

where S1 is considered "critically imperiled because of extreme rarity (5 or fewer extant occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extirpation or extinction".

In the remainder of its range, this taxon has been ranked S1 by the Washington Natural Heritage Program, where there are seven extant sites (Sheenan and Sprague 1984) and SX (extirpated) by the Oregon Natural Heritage Program. It has been globally ranked by The Nature Conservancy of the United States as G1. The latter rank carries the same definition as the S1 Rank above.

There is no specific legislation for the protection of rare and endangered vascular plants in British Columbia. The two British Columbia populations of *Castilleja levisecta* are protected to a certain extent by their location on public property in ecological reserves.

### Evaluation of Status

*Castilleja levisecta* is considered by the British Columbia Conservation Data Centre to be endangered in Canada and is known only from two extant populations restricted to two islands adjacent to southeastern Vancouver Island. The prognosis for this species is not good considering the threats posed by aggressive exotic species and potential marine oil disasters.

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## Construction of a Natal Den by an Introduced River Otter, *Lutra canadensis*, in Indiana

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We describe construction of a nest-like structure at a natal den site in a shallow marsh in southern Indiana by an adult female River Otter (*Lutra canadensis*). Construction appeared to coincide with periods of high water, perhaps to avoid mortality of dependent pups from repeated flood events.

Key Words: River Otter, *Lutra canadensis*, natal den, Indiana.

North American River Otters (*Lutra canadensis*) select den or resting sites based on availability of suitable shelters that offer protection and seclusion (Melquist and Hornocker 1983). Otters are not known to excavate or construct dens, and often use existing burrows dug by other species such as Muskrat (*Ondatra zibethicus*), Woodchuck

(*Marmota monax*), Nutria (*Myocaster coypus*), and Beaver (*Castor canadensis*) (McDonald 1989; Melquist and Dronkert 1987; Toweill and Tabor 1982). Natural and artificial shelters such as log jams, undermined root cavities, tree falls, riparian vegetation, hollow logs, and duck blinds also are used (Griess 1987; McDonald 1989;

Melquist and Dronkert 1987; Toweill and Tabor 1982).

River Otter natal den sites have not been thoroughly described. Liers (1951) reported on two litters in Wisconsin raised in Woodchuck burrows. In Idaho, Melquist and Hornocker (1983) reported young raised in an abandoned fox (*Vulpes vulpes*) den and an exposed brush pile. Natal dens in Alaska were located in burrows beneath rotted stumps and a natural rock cavity (Woolington 1984). We describe the construction of a nest-like structure at a natal den site by a female otter translocated from Louisiana to Indiana.

### Methods and Materials

We released 25 River Otters (15M:10F) obtained from Louisiana on 17 January 1995 at the 3125-ha Muscatatuck National Wildlife Refuge (MNWR) in Jackson and Jennings counties in southern Indiana. The MNWR lies 5 km east of Seymour in the Scottsburg Lowland Section of the Bluegrass Natural Region (Homoya et al. 1985). Excluding Seymour, the area is sparsely populated and rowcrop production (i.e., corn and soybeans) comprises the major land use. The refuge maintains about 525 ha of permanent or seasonal water in ten moist-soil units ( $\bar{x} = 13.5 \pm 7.0$  ha), three bottomland forest units ( $\bar{x} = 27.6 \pm 9.2$  ha), several impoundments, natural marshes, and numerous small ponds. Storm Creek and Mutton Creek flow, respectively, 5.3 km and 6.1 km through MNWR. The Vernon Fork of the Muscatatuck River forms the southern boundary (6.6 km) of the refuge. Two impoundments, Stanfield Lake (55 ha) and Richart Lake (43 ha), are the largest open-water habitats on MNWR. In contrast, 306-ha Moss Lake supports emergent and scrub-shrub vegetation and seasonally-flooded timber stands. This release was the initial attempt to restore extirpated otter populations to suitable habitats throughout Indiana (Johnson and Madej 1994). To evaluate the release, we monitored the activities of 15 otters (9M:6F) for one year using intraperitoneal transmitters.

### Observations

On 13 February 1995 (27 days post-release), we observed F47, an adult radioed female of unknown age, mating with a radioed male in Moss Lake in the southwest corner of the refuge. She remained on MNWR for >1 year after the release where she restricted most of her activity to Moss Lake (110 of 121 relocations). In early March 1996, her movements became confined to a shallow marsh dominated by Buttonbush (*Cephalanthus occidentalis*) and Broad-Leaved Cattail (*Typha latifolia*) on Sandy Branch, a slow-flowing tributary into western Moss Lake. On 13 March, we located her beneath a hummock island (ca. 4.5 m long, 3.6 m wide) formed by root structures of several American Sycamore

(*Platanus occidentalis*) trees. No sign or evidence of otter activity was present, and we assumed she would use the tree root cavity system beneath the hummock as a natal den site. On 3 April, we located F47 in the den, but found a loose mound of cattail stalks and dried grasses on top of the hummock (Figure 1A). The mound was about 1 m long, 45 cm high, and had what appeared to be a 15-cm diameter entrance hole. On 11 April, the female was again located beneath the hummock, but the mound lacked new material and the entrance hole appeared disheveled and unused. On 1 May, we flushed the female from the top of the mound, which was now noticeably larger and more structured and complex (Figure 1B). It measured about 1 m in height and had at least two entrance chambers, one of which contained an otter pup. A shallow depression was evident on top, perhaps used by the female for basking or sentinel use. On 8 May, the Sycamore trees were uprooted at their base by high winds, and a subsequent visit revealed a complex root cavity system beneath the hummock island. The nest-like structure had remained intact, but the den appeared abandoned and F47 was < 100 m from the site.

### Discussion

Surface den construction by River Otters has not been reported previously; however, our observations are confounded by the fact that they were of an animal introduced into habitats markedly different from its source location. Otters in coastal marshes of Louisiana use old muskrat houses or nutria burrows (Lowery 1974), but they are not known to construct their own den sites (R. G. Linscombe, Louisiana Department of Wildlife and Fisheries, personal communication). Our account of den construction may represent atypical behavior in response to a unique situation in unfamiliar habitats.

Although River Otters are adaptive and use a variety of den sites, selection of natal dens may be important because of the potential for spring flooding. Newborn otters depend on the female for food, protection, and shelter, and pups do not emerge from the natal den until about 8 weeks of age (Liers 1951; Melquist and Hornocker 1983). Pup survival could be jeopardized if early spring snow melt or excessive rainfall floods the den before the pups become mobile and less dependent. To minimize this risk, female otters should select natal dens that are protected, secure, and unlikely to flood. Two Woodchuck burrows used as natal dens in Wisconsin were located on hillsides about 45 m above the high-water mark and on a 150-m high bluff about 0.8 km from water (Liers 1951). Natal dens in southeast Alaska were located from 0.25 to 0.8 km from shore and at elevations up to 210 m (Woolington 1984). Melquist and Hornocker (1983) felt canid dens in Idaho would serve as natal dens

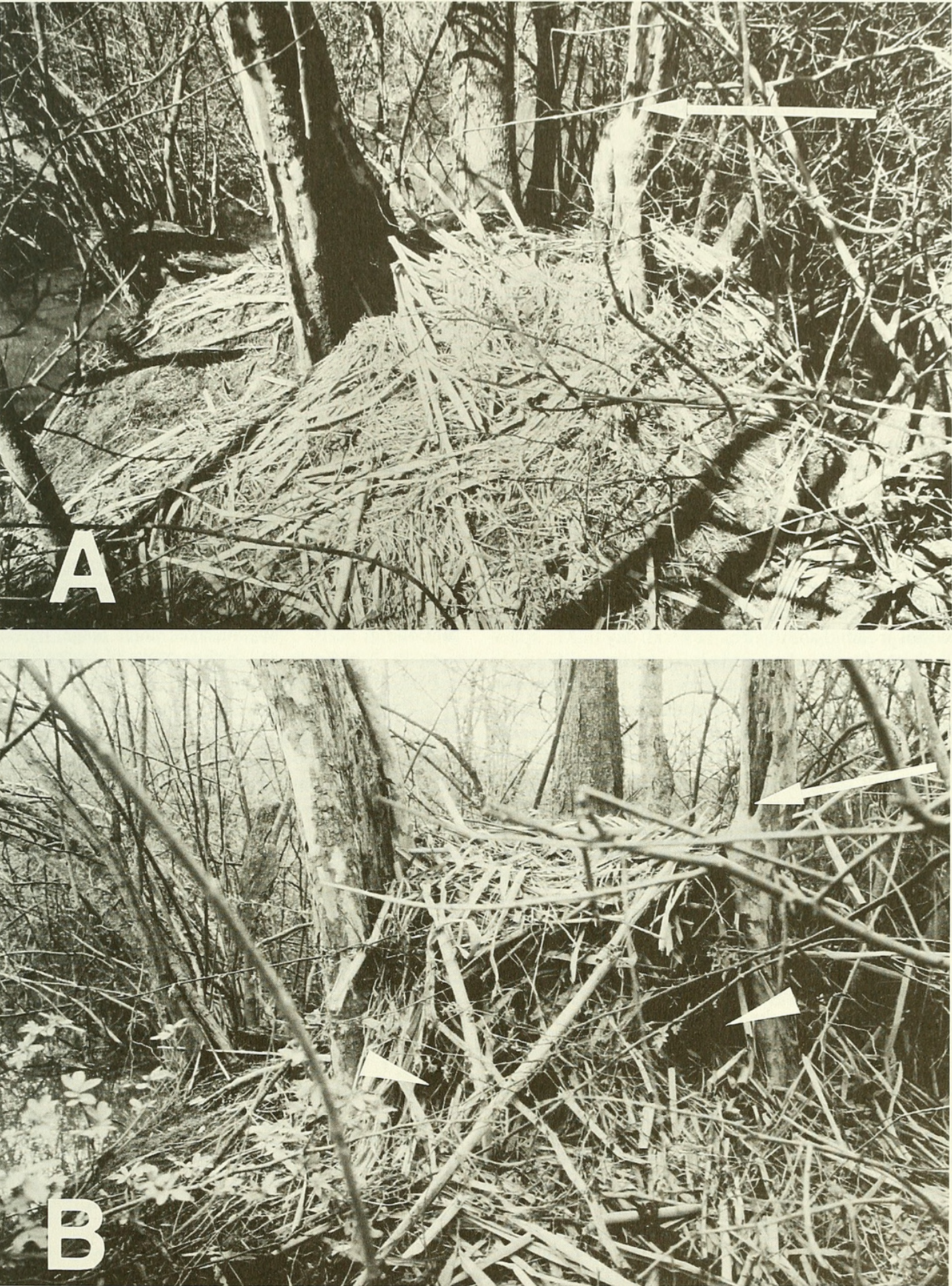


FIGURE 1. (A) Loose mound of vegetation on top of hummock island in southern Indiana, 11 April 1996; and (B) complex nest-like structure constructed by adult female River Otter, 1 May 1996. Two entrance chambers are denoted by white triangles. White arrow indicates common reference point to compare changes in den site. Photographs by S. A. Johnson.

for otters because they were often on bluffs above streams and unlikely to flood during spring run-off. Similarly, Harper (1981) found holts of the European Otter (*Lutra lutra*) were located in situations where flooding was unlikely or on small tributaries with low rates of water flow.

Yeager (1938) speculated otters would use temporary or emergency refuges if natal dens were flooded at or shortly after whelping. We suggest F47 constructed the nest-like structure in response to periodic flooding that had inundated her original den beneath the hummock island. Once the den was discovered, we limited our visits to avoid disturbance, and as a result, never observed her adding vegetation to the structure. It is unlikely that other species [e.g., Muskrat, Canada Goose (*Branta canadensis*)] built the nest because female otters aggressively protect their young (Toweill and Tabor 1982) and would not tolerate other species near their litters. Further, Liers (1951) reported an otter nest in a dry saw-grass marsh in Florida and other species of otters are known to construct beds or couches (Hewson 1969).

Based on localized movements of F47 in early March and the first known use of the den, her litter was likely born in mid-March. On 19-20 March, MNWR received >22 cm snow that caused widespread flooding for several days. Air space beneath the island was likely restricted at this time when her pups were <2 weeks old, which coincides with our first observation of the structure on 3 April. The nest appeared unused on 11 April after water levels had receded, but MNWR again reached flood stage after 10.9 and 14.2 cm rain fell on 21-24 April and 28-29 April, respectively. High water again probably inundated the cavity beneath the hummock, which may have prompted further construction and subsequent use of the larger structure that we observed on 1 May.

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