for inclusion in the study and any which had noticeable defects were immediately returned to the fisherman for sale. Study lobsters were immediately identified using sequentially number coded polyethylene labels adhered to the dorsal-lateral surface of the carapace. Individual lobsters were monitored throughout the study. A random number list was used to identify lobsters which were to receive more detailed health assessments, which included hemocyte counts, total serum protein, and gaffkemia cultures. Each lobster was then placed with the other study lobsters in tote boxes containing fresh seawater for transport to the wharf.

Each lobster was assessed by two independent observers, one of which was a fisherman who fished in the affected area and the other was a researcher who had experience in lobster health assessments. Assessments were done without knowledge of the other observer's findings. Each lobster was scored as to healthy (normal), weakened, or damaged and the type of damage recorded. Only lobsters that were healthy (normal) were used in this study. Lobsters were returned to one of two original seawater containers depending on treatment group assignments.

A randomly numbered list was used to assign individual lobsters to group A or group B. A coin toss was used to decide the group to be placed at each site. Distribution was 50% of lobsters to "suspect area" of Colville Bay and 50% to a similar environment not in a suspicious environmental quality area. A total of 60 lobsters were placed into 6 cages with individual compartments at the non-suspect site and into 5 similar cages at the suspect site. Cages were then placed on the sea floor, using Global Positioning Systems for location, with a rope attaching cages together and to an anchor for future recovery.

All study cages were located and brought to the surface once per week for the duration of the study. Cages were opened to identify dead or moribund lobsters which were recorded and removed. Each lobster compartment was provided with a similar piece of herring each week. Compartments and cages were then resealed and returned to as close to the original location as possible. At the end of eight weeks, all lobster cages were recovered from the sea floor from both study sites. The transport to the wharf was under conditions as similar as possible for both treatment groups. Once the lobsters were removed from their study cages, they were mixed so that only their label could identify which group was represented.

Each lobster was weighed, measured for carapace length, and assessed for vigour. The same assessments (by the same assessors blinded to their initial findings and those of the other observer) were performed on each lobster as at the beginning of the trial. Assessments were done by scoring as to healthy (normal), weakened, or damaged and the type of damage was recorded. Procedures similar to initial health assessments were performed on the lobsters subsampled at the beginning of the trial and any lobsters deemed "abnormal" by the assessors.

Data was entered into a computer spreadsheet (QuattroPro 9, Corel Corporation Ltd, Ottawa, Canada) and Stata, Version 5 (Stata Corp, College Stn, Texas). Descriptive statistics were generated to examine variables. Unconditional associations between risk factors and the dependent variables, and linear and logistic regression analyses were used to evaluate predictors of mortality, serum protein levels, hemocyte counts, and final subjective assessments.

Results & Discussion

Characteristics / Factor	Proportions or Percent		Risk Ratio	Prob > χ^2
	Control Site	Suspect Site		
Mortality proportion in first 3 wks (%)	8.3	6.7	0.80	0.729
Mortality proportion in last 5 wks (%)	9.1	14.3	1.57	0.395

Mortality proportion for entire study (%)	16.7	20.0	1.20	0.637
Molt proportion for entire study (%)	53.3	46.7	0.88	0.465
Damaged by end of study (%)	63.3	68.1	1.08	0.619
Gaffkemia prevalence end of study (%)	16.0	14.8	0.93	0.906
Carapace fouling (mod-severe) at end of study (%)	57.1	51.1	0.89	0.550

This study was a well-designed investigation of the effects of the environment while attempting to control the confounding effects of other variables. The design was most similar to a clinical field trial used to evaluate the effects of a therapeutic or husbandry effect on health or productivity under the most natural conditions possible. Although confining lobsters in a cage was not considered “natural”, it did permit the investigation of the effects of water quality on the health and productivity of a natural population of lobsters collected from a nearby area.

Blinding was accomplished in this study by having each lobster uniquely identified with a tag and then all measurements and assessments were performed with reference to the identification number and without knowledge of the study group being assessed. This was particularly critical to the objectivity of this study as many people, particularly the fishers involved, had pre-conceived opinions of the effect expected. This study objectively examined the possible effects on lobster health of the environmental quality existing in Colville Bay from the end of June to the end of August, 1998. The fact that the study group identification was unknown to the evaluators permitted the study to conclude that the perceived damage was present in both groups at similar levels (i.e. about 40% of lobsters were damaged in some way).

Virtually all detectable health and productivity measurements monitored in this study were not significantly different when compared between the two study sites. Sample sizes used in this evaluation (i.e. sixty lobsters in each group) were relatively small to permit detection of very small differences. For example, the proportion of mortalities (for the entire study) at the suspect site was 20.0% compared to 16.7%. Extraordinarily large group sizes would be necessary to conclusively state that a difference of this magnitude exists. However, the investigators decided prior to commencing the study that if the difference between the two groups was less than about 10%, then it would not be detectable using this type of study. The expense and logistical constraints of incorporating the much greater sample sizes could not be justified.

Using a rigorous clinical field trial to compare two different natural environments, it was concluded that there was no significant difference in lobster health or productivity between the Colville Bay site and a similar control site.