Distribution of River Otter Study On Mount Desert Island, Maine

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ABSTRACT

Twenty-six watersheds on Mount Desert Island were surveyed by foot during the winter of 1998 to determine river otter distribution. A new model predicting suitable river otter habitat was created using new data and previous models by Dubuc et al. (1990) and Reebs et al. (1992). This was applied and tested on the known distribution of river otters in the study area.

INTRODUCTION

The North American river otter (*Lutra canadensis*) is distributed throughout the continent from east to west and extends from southern Florida to northern Alaska (Melquist and Dronkert 1987). It is one of the most aquatic members of the Family Mustelidae and can survive in both marine and fresh water (Melquist and Dronkert 1987).

The area of study, Mount Desert Island (MDI) is located in the Gulf of Maine and is approximately 281 km2. All surveys were conducted in watersheds within the boundaries of Acadia National Park.

During the winters and summer of 1995-1987, Leslie Dubuc conducted a study to determine the abundance of river otters in watersheds on Mount Desert Island. Dubuc found that river otters were using eighteen out of 39 watersheds surveyed (Dubuc 1987). In 1992, Carolyn Reeb surveyed watershed use and found that on the eastern side of MDI, seven out of twelve watersheds were being used by river otters (Reeb 1992).

Dubuc found that the most important factors influencing river otter distribution included access to food resources, beaver activity, stream length, and the shoreline diversity.

The most important factor that determined river otter habitats on MDI was food (Dubuc 1987). During the winter, river otters prey primarily on fish species such as banded killfish and mummichogs (*Fundulus* spp.) found in both marine and fresh water, and cunner (*Tautogolabrus adspersus*), which is restricted to marine environments (Dubuc 1987). As lakes and ponds become more productive with the coming of summer, otters shift from foraging in bays and streams to foraging in lakes, ponds, and streams. During the summer months, amphibians and reptiles are preyed on most frequently, followed by fish, frogs, and crayfish (Dubuc 1987).

In 1990, Dubuc created a model predicting suitable river otter habitats. The model incorporated the presence of beaver (*Castor canadensis*), stream length, shoreline diversity, and a negative correlation with the percentage of mixed hardwoods-softwoods present in a watershed. In 1992, Caroline Reeb tested the model and found that some factors did not correctly predict river otter habitats. Reeb used discriminant analysis on new data collected in 1991 and found shoreline diversity to be the only accurate discriminator between used and unused river otter watersheds.

The intent of this study was to update the river otter data to the current distributions in Acadia National Park and to create a new model predicting suitable river otter habitats. My study area included most of the Acadia National Park watersheds on eastern MDI and some parts of the rest of the island. Surveyed watersheds were selected by beaver activity, stream length, amount of wetland softwood, and proximity to possible food resources. The survey included 25 out of a total of 110 watersheds in Acadia National Park.

METHODS

GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND STATISTICAL PROCEDURES

Using the GIS programs Arcview and ArcInfo, variables were extracted for a new model predicting suitable river otter habitats. I began by using the latest watershed cover (database files) from the College of the Atlantic's GIS database. The cover was updated and 110 watershed names were added in a new field within the watershed cover. The updated files were merged with a vegetation data layer to create a new cover. New fields included the percent of forested land composed of wetland softwood (NWCBLK), the percent of forested land composed of birch-aspen (BASP), the sum of areas of all water bodies characterized by emergent herbaceous vegetation (SEMER), the sum of the perimeters of all water bodies (SPERIM), the sum of the area of all water bodies (SAREAREA), the mean shoreline diversity index (MIRREG), and the percentage of all wetlands with active or inactive beaver sign were added to the new watershed cover.

After all the fields were added, calculations were done using the query builder in Arcview. This command was used to select a particular watershed from the 110 within the new watershed cover. Once selected, the field calculator was used to calculate the percentages and sums for each field within the selected watershed.

Using Microsoft Excel 97, a database file was created with the same field names as the GIS watershed cover. Then in Arcview, the query builder and field calculator was used again to add all the polygons within each field together for each watershed. After the sum was totaled, it was added to the field boxes for the watersheds in the Excel file. A field "TOTL", which is the total stream length in a watershed, was added to the Excel file and stream lengths were added up for each watershed.

Once all the data was collected and added into the Excel file, the field "Otter" was added to the database. Under this field, each watershed surveyed was marked as either containing river otters with a 1 or not with a 0. All of the data was then imported in a statistical program, Systat, and discriminant analysis was performed.

Table 1. Variables used to predict river otter presence or absence

Mnemonic	Variable Description
NWCBLK	% of forested land composed of "wetland softwood" (Northern White Cedar, Black Spruce-Tamarack Swamp)
BASP	% of forested land composed of birch-aspen (birch-aspen forest, birch aspen scrub, alder scrub)
SEMER	Sum of the areas of all water bodies characterized by emergent herbaceous vegetation
SPERIM	Sum of the perimeters of all water bodies
SAREAREA	Sum of the area of all water bodies
MIRREG	Mean shoreline diversity index (SPERIM/SAREAREA)
ALLBEAV	% of all wetlands with active or inactive beaver sign
TOTL	Total stream length over all stream orders

WINTER TRACKING

Since river otters tend to follow drainage patterns, classification units were broken up into 110 watersheds to show river otter distributions. The original classification units were extracted from Steve Perrin's "Index to MDI Watershed Systems 1996".

A total of 35 surveys were conducted on foot between December 11, 1997 and March 7, 1998 to determine the presence or absence of river otters along 25 watersheds on MDI. If otter signs were found in a watershed, it was classified as having otters present. Watersheds with no otter signs were classified as having otters absent.

Signs of river otter presence included: tracks, snow slides, holes in the ice, scat, and direct observation. If signs were questionable, watersheds were surveyed again during better tracking conditions.

Identification of scat was done using tracking guides and information from Dubuc's study.

Dubuc found that river otters main food source in the winter were marine and fresh water fish, therefore fish scales and bones served as good indicators of otter scat (1987). The size, shape and musk odor also served as good indicators of otter scat.

Weather conditions determined when specific watersheds were surveyed. After a heavy snowfall, one or two days were allowed for otter movement. If the snow crusted or it rained, the conditions were considered poor. Under good tracking conditions, otter signs were obvious. Otter scat and holes in the ice were also good indicators of otter activity regardless of weather conditions. When otter signs were found along part of a watershed, the remainder of the watershed was not always walked completely. When otter signs were unclear during poor tracking conditions, the watershed was surveyed again during better conditions. Watersheds classified as unused were walked in their entirety during good conditions.

RESULTS

Of the 25 watersheds surveyed, 13 watersheds were used by otters and 12 watersheds were unused (see Table 4). Most of the surveys were conducted in watersheds previously surveyed by Dubuc and Reeb.

Discriminant analysis was performed on the model factors and was highly successful in correctly classifying otter distribution on all the watersheds when a combination of five variables were used. These model factors included: birch-aspen (BASP), shoreline diversity index (MIRREG), active or inactive beaver sign (ALLBEAV), stream length (TOTL), and wetland softwood (NWCBLK) (see Table 1).

The model factors were extracted from the canonical discriminant function results that included variables with P-values greater than .05. Then, the numbers were put into the following equation: y = -.023189 + 139.287BASP + 1.115MIRREG + 13.899ALLBEAV -.000314TOTL – 583.224NWCBLK

The model generated results to be 93% effective in predicting river otter presence and 83% effective in predicting absence. Overall the model was 88% effective in predicting presence or absence of river otters.

Table 3. Distribution of river otters (winter 1992 survey)

Watershed Name	River Otter Presence/ Absence
Fresh Meadow Marsh	Present
Hamilton Pond & Stony Brook	Present
Old Mill Brook	Present
Breakneck Brook	Present
Lake Wood	Present
Faun Pond	Present
French Hill Pond & Brook	Present
Witch Hole Pond	Present
Breakneck Ponds	Present
Eddie Brook	Absent
Cromwell Brook	Present
Kebo Brook	Present
Eagle Lake	Present
Bear Brook	Present
The Tarn	Present
Meadow Brook & Kents Field	Absent
Jordan Pond	Absent
Hunters Brook	Present
Unnamed meadow & Kief Pond	Present
Little Harbor Brook	Absent
Duck Pond & Brook	Present
Stanley Brook	Absent
Little Long Pd & Jordan Stream	Absent

Table 4. Distribution of river otters (winter 1998 survey)

Watershed Name	River Otter Presence/ Absence
Breakneck Brook	Present
Witch Hole Pond	Present
Duck & Witch Hole Brooks	Present
Breakneck Ponds	Present
Kebo Brook	Absent
Eagle Lake	Absent
Aunt Betty Pond	Absent
Richardson Brook	Absent
Bear Brook	Present
Beaver Dam Pond	Present
The Tarn	Present
Meadow Brook & Kents Field	Present
Otter Creek & Canon Brook	Present
Echo Lake & Denning Brook	Absent
Jordan Pond	Absent
Bubble Pond	Absent
Unnamed meadow	Present
Upper Hadlock Pond	Absent
Hunters Brook	Present
Unnamed meadow & Kief Pond	Present
Stanley Brook	Absent
Little Long Pond & Jordan Stream	Absent
Lower Hadlock Pond	Absent
Seal Cove Pond	Absent
Bass Harbor Marsh	Present

DISCUSSION

DISTRIBUTION

The river otters on Mount Desert Island appear to use many of the same watersheds from year to year. Some are used only in the summer and others only in the winter. Some of the watersheds used during the 1987 and 1992 survey were not seen as used during this winter.

Thirteen out of the 25 watersheds surveyed during the winter of 1998 were used by otters (see Figure 1). Of the 25 watersheds surveyed, 6 watersheds had changed from used to not used and one changed to used (see Figure 2, and Tables 2, 3, and 4). Seal Cove Pond, Echo Lake & Denning Brook, Lower Hadlock and Richardson Brook were found to have otters present in Dubuc's 1985-87 study. My study did not find any signs of otter in those watersheds.

Dubuc had only found otters in the Echo Lake & Denning Brook, and Richardson Brook watersheds during one of the winter surveys. These watersheds appeared to be suitable habitats since they had been used in the past and there was evidence of beaver activity.

During the summers in 1985-87, otter were using the Lower Hadlock watershed but no otter signs were found during the winter surveys. It is possible that food resources increase in the pond during the summer months.

There are some other hypotheses for the change in presence to absence in watersheds from the 1985-87 survey to 1998. Male river otters tend to have large home ranges, which often extend into more than one watershed (Melquist and Dronkert 1987). This may account to the absence of river otters in the Eagle Lake watershed. It is in between many otter watersheds found to have otter sign and could be an occasional extension of an adult male's home range. Other possible factors might include mortality, a change in water quality, or a shift in food resources (Dubuc

1987).

VARIABLES AFFECTING DISTRIBUTION

The discriminant analysis performed on my data set generated five variables that could be used to predict otter presence or absence in watersheds. Those model factors included: birch-aspen (BASP), shoreline diversity index (MIRREG), active or inactive beaver sign (ALLBEAV), stream length (TOTL), and wetland softwood (NWCBLK) (see Figure 3, and Table 1).

Birch-aspen (BASP) is a key food and building resource for beavers. Since watersheds altered by beavers provide an excellent habitat for otters, it is an indicator for an otter habitat.

Wetland softwood (NWCBLK) is also good indicator for otter habitats. River otters are secretive animals that dislike human contact. Vegetation such as NWCBLK describes areas characterized by tall herbaceous vegetation, concealed logs, and mucky soils. This offers a secluded and safe place for otters to inhabit. It also offers a suitable foraging habitat.

Although the variables SPERIM and SAREAREA were not directly part of the model, they do represent the amount of shoreline diversity (MIRREG). They depict the general shape of water bodies present within a watershed and are helpful in discriminating between used and unused watersheds.

Total stream length (TOTL) is an important variable when examining otter habitats. Longer stream lengths allow otter easier access to other watersheds and food resources.

The presence of beaver plays a significant role in river otter ecology. Many studies have found a high correlation between river otter distribution and beaver activity (Melquist and Hornocker 1983). Beavers alter watersheds to create deep ponds and bring in more food resources. River otters use those watersheds and coexist with the beavers.

PREDICTIVE MODEL

In Reeb's study, Dubuc's model was tested on a new data set. It was found to be 59% effective in correctly identifying otter use in Reeb's study area. The model incorporated a positive correlation between beaver, stream length, and shoreline diversity. It also had a negative correlation between the percentage of mixed hardwood-softwoods.

Dubuc's model and data from Reeb's study was used to create a new model to better predict suitable otter habitats. Discriminant analysis was used to test variables from both Dubuc's and Reeb's studies to find the best predictive variables. The different variables were tested against my new data set until the results showed highest percentage of correctly classified watersheds.

Reeb's sample size may have been the reason for the failure of Dubucs model. If Reeb's study area was expanded to include more areas including the variables in the model, the percentage of correctly classified watersheds may have been higher. The fact that beavers were not found to be significant indicators in the 1992 study suggests that the sample size was too small.

SOURCES OF ERROR

As with this study and the previous river otter studies, there are possible errors that may have caused differing results. The first source of error is the data source for model variables. In 1985-87, Dubuc gathered data using an electronic planimeter (measures physical features), a random dot grid on orthographic vegetation maps (vegetation), and a Saltzman projector (basin area perimeter). The data from the recent study and Reeb's study came from the College of the Atlantic's GIS database. The vegetation data originally came from 1979 photographs that were studied and data was extracted into a GIS database.

The second source of error is sample size. In the 1985-87 survey, 39 watersheds were surveyed. This is much larger than my survey that included 25 watersheds and Reeb's survey of 12 watersheds. As the sample size increases, the accuracy of the discrimant analysis increases. Also, the sample size may determine which variables best predict the presence or absence of river otters.

A third source of error specific to my study is the classification for watersheds. I used a different set of watersheds than Dubuc and Reeb. Using maps created by Dubuc, Reeb, and Steve Perin, a watershed map with 110 individual watersheds was created. All of the watersheds overlapped with the previous studies but since mine was broken up to greater degree, some watersheds in Dubuc and Reeb's study may have been misinterpreted.

RESOURCE MANAGEMENT AND PROTECTION

Dubuc found that habitat conditions, and not recreational trapping or human disturbances were the primary factors influencing the distribution of river otters on MDI. Therefore, the focus of resource managers should be on the factors found to provide suitable otter habitats.

Using the updated GIS database that includes data from this study and the previous studies, and the new predictive model, resource managers can estimate possible suitable river otter habitats. Factors such as birch-aspen (BASP), shoreline diversity index (MIRREG), active or inactive beaver sign (ALLBEAV), stream length (TOTL), and wetland softwood (NWCBLK) should be studied in these areas and protected or restored if disturbed.

Surveys such as this one should be conducted every five years or as the availability of personnel allows. Since winter tracking is the best time to detect otter signs, the surveys should be conducted seasonally in watersheds previously known to have otters present.

One of the easiest ways to detect otter presence is by finding beaver habitats. Since river otters and beavers often coexist in the same watershed, a survey of beaver lodges and other related structures would give a rough estimate of otter distributions.

In order to ensure habitats for the beavers and indirectly river otters, prescribed burning could be applied to promote birch-aspen stands, but is unlikely to be implemented in ANP. Removal of softwood seed trees is an alternative and would allow for growth of birch-aspen stands.

Other than protecting beaver habitats, food resources are one of the most important factors in protecting river otters. Marine habitats should be examined. Since otters use these areas for foraging, resource protection zones should be established to allow vegetation corridors along waterways that emerge from the Park. Homeowners should also be contacted to help develop a vegetative buffer along streams and waterfronts to minimize human disturbance.

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