# An Analysis of San Juan River Otter (*Lontra canadensis*) Diets


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Nearshore Ecology Research Experience

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## Abstract

This study analyzes the diets of *Lontra canadensis* populations on San Juan Island, Washington. It tests the hypothesis that the majority of river otter diets, in the populations studied, is composed of fish and crustacean species. Sixty scat samples were collected from two latrine sites in differing environments, and sorted through for remaining hard prey fragments. Fish and crustaceans were the overwhelming majority of otter prey found at each site. However, crustaceans made up a greater proportion of the diets of *L. canadensis* foraging in the sheltered harbor site than those hunting at the wave-exposed point. This study acts as a starting point for future river otter diet analysis in the San Juan Archipelago, an area not previously studied.

## Introduction

Marine mammals are key oceanic predators, capable of impacting entire ecosystems (Williams *et al.* 2004). A prime example of this is the sea otter trophic cascade: sea otters decrease coastal urchin populations such that kelp beds, which are consumed by urchins, thrive where otters are found (Estes *et al.* 1995). Sea otters are thus a keystone species capable of completely altering nearshore environments through top-down predation. Keystone species are important indicators of environmental health, as their populations' health directly reflects that of the ecosystem. *Lontra canadensis,* the Northern river otter, is in the same family as sea otters, and also forages in marine ecosystems. However, considerably less is known about their impact on nearshore communities, and whether or not their predatory activity is sufficient to regulate or deplete prey species populations.

River otters (hereafter referred to as otters) can be found in a variety of both freshwater and marine habitats throughout the North American continent (Encyclopedia of Life 2014). Voracious and opportunistic predators, their diets vary with habitat and season, and can have significant impacts on freshwater environments (Cote *et al.* 2008a, Dekar *et al.* 2010). In wetlands, the ratio of prey consumption by otters to production by prey species is relatively high, suggesting the capability for otters to heavily impact these ecosystems (Dekar *et al.* 2010, Dolloff 1993). Prey behavior is also indirectly affected. Fish species frequently consumed by otters will avoid otter hunting grounds, taking shelter in deeper water than is typical for their species (Cote *et al.* 2008a). While there is some literature on the feeding habits of coastal marine otters (Cote *et al.* 2008a, Cote *et al.* 2008b), no such study has been conducted within the San Juan Island archipelago.

The objective of this study is to gain a better understanding of the role river otter populations might play in the San Juan Island food web, and compare their prey selection to that of other coastal-marine otter populations. Specifically, we are curious as to whether river otters consume kelp crab (*Pugettia productus*), and if so, is this top-down predation comparable to that of sea otters on urchins. We hypothesize that marine fish and crustaceans will make up the majority of otter diets, as was found in previous studies (Cote *et al.* 2008a, Cote *et al.* 2008b), but that diet will differ by location.

## ***Methods***

This study tests the hypothesis that the majority of *L. canadensis*' diet, in the populations studied, is fish and crustacean species. Thirty samples of *L. canadensis* feces were collected at both Point Caution (PC), on rocks high on the shore, GPS co-ordinates 48°33'43.36"N 123°01'01.65", and Friday Harbor Laboratories docks (FHL), GPS co-ordinates 48°32'42.91"N 123°00'44.93"W on San Juan Island, Washington. Friday Harbor is a protected harbor with very little wave action and currents. Point Caution is an unprotected rocky outcropping exposed to San Juan Channel, an area of highly variable winds and currents, and strong wave action. Each are known otter latrine sites, locations where otters repeatedly defecate (Cote *et al.* 2008a, Cote *et al.* 2008b, Stearns *et al.* 2011). Samples were collected between April 18, 2014 and May 15, 2014. Each sample was rinsed with freshwater using a 1 mm mesh sieve (Cote *et al.* 2008b), and the retained fragments were sorted into three categories: crustaceans, fishes, and other. Once sorted, the samples were dried in an oven at 45° C for 16 hours after which each component was weighed to the nearest 0.1 gram. Percent of the total dry mass of each category per sample was calculated to represent the relative abundance of the different prey types.

Only indigestible parts were collectable, and therefore there is a bias in this study. We cannot determine how many of each species was consumed per sample, only the frequency with which each type appears in the fecal matter.

## **Results**

Composition of prey species eaten did not differ between sites (ANOVA, $p > 0.99$); at both PC and FHL, the majority of retained fragments were fish bones, and pieces of crustacean exoskeleton. Any undigested hard parts collected other than fish or crustaceans were categorized as ‘other’ and lumped together as a group. The three food categories were not consumed in equal quantities regardless of site (ANOVA, $p<0.001$); overall, fish parts outweighed crustaceans, and both greatly outweighed ‘other’, as seen in Figure 1. There is significant interaction between site and diet (two way ANOVA, $p<0.005$), meaning that the relative proportions of prey fragments differed between sites. The significant difference between sites lay in the higher proportion of fish parts at PC vs. crustacean parts at PC (Table 1).

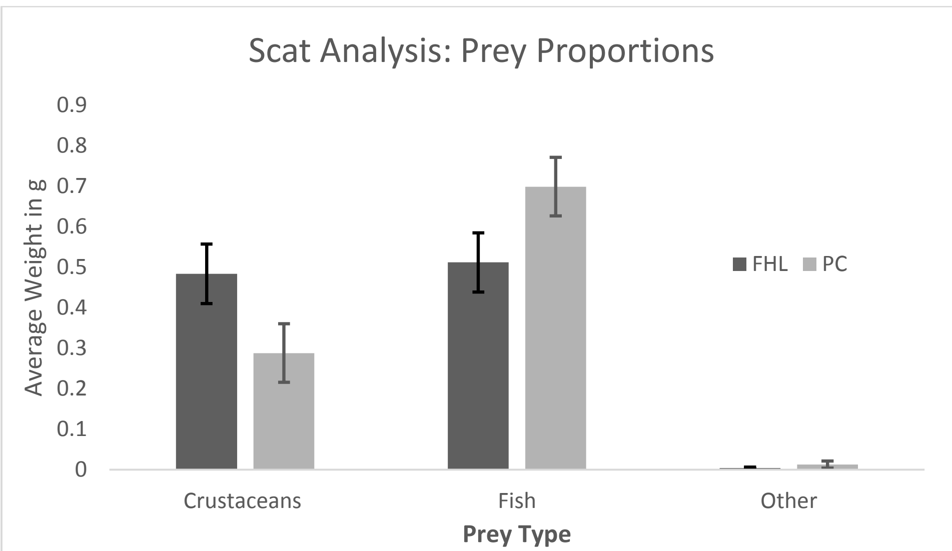


Figure 1: The graph above shows the average proportions of each prey type found in the 30 scat samples from each site, Friday Harbor Labs and Point Caution.

| Site: Prey | p-values |
|---|---|
| PC:Crab-FHL:Crab | 0.157 |
| FHL:Fish-FHL:Crab | 1.000 |
| PC:Fish-FHL:Crab | 0.148 |
| FHL:Other-FHL:Crab | 0.000 |
| PC:Other-FHL:Crab | 0.000 |
| FHL:Fish-PC:Crab | 0.100 |
| PC:Fish-PC:Crab | 0.000 |
| FHL:Other-PC:Crab | 0.002 |
| PC:Other-PC:Crab | 0.004 |
| PC:Fish-FHL:Fish | 0.224 |
| FHL:Other-FHL:Fish | 0.000 |
| PC:Other-FHL:Fish | 0.000 |
| FHL:Other-PC:Fish | 0.000 |
| PC:Other-PC:Fish | 0.000 |
| PC:Other-FHL:Other | 1.000 |

Table 1: Multiple comparisons results (Tukey test) showing the comparisons for which the types of prey were significantly different. Comparisons are shown to the left, and the p-values of each comparison to the right.

The types of prey identified in each of the 60 samples collected are given in Table 2. While fish and crustaceans were the overwhelming majority, hard parts of other marine invertebrates such as marine snails, limpets, and chitons were also identified. With the resources at hand, it was impossible to identify the diets of the otters beyond these rough categories. Local marine invertebrate expert Megan Dethier and fish expert Nicholas Gidmark were consulted when attempting to identify prey to species. However, the parts collected were too chewed up to identify. This severely limits what we can learn from the samples collected, and therefore we will not be able to draw any conclusions in regards to the effects of otter predation on kelp crab with this study alone.

| Organisms | FHL | PC |
|---|---|---|
| Crustaceans | 25 | 21 |
| Fishes | 26 | 27 |
| Snails | 6 | 5 |
| Limpets | 2 | 4 |
| Unidentified Parts | 2 | 3 |
| Chitons | 0 | 1 |

Table 2: List of all types of organisms found within scat samples, and the number of samples they were found in. A total of 30 samples were collected from each latrine site.

## Discussion

We can accept our initial hypothesis; fish and crustacean species do make up the majority of *L. canadensis* diet in the San Juan Archipelago. While the general types of prey did not differ between sites, the proportions of prey types consumed did, with relatively more weight of fish parts and less of crustacean parts at Point Caution relative to FHL. This may suggest a difference in prey availability between the two geographically different sites. A similar study found that feces samples collected at harbor latrine sites had a greater number of crustaceans than exposed sites (Guertin *et al.* 2010). There could be numerous reasons for this. Crustacean populations in wave-exposed habitats may be less dense than in areas with less wave action, as is suggested by a study conducted by Palmer in 1990, or the types of crab inhabiting exposed habitats may be less palatable to river otters. It is also possible that environmental factors affect the fish rather than crustaceans, since it is the proportions of these two categories that differ between sites.

The presence of 'other' species, as listed in Table 1, is too uncommon to offer a significant source of nutritional value to the otters. Therefore, it is more likely that these species were bycatch, either attached to larger prey species, or unintentionally consumed while hunting. Supporting this is the knowledge that these "other" species have not been documented in otter dietary analyses.

This study may serve as a starting point for a number of follow-up studies. Given additional time and resources, we would like to quantify the types and abundances of crab at both sampled sites, and at similar sites around San Juan Island, to try and understand why otter diets differ between sites. This could also serve to further resolve the question of whether *L. canadensis* are preying heavily enough on *P. productus* to be considered the "Sea Otters of the San Juan Archipelago".

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