

Species - Habitat Model for Northern River Otter

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Species Data

Common Name: Northern River Otter
 Scientific Name: *Lontra canadensis*
 Species Code: M_LOCA
 BC Status: Yellow-listed (6)
 Identified Wildlife
 Status: None
 COSEWIC Status: Not at Risk
 Syilx Status: Unknown

Project Data

Area: Merritt Timber Supply Area
 Ecoprovince: Southern Interior, Minor inclusion of Coast and Mountains
 Ecoregions: Northern Cascade Ranges, Pacific Ranges, Thompson-Okanagan Plateau, Interior Transition Ranges, Okanagan Range
 Ecosections: Eastern Pacific Ranges (EPR), Guichon Uplands (GUU), Hozameen Ranges (HOR), Nicola Basin (NIB), Okanagan Ranges (OKR), Pavilion Ranges (PAR), Southern Thompson Upland (STU), Thompson Basin (THB)
 BEC Variants: AT, AT-Emwp, BGxh2, BGxw1, CWHms1, ESSFdc2, ESSFdcp, ESSFmw, ESSFmwp, ESSFxc, ESSFxcp, IDFdk1, IDFdk1a, IDFdk2, IDFxh1, IDFxh1a, IDFxh2, IDFxh2a, MHmm2, MHmm2p, MSdm2, MSmw, MSxk, PPxh1, PPxh2, PPxh2a
 Map Scale: 1:20,000

1 ECOLOGY

1.1 Description

The northern river otter is the largest member of the weasel (2) family *Mustelidae*, which includes the weasel, skunk, badger, and mink (5). They are semi-aquatic mammals (5) that are highly modified for aquatic life (1). The pelage (2) of the river otter is generally black to shades of red-brown on the dorsal surface, and a lighter gray-brown on the ventral surface (5). The throat and cheeks are more of a yellow-gray colour (5) or golden brown (3). The ears are short, and along with the eyes are on top of its relatively flat, wide and rounded head, enabling it to see

and hear with only a small portion of its head protruding above water (2). The ears and nose close when the animal submerges in water (5). A nictitating membrane covers the eyes while the otter is swimming (5). The body is long and streamlined and ranges in length from 90 to 135 cm (2). A thick powerful tail constitutes approximately one-third of its body length (1, 2). The tail is thick nearest the body and tapers toward the end (1, 5). The tail is also stout and larger in surface area than the limbs (1). The legs are short and powerful (1) with five toes on each foot (5), which are fully webbed (1). The rear legs and tail provide primary propulsion and steering when the animal is swimming (2). The otter has a delicate sense of touch in the paws as well as great dexterity (1). Both male and female otters reach their maximum weight and length at three to four years of age (4.2, as cited in 4).

There is some degree of sexual dimorphism in that males are generally larger than females (5) by an average of 17% (2).

1.2 Reproduction

River otters generally practice mutual avoidance (3), usually associating only during mating season (3). The northern river otter is polygynous (4.20, as cited in 4). Males often breed with several females; most likely those whose home ranges overlap with their own (3). Female river otters are in heat for 42 to 46 days (4.19, as cited in 4). The males follow the females' scent trails (4.21, as cited in 4). Adult male otters begin traveling extensively in search of females around February in most areas (2), or December (4), and breeding may take place from then through April (2). Copulation may last from 16 to 73 minutes and may occur in water or on land (4.1, 4.22, as cited in 4). True gestation lasts from 61 to 63 days, but because otters delay implantation of the fertilized egg in the uterus (3), the interval between copulation and parturition (giving birth) may reach ten to twelve months (1.4, 1.5, as cited in 1). The pups are born between February and April (1.4, 1.6, as cited in 1). Parturition lasts three to eight hours (1.5, as cited in 1).

Males mature sexually at two years of age (1.4, as cited in 1), but may not successfully breed until they are five to seven years old (5). Female otters usually do not reproduce until two years of age, but occasionally yearlings may produce young (1.4, 1.7, as cited in 1). The litter size ranges from one to five young, but two or three are most common (2).

Northern river otters are born fully furred, blind, and toothless (1). A full-term fetus from a three year old female measured 275 mm in length, the tail measured 64 mm, and the hind foot measured 28 mm, and weighed 132 grams (1.4, as cited in 1). Newborns have well-formed claws and facial vibrissae are present (1.4, as cited in 1). The pups' eyes open from 30 to 38 days of age (1.5, as cited in 1), and playful behaviour begins at five to six weeks (1).

The milk of a lactating female is rich, containing 62 % water, 24 % fat, 11 % protein, 0.1 % carbohydrates, and 0.75 % ash (1.8, as cited in 1). Female otters nurse and care for their young in a den near water (3), and provide solid food (4). River otter pups take their first solid food at nine to ten weeks of age (4.1, as cited in 4). They are fully weaned at 12 weeks and remain with their mother until they are 37 to 38 weeks old (4). During this time the female continues to provide food and teaches her young to hunt (4.22, as cited in 4). Important habitat for family groups with pups learning survival skills are quiet waters such as beaver ponds, marshes, and back water sloughs (4.2, as cited in 4).

1.3 Natal Dens

Northern river otters build dens in the burrows of other mammals, in natural hollows, such as under a log, or in river banks (3). The dens have underwater entrances and a tunnel leading to the nest chamber (3). The nest chamber is lined with leaves, grass, moss, bark, and hair (3). Den sites include burrows dug by woodchucks, red foxes, nutrias, beavers, or beaver and muskrat lodges (1.3, 1.5, 1.6, 1.9, as cited in 1). Otters may also use hollow trees or logs, undercut banks, rock formations, back water sloughs, and flood debris (1.10, as cited in 1). Beaver bank dens, dams, and lodges are important sites for the river otter for latrine sites, dens, and resting sites (4). Beaver bank dens were used by river otters in 31 percent of 1,300 observations in Idaho (4.2, as cited in 4). Natal dens may occasionally be up to a few hundred feet from water (4.4, as cited in 4).

1.4 Territoriality and Movement

Northern river otters are active year-round. They are most active at night and during crepuscular hours (1.3, 1.6, 1.11, as cited in 1). They become significantly more nocturnal in the spring, summer, and fall, and more diurnal in the winter season (1.6, as cited in 1). They may emigrate due to food shortages or environmental conditions, but do not migrate annually (1.12, as cited in 1). The otters are not territorial, but individuals of different groups exhibit mutual avoidance (1.6, 1.13, as cited in 1).

Male home ranges are larger than that of the female. Males and females exhibit intra and intersexual overlap of their ranges (1.3, 1.6, 1.11, as cited in 1). In Alberta, observations of six male otters determined an annual home range of 231 ± 44 km², with 70 ± 65 km² observed for three females (1.3, as cited in 1). Winter home ranges for male and female otters averaged 9 % of annual home range value and showed less overlap (1.3, as cited in 1). Otter home range length in Idaho was from 8 to 78 km of stream and/or lake shoreline (1.6, as cited in 1). River otters are highly mobile and can move up to 42 km in one day (1.6, as cited in 1). Daily movements of yearling male otters in Idaho averaged 4.7 km in the spring, 5.1 km in summer, and 5.0 km in autumn (1). Yearling females in Idaho averaged 2.4 km in the spring, 4.0 km in summer, and 3.3 km in the autumn (1). Daily movements of family groups averaged 4.7 km in spring, 4.4 km in summer, and 2.4 km in winter (1). Males and family groups move much less in the winter (1.3, 1.6, as cited in 1). In Idaho, juveniles disperse in April and May at 12 to 13 months of age (1.6, as cited in 1). Otter groups consisting of a mother and her offspring usually break up between November and March (4). Most juveniles probably disperse at about the time their mother is producing the next litter and the juveniles may remain together in sibling groups for some time after that (2). The dispersal route may reach 200 km, at a rate of 3.5 to 3.8 km per day.

The basic social group of the northern river otters is the family, consisting of an adult female and her offspring (1.6, as cited in 1). Adult males may form groups ranging from less than 10 to 17 individuals, but this is uncommon (1.3, 1.14, as cited in 1). Groups of up to 21 male individuals are common in coastal marine systems, which apparently supports cooperative foraging for schooling fish (4.24, 4.25, as cited in 4). Family groups may also include helpers: unrelated adults, yearlings, or juveniles (1.6, 1.15, as cited in 1). Occasional observations have been reported of groups of unrelated juveniles (1.6, 1.14, as cited in 1). Groups of otters hunt and

travel together, use the same dens, resting sites, latrines, and also perform allogrooming (1.3, 1.14, 1.16, as cited in 1). Groups occur most often in autumn and early winter and from mid-winter through the breeding season in freshwater systems (1). Northern river otters are solitary when moving and denning (1.3, as cited in 1). Male otters may remain gregarious in coastal areas even during the females' oestrous period (1). Areas in the otters' home range where they focus their activity during certain times are called "activity centers" (4.2, as cited in 4). These activity centers provide adequate shelter, abundant food, and minimal disturbance (4.4, as cited in 4). Observed examples of activity centers are large logjams with spawning salmon (in Idaho) (4.2, as cited in 4) and deep river pools with abundant crayfish and beaver bank dens in Colorado (4.8, as cited in 4).

River otters can remain submerged in water for almost four minutes, may reach speeds up to 11 km/h while swimming, reach depths of nearly 20 m while diving, and travel up to 400m in distance under water (1.2, 1.12, 1.17, as cited in 1). Northern river otters dry themselves and retain the insulative quality of their fur by regular rubbing and rolling on grass, bare ground, or logs (1.6, 1.18, as cited in 1).

1.5 Densities

Otter densities have not often been reported (4). The nature of their ranges along water bodies is not conducive to easy calculations of density. Densities of otters in a large coastal marsh were 1.2 per km² (15), and as of 1988, this was the first attempt at estimation of population size and density of otters. Much more recently density of otter (*Lutra lutra*) populations in central Finland have been reported as 0.12 to 0.29 individuals per river ha (13). The linear nature of much of their habitat often confounds calculation of densities. However, even without that complicating factor, numbers are simply very hard to determine without intensive studies. Otter abundance has been reported as number of activity sites per stream km (e.g. 14), but this only a relative index of abundance, and even such statistics are not widely reported.

Average densities of one otter per 3.9 km of waterway (or 0.25 per km) were estimated in Idaho (1.6), and often densities are extrapolations from home range sizes determined by radio-telemetry (4). Maximum densities in interior west appear to be about one otter per 2.5 km of stream or shoreline (1.6, 4.20).

1.6 Mortality

Free ranging river otters have been documented surviving up to 14 years of age in B.C. (2), and 25 years of age for captive otters (4). On land, northern river otters are prey to bobcats (*Lynx rufus*), cougar (*Felis concolor*), coyote (*Canis latrans*), domestic dogs (*Canis familiaris*), grey wolf (*Canis lupus*), red fox (*Vulpes vulpes*), and the Bald Eagle (*Haliaeetus leucocephalus*) (4.2, 4.4, 4.20, 4.26, 4.27, as cited in 4). An unverified report from Alaska claimed to corroborate black bear predation on river otters (4.28, as cited in 4). A major cause of mortality is human-related, including trapping, illegal shooting, road kills, and accidental captures in fish nets or set lines (1.6, 1.12, as cited in 1). Ice floes or shifting rocks may contribute to accidental deaths of the river otter (1.10, as cited in 1). Major tooth damage may lead to starvation (1.10, as cited in 1). Endoparasites such as nematodes, cestodes, trematodes, the sporozoan *Isopora*, and acanthocephalans are hosted by northern river otters (1.19, 1.20, 1.21, 1.22, as cited in 1).

Ectoparasites such as ticks, sucking lice (*Latagophthirus rauschi*), and the flea (*Oropsylla arctomys*) are also known to afflict river otters (1.22, 1.23, 1.24, as cited in 1). They may fall victim to canine distemper, rabies, respiratory tract disease, and urinary infection (1.17, 1.21, 1.25, 1.26, 1.27, as cited in 1). Jaundice, hepatitis, feline panleucopenia, and pneumonia can be contracted by river otters as well (1.25, as cited in 1).

2 DISTRIBUTION

The northern river otter historically ranged throughout Canada and the United States (Polechla 1990 as cited in 1) except in the Arctic and the arid southwest (2) such as southern California, New Mexico, Texas, and the Mohave Desert of Nevada and California (3). They are presently distributed from approximately 25° N latitude in Florida through the Gulf of Mexico, to 70° N latitude in Alaska: and from eastern Newfoundland west throughout Canada, Alaska and Aleutian Islands (5). There are areas of no or very few occurrences in the southern prairies in Canada (2).

2.1 Provincial Range

In British Columbia, the otter occurs broadly throughout the province, including on all offshore islands, and the distribution is not known to have changed from historic times (2).

2.2 Distribution in the Project Area

River otters would be expected in the all the BEC zones of the Merritt TSA except the alpine (AT) (11) (Table 1).

Table 1. Expected river otter occurrence within the Ecosection - BEC Variant combinations found within the Merritt TSA.

Eco-province	Ecoregion	Eco-section	BEC Subzones/Variants/Phases	Expected Occurrence
Coast and Mountains	Pacific Ranges	EPR	AT-Emwp	No
			CWHms1, ESSFmw	Yes
Southern Interior	Interior Transition Ranges	PAR	AT	No
			ESSFdcp2, ESSFmwp, ESSFdc2, ESSFmw, IDFdk1, IDFdk2, IDFxh2, IDFxh2a, MSdm2, MSxk, PPxh2	Yes
	Northern Cascade Ranges	HOR	AT, AT-Emwp	No
			ESSFdcp2, ESSFmwp, ESSFxc, MHmmp2, MSdm2, MSmw, MSxk, CWHms1, ESSFdc2, ESSFmw, ESSFxc, IDFdk2, IDFxh1, IDFxh2, MHmm2, MSdm2, MSmw, MSxk	Yes

Eco-province	Ecoregion	Eco-section	BEC Subzones/Variants/Phases	Expected Occurrence	
		OKR	AT	No	
			ESSFdc2, ESSFxc, ESSFdc2, ESSFxc, IDFdk1, IDFdk1a, IDFdk2, IDFxh1, IDFxh1a, MSdm2, MSxk	Yes	
	Thompson-Okanagan Plateau	GUU	BGxh2, BGxw1, ESSFxc, IDFdk1, IDFdk1a, IDFxh2, IDFxh2a, MSxk, PPxh2, PPxh2a	Yes	
			THB	BGxh2, IDFdk1, IDFxh2, PPxh2	Yes
			NIB	BGxw1, IDFdk1, IDFdk1a, IDFdk2, IDFxh1, IDFxh2, IDFxh2a, PPxh2	Yes
			STU	BGxw1, ESSFxc, ESSFdc2, ESSFxc, IDFdk1, IDFdk1a, IDFdk2, IDFxh1, IDFxh1a, IDFxh2, IDFxh2a, MSdm2, MSxk, PPxh1, PPxh2,	Yes

2.2.1 Elevation Range

Elevation of habitats utilized changes seasonally. The river otter avoids mountainous habitats in the winter, as open water habitats are limited. They tend to move into lower valleys to overwinter (12). No documented elevation limits could be located.

3. HABITAT USE – LIFE REQUISITES AND SEASONS

3.1 Living Habitat (LI)

Primary habitat is determined by the presence of permanent water, abundant prey, and a relatively high water quality (3, 4). Aquatic habitats include: near-shore marine waters along the open ocean, coastal and freshwater marshes and estuaries, and inland streams, rivers, lakes, and ponds of all sizes (2). The river otter inhabits water bodies and riparian areas within a broad range of ecosystems from semi-desert shrubland to Montane and Subalpine forests (4).

Habitats used by the northern river otter are streams, lakes, ponds, swamps, marshes, estuaries, beaver flowages, and exposed outer coast in the Pacific Northwest and Alaska (6). The total habitat area must provide otters with escape cover, den sites, and resting sites (5).

3.2 Thermal/Security

When the otter is inactive, it will occupy a hollow log, space under roots, log, or overhang, abandoned beaver lodge, dense thicket near water, or a burrow of another animal (6). These burrows are also used for rearing young (6). They may also build dens in the burrows of other mammals, in natural hollows under logs or in river banks (3). From the northern Rockies,

Alberta, and the eastern United States other types of den sites used by the river otter are: red fox (*Vulpes vulpes*) dens, muskrat (*Ondatra zibethicus*) lodges, snow and ice caves, bush piles and talus (4.1, 4.2, 4.3, as cited in 4).

Optimum habitats are highly vegetated areas with slow moving waters with deep pools (5). Riparian vegetation provides security cover while feeding, denning, or moving on land, and enhances otter habitat by stabilizing banks, reducing soil erosion and protecting water quality (4). In the winter, ice can provide cover in areas where it is otherwise lacking, but the presence of some open water is a critical habitat element (4). During winter, the river otter makes substantial use of openings in the ice, and may excavate passages in beaver dams to gain access to open water (1.1, 1.2, 1.3, as cited in 1).

Objects such as fallen trees, logjams, stumps, undercut banks, and rocks provide structural diversity and complexity, another essential habitat component (4.4, as cited in 4). Physical structures in and near waterways are extensively investigated and used by river otters for latrine sites that are important for olfactory communications (4). Points of land, bases of large conifers, beaver bank dens and lodges, isthmuses, mouths of permanent streams, and logjams or rocks protruding from the water are important latrine sites for the northern river otter (4.2, 4.5, as cited in 4).

3.3 Food Habitat (FD)

The northern river otter forages in water and on land near aquatic habitats such as saltwater habitats that are close to shore, and riverine and lacustrine habitats (7).

Food availability is a prime factor in determining otter movements and habitat use (4.2, as cited in 4). Northern river otters are highly mobile and often move in response to shifting availability of food (4). The shoreline complexity of rivers and lakes offer greater areas of shallow water and wetlands that provide prey habitat for such species as slower-swimming fish, amphibians, reptiles and invertebrates (4). River otters capture prey by means of a quick lunge from ambush, they more rarely capture prey after a prolonged chase (4.6, as cited in 4).

Throughout the northern river otter's range, fish comprises most of its diet (2, 4), particularly slow moving species such as suckers (*Catostomidae*), shiners, daces, sculpins (*Cottidae*), sticklebacks, northern pike minnows (*Ptychocheilus oregonensis*), ciscos (*Coregonus*), and whitefish in freshwater (2). Surfperch, sculpins, flounders, greenlings, and rockfish are taken in saltwater (2). Fish species are taken in proportion to availability, related to both fish abundance and the relative ease of each species' detection and capture (4.2, 4.7 as cited in 4). More mobile fish are sometimes taken, such as kokanee and salmon, especially when those species are spawning in shallow water (2). Deep water fish species such as lake trout are rarely eaten (2). In the Delores River, Colorado, the fish most commonly consumed by river otters were channel catfish (*Ictalurus punctatus*), carp (*Cyprinus carpio*), and bluehead suckers (*Castostomus discobolus*) (4.8, 4.9, as cited in 4). In the Rocky Mountain National Park, river otters mostly consumed introduced trout (*Salmo* and *Oncorhynchus* species) and native suckers (4.10, as cited in 4). The three most important fish species for river otter documented in an Idaho Montane valley were kokanee salmon (*O. nerka*), mountain whitefish (*Prosopium williamsoni*), and large-scale sucker (*C. macrocheilus*) (4.2, as cited in 4). Salmonids and suckers taken in both

areas were mostly adult fish over 30 cm in Idaho, and over 20 cm in Rocky Mountain National Park (4). Adult fish are less maneuverable and less able to find hiding cover (4.11, as cited in 4).

Northern river otters eat a variety of invertebrates, such as crabs in saltwater and crayfish in freshwater (2). River otters have been observed rolling submerged rocks to expose crayfish (4.8, as cited in 4). Insects such as aquatic beetles and dragonfly nymphs are sometimes eaten (2). Large insects form an important portion of the otter's diet in warmer months (4). Mollusks such as clams and snails are also eaten (2). Occasionally, frogs, toads, snakes and turtles, waterfowl and shorebirds such as ducks, rails, and ground-nesting seabirds are eaten (2). In lake habitats and wetlands in the summer, waterfowl such as broods and moulting adult ducks are especially taken (4.3, as cited in 4). River otters rarely prey on small mammals; muskrat and beaver are the only mammals consistently recorded in otter diets (2, 4). Reptiles, birds, and fruits are also taken opportunistically (4.12, 4.13, 4.14, 4.15, 4.16, 4.17, as cited in 4). Otter diets are less diverse in winter where lakes and rivers freeze; this reflects the otter's dependence on small lakes, bog ponds, and beaver ponds (4.3, as cited in 4).

Competition for food between the northern river otter and other wildlife appears to be low (4). In Region 2 in the United States, mink are typically sympatric with river otters and their ecological niches partly overlap (4). In Idaho, competition is minimized between the otter and mink due to differences in size, morphology, feeding habits, and foraging strategies (4.18, as cited in 4).

3.4 Life Requisites to be Modeled

The life requisites for the northern river otter are Living (LI), Food (FD), Thermal/Security and Reproducing-birthing (RB). These can be adequately summarized within modeling for Living since they rely so heavily on aquatic habitats. The single live requisite that will be modeled for the otter will be Living – All Seasons (MLOCA_A) (Table 2).

Table 2. Life Requisites for River Otter in the Merritt TSA.

Food/cover life requisite	Habitat-use	Months	Rating column title	Requirements
Food	Living	All year	MLOCA_A	Abundant fish, spawning grounds, aquatic insects, 2 nd to 4 th order streams,.
Reproducing Habitat	Denning	Growing Season	MLOCA_A	Beaver lodges or burrows on banks of lakes, ponds, riparian areas and vegetation.
Security and Thermal Habitat	Denning, Feeding	All year	MLOCA_A	Open water, beaver lodge and bank dens, other mammal dens, abundant fish.

PEM attributes that will be useful for modeling the Living Requisite for otter will primarily be the ecosite. These will primarily be water ecosystems to which structural stages will not usually

apply. Additional useful information would be the slope and soil texture of the water body banks. Stream order would be useful because first order streams would rarely be large enough to be occupied.

4. RATINGS

There is a good knowledge of the habitat requirements of river otter in British Columbia, but only a rudimentary knowledge of how densities change quantitatively with habitat differences, so the 4-class rating scheme of RISC (8) will be used (Table 3).

Table 3. Description of 4-Class Rating Scheme.

% OF PROVINCIAL BEST	RATING	CODE
100% - 76%	HIGH	H
75% - 26%	MODERATE	M
25% - 1%	LOW	L
0%	NIL	N

4.1 Provincial Benchmark

No provincial benchmark has been set for this species. River otters reach their highest densities in food-rich coastal habitats and lower stream reaches, with coastal densities reported to be two to three times higher than for interior populations (4). Therefore only a maximum of Moderate compared to the possible provincial benchmark along coastal habitats would be possible in the Merritt TSA.

4.2 Ratings Assumptions

1. The maximum rating for the Merritt TSA will be Moderate.
2. The AT and AT-Emwp will be rated Nil.
3. Ratings up to Moderate will be possible in the BG, CWH, ESSF, IDF, MH, MS, and PP.
4. Only ratings up to Low will be possible in parkland variants because these are often above the range of streams regularly occupied by fish.
5. Ratings up to the maximum for the BEC zone or variant will be for lakes, rivers, and wetlands (but not including scrub carr in the parkland variants).
6. Ratings up to the maximum for the BEC zone or variant will be for cutbanks and gravel bars adjacent to lakes, rivers or wetlands (e.g. would not include cutbanks adjacent to roadways).
7. Ratings one level below the maximum for the BEC zone or variant will be for riparian forests, or for wet forests if these are adjacent to lakes, rivers or wetlands.

8. Mesic and moist forests will be rated Nil, although these may sometimes be used if they are adjacent to water bodies. This will be reflected in the ratings adjustments.
9. All other ecosites are rated Nil.

4.3 Reliability Qualifier

No otters or otter sign were seen on the 206 plots during field work for model verification in March 2008 (Table 4). Some riparian polygons were assigned low values for otter, but only because of proximity to large, permanently-open rivers (e.g., the Coldwater and Nicola), no actual otter sign was seen. Otters are generally very scarce in the Merritt TSA, and their presence is difficult to detect. Most small streams were considered unsuitable for otter because they do not remain open in the winter. The model was already designed to include only larger rivers (double-blue-line water features that had already been mapped as Lakes, Rivers or Wetlands), so no further modifications were necessary. However, for a reliable and effective rating, Ratings Adjustment No. 6 will be necessary to exclude small wetlands that freeze over in the winter and/or are isolated from other suitable habitat, and are therefore not suitable for otters.

Table 4. Number of plots in each rating class for field work.

	High (1)	Mod High (2)	Moderate (3)	Low (4)	Very Low (5)	Nil (6)	Total
M-LOCA-A			1	4	10	191	206

This model is considered to have moderate reliability because of the difficulty of field verification.

5 RATINGS ADJUSTMENTS

1. Cutbanks that are not adjacent to rivers will be downrated to Nil.
2. As otter dens have been located a mean of 316 meters from the nearest body of water (10), terrestrial habitat that is rated Low but is >500 meters from LA, RI or blue-line water features of 3rd or greater order using the 1:50,000 NTS watershed atlas should be reduced to a rating of Nil.
3. Small isolated wetlands that do not contain any open water (i.e., are not suitable for fish presence) should be reduced to a rating of Nil. This will only be possible by examination of orthophotos, so will be difficult to include in PEM ratings adjustments.
4. Habitats with deep soils and slopes <25% within 500 m of Moderate rated habitat (LA, RI, or wetland complexes) will be rated Low as these sites may occasionally be used for foraging or denning.
5. Density is a function of available food, which is (probably) principally fish in the Merritt TSA. If there are estimates of stream productivity or fish abundance in streams, rivers, or lakes systems, then these could be used to refine the ratings, with unproductive stream

systems downgraded. However, such estimates do not appear to be readily available. Stream size, gradient or substrate may be a suitable stand-in for stream productivity but this was not explored for this model.

6. At a scale larger than individual polygons, landscapes where aquatic and riparian communities provide high ratios of water/land, and are interconnected by small intermittent streams and marshy wetlands that provide high quality habitats for otters should be upgraded by one level. This would require a grid-based analysis based on the water/land ratio. Water features in this analysis would include LA, RI, and open water WL, which may require verification of individual polygons from digital orthophotos to separate the WL with open water from those without. Where these water features including oxbow lakes, meandering streams, lakes, and ponds cover approximately 10-50% of the landbase, the rating for otter should be upgraded by one level for the entire area (16). Where areas do not meet this criteria, i.e., <10% or >50% of the area are non-water features, these areas will have their rating reduced by one level.
7. An adjustments for open water in the winter would differentiate the highest value habitat (Moderate) from Low since water that is completely frozen is less likely to provide winter habitat (16). However, this is difficult to estimate within this PEM project, but would be valuable as a criterion during field verification.

6 REFERENCES

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