Spring Diet of River Otters, *Lontra Canadensis*, in the San Juan Islands of Washington State

Kate Aarden[1, 2], Dr. Megan Dethier[1,2], Katie Dobkowski[1,2]

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[1]Friday Harbor Laboratories, University of Washington, Friday Harbor, WA 98050
[2]Department of Biology, University of Washington, Seattle, WA 98195

Contact information:
Kate Aarden
Department of Biology, University of Washington
BOX 351800, Seattle, WA 98195-1800
aarden@uw.edu

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Abstract

Lontra canadensis, the river otter, is a predator in marine nearshore ecosystems in North America. Because it is a top carnivore, *L. canadensis*, may be exerting a trophic cascade. Its diet can vary regionally and possibly seasonally. This study examines the diet of *L. canadensis* through feces analysis from two sites on San Juan Island, WA. Fishes and crustaceans were found to be the main prey items, and there was evidence that relative proportions of different prey types differ with location.

Introduction

The trophic cascade concept in ecology suggests that predation is the main factor controlling the organization of many communities (Reece et al. 2011). A classic example of this model is when sea otter abundance is high, sea urchin populations are reduced through predation, which allows for higher density of their kelp prey (Estes and Palmisano 1974). Another example is the increase of biodiversity when the sea star, *Pisaster ochraceus,* consumes *Mytilus californianus*, a competitively dominant mussel (Paine 1966). For any community, it is thus important to know what the predators in an area are consuming to be able to estimate the importance of top-down control.

Lontra canadensis, the river otter, is a predator in aquatic systems in North America and an opportunistic carnivore (Melquist & Hornocker 1983). Their diet has been studied in several locations. In Eastern North Dakota, scat analysis showed that they consume mainly freshwater fishes and crayfish with relatively smaller amounts of insects, birds, amphibians, mammals, and freshwater mussels (Stearns and Serfass 2011). In Kentucky, the stomach contents of trapped river otters consisted mainly of freshwater fishes and crayfish with vegetative matter present, as well as occasional frogs, snakes, turtles, and duck (Barding and Lacki 2012). Marine coastal river otters of Newfoundland, Canada were found, using scat analysis, to eat mainly marine fishes and molluscs with some crustaceans, polychaetes, and echinoderms (Cote et al. 2008). Comparing the results of these studies shows that the diet of *L. canadensis* can vary in different locations, but that fishes and crustaceans are the primary organisms consumed across sites.

L. canadensis is common around the San Juan Island archipelago, Washington. It is important to know what the river otters eat in this area since fishes and crabs are a common element in their diets and many fish are predators and crabs are predators as well as herbivores, therefore river otter consumption of fishes and crabs could create trophic cascades. During the summer, on Vancouver Island, in western Canada, river otters consume mainly fish with some crustaceans (Guertin et al. 2010). Even though Vancouver is relatively close to San Juan Island, the diet of *L. canadensis* may differ because their prey can vary between different locations and because of the possibility that there is seasonality in prey abundance.

This study investigated the springtime diet of *L. canadensis* in the San Juans by collecting and analyzing the feces taken from two "latrine" locations. We sought to describe the diet from each location and discover whether or not these varied between sites.

Methods and Materials

Thirty samples of *L. canadensis* feces were collected from each of two sites on San Juan Island: Point Caution (PC), from rocks high on the shore (GPS co-ordinates 48°33′43.36″N 123°01′01.65″), and from the docks at the Friday Harbor Laboratories (FHL), (GPS co-ordinates 48°32′42.91″N 123°00′44.93″W). The FHL site is within an embayment rather protected from waves while PC is a more open high wave/high current site. Samples were collected between April 18, 2014 and May 15, 2014. Each sample was rinsed with freshwater using a 1 mm mesh sieve and the retained fragments were sorted into three categories: crustaceans, fishes, and other. The samples were dried in an oven at 45° C and then each component was weighed. Percent of the total dry mass of each category per sample was calculated to represent the relative abundance of the different prey types. The samples contain only the part of the diet that was indigestible and passed through the digestive tract. One hour per week of visual observations of otter feeding behavior were made from the shore at both sites using binoculars.

Results

Fecal samples from both sites were dominated by hard parts of crustaceans and fishes with very few other organisms represented. A 2-way ANOVA on the proportions of the three diet categories of the two sites showed a significant difference in diet categories ($p < 0.0001$) and a significant interaction between site and diet ($p = 0.005$). The FHL docks samples contained hard parts with almost equal proportions (by weight) of crustaceans at 48%, and fishes at 51%, with very small amounts of other organisms at ~0.5% (Fig.1; Tukey multiple comparison of means, $p > 0.99$). The PC site samples contained hard parts with significantly different proportions between crustaceans at 29% and fishes at 70% (Tukey multiple comparisons of means, $p < 0.00004$), with very small amounts of other organisms at ~1% (Fig.1). Crustacean parts were also found in more samples at FHL than at PC, fish parts were found in most samples at both sites, and other organisms were found in few samples at both sites (Table 1).

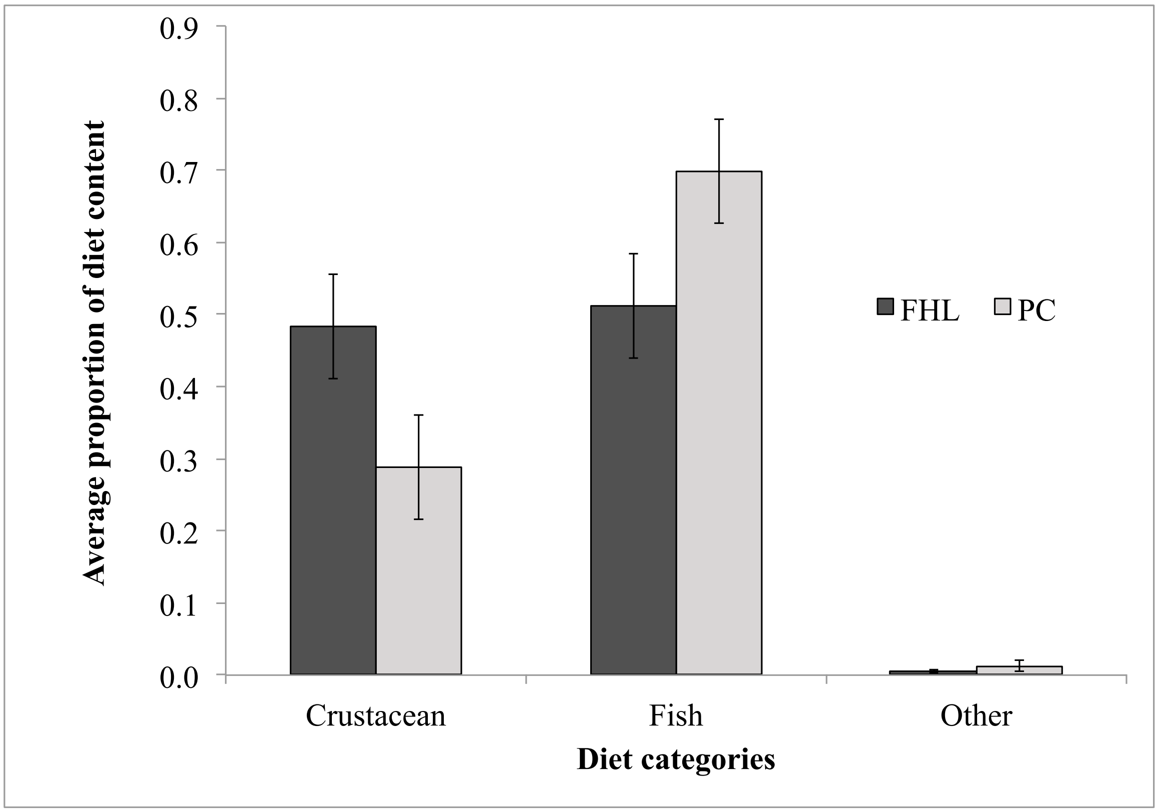

Figure 1 Proportions are of dry weights in grams. Each bar represents the mean and one s.e. from the 30 samples per site (FHL = Friday Harbor Laboratories docks, P = Point Caution.)

Table 1 Number of fecal samples per site where each type of organism was present (FHL = Friday Harbor Laboratories docks, PC = Point Caution)

Organism	FHL	PC
Crustaceans	25	21
Fishes	26	27
Snails	6	5
Limpets	2	4
Orbs	2	3
Chitons	0	1
Mussels	0	1

Our field observations of *L. canadensis* noted occasions when they were eating fish and unidentifiable organisms at the FHL site both in the water and on the docks or shore adjacent to the docks. During one field observation, a whole fish (identified as a sculpin) was seen lying on the FHL dock and then consumed by a river otter. The river otters did not exhibit feeding behavior during any of the field observations at the PC site.

Discussion

Analysis of otter fecal samples from two sites showed that they consume a diversity of organisms, and our data suggest that the importance of different prey types varies among sites. We found a fundamental difference in the relative proportions of dominant diet organisms between the FHL and PC sites, with a higher proportion of crustacean parts at FHL. These differences may result from differing abundances of organisms at each site. Two possible causes of the diet patterns we observed could be 1) there is a higher proportion of available fishes vs. crustaceans at PC than at FHL, 2) there is a higher proportion of crustaceans at FHL than at PC. If fishes are more plentiful than crustaceans then this may cause more fishes to be consumed, assuming that there is no outright river otter preference between the two categories. The very similar proportions of fishes to crustaceans in the diet at the FHL site might be attributed to a relatively equal abundance of these organisms in the embayment.

There are various abiotic factors that could cause a higher proportion of crabs at FHL than PC, if in fact such a distribution pattern is a cause of the diet differences. Human disturbance may be a factor in relative abundance of the different organisms. The FHL docks are a human-made construction, which may be a preferred habitat for crabs. The relative abundance of crabs and fishes could also be influenced by water flow. PC is an open area with relatively high energy/high currents, where crab abundance may be lower than at a more protected site (Palmer 1990). The FHL site location is within a quieter embayment (protected area).

Although we were able to quantify the proportion of hard parts found in the river otter feces, we have no information about the ratios of hard parts to soft parts (biomass) for either the fishes or the crustaceans: such biomass information would be important for understanding the relative nutritional value of the prey types to the river otters. Also, we have no data about what soft organisms are being consumed, eg. sea cucumbers, anemones, jellyfish, tunicates, or worms. To have information about all organisms being consumed would give a more comprehensive picture about river otter diets and therefore potential ecosystem impacts.

Fishes and crabs are important prey of *L. canadensis*. Since both are predators and some crabs are herbivores, it is possible that the consumption of these organisms could be involved in a trophic cascade. To be able to address the possibility of a trophic cascade concerning river otter consumption, additional data we would need to collect would include identification to species level of all organisms consumed and collection of data for all four seasons.

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