

The only other reference we found to Wood Ducks eating vertebrates was Bellrose (1980: 194), where he cited a Mississippi study in which "tiny fish" were found in the diet of some ducklings. In fact, in other major reviews of the diet or general biology of this species (Drobney and Fredrickson 1979; Drobney 1990; Hepp and Bellrose 1995; and references therein), invertebrates were the only animals that comprise parts of Wood Duck diets.

Because most published information on Wood Duck diet comes from its principal breeding and wintering range south of Ontario, it is unclear whether our observation represents opportunistic foraging by this particular female on some lethargic frogs (temperature was approximately 10°C), or an occasional feature of Wood Duck diet in this region where wetlands tend to be unproductive (McNicol et al. 1987) and preferred aquatic plant foods may be less available. In Ontario, the Wood Duck is common in the south (where productive wetlands are interspersed among agricultural lands; Ross et al. 1984), but is much less common in the north (on the Precambrian Shield where wetland productivity is substantially lower; McNicol et al. 1987), where it must also compete with other cavity-nesting ducks such as Hooded Mergansers (*Lophodytes cucullatus*), Common Goldeneyes (*Bucephala clangula*) and Buffleheads (*B. albeola*) for breeding sites (Biro 1987). In these northern habitats, Wood Ducks may be forced to consume food items less typical of their principal breeding areas.

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Intertidal Foraging for Pacific Sand-Lance, *Ammodytes hexapterus*, by Birds

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Bald Eagles, Northwestern Crows, Common Ravens, and Glaucous-winged Gulls foraged for buried Pacific Sand-Lance in the intertidal zone near Juneau, Alaska, by digging or disturbing the sand so that the concealed fish emerged.

Key Words: Pacific Sand-Lance, *Ammodytes hexapterus*, Bald Eagle, *Haliaeetus leucocephalus*, Northwestern Crow, *Corvus caurinus*, Common Raven, *C. corax*, Glaucous-winged Gull, *Larus glaucescens*, foraging, southeast Alaska.

Pacific Sand-Lance (*Ammodytes hexapterus*) are an important forage fish for many marine animals in the north Pacific (Willson et al., *manuscript**). In North America, this species ranges from California to the Bering Sea. They are among the most nutritious small fishes (Willson et al., *manuscript**) and they are more rich in energy than "worms", another common intertidal prey (Robinette and Ha 1997). One defensive tactic of this small fish species is to bury itself in soft sand in the intertidal zone. However, there they become vulnerable to attack by several species of birds, including eagles, gulls, and corvids (Robinette and Ha 1997).

Our observations were made at the northwest end of Gastineau Channel, near the mouth of the Mendenhall River, in Juneau Alaska (58° 21' N, 134° 36' W), and at the mouths of rivers flowing into Berners Bay (58° 50' N, 134° 58' W) on several occasions, particularly in April-July in 1985, 1987, 1995, and 1996. In 1995 and 1996 we also recorded seasonal peaks in eagle numbers in these months at the Gastineau Channel site, as Cain et al. (1988*) did previously.

Avian predators were generally able to detect locations where sand-lance were abundant and concentrated their foraging there. We sampled the distribution of sand-lance where the birds were foraging and in randomly selected areas in the intertidal sand flats. Each sample consisted of one shovelful of wet sand ($N > 200$ in both random and foraged areas). On 8 of 10 sampling days, the abundance of sand-lance was 2 to 100 times higher in the areas where birds were actively foraging; in the remaining two cases, sand-lance abundance appeared to be uniformly very low. Buried sand-lance, mostly adults, were markedly more common in April-June than at other times of year; a few juvenile sand-lance appeared in the sands later in the summer.

Bald Eagles (*Haliaeetus leucocephalus*) rapidly patted the loose sand with their feet, shifting their weight from side to side. This activity disturbed buried sand-lance, which emerged from the sand and were seized by the eagles. Up to 85 eagles sometimes "danced" together in a tight cluster on the sands, especially at minus tides. On one occasion, hundreds of living but inactive sand-lance were observed lying in the shallows and on the sand flats after a large group of eagles had disturbed them. Standing eagles also captured sand-lance from shallow water, using bill or feet, without preliminary sand-patting. Prey was eaten quickly, on the spot.

Glaucous-winged Gulls (*Larus glaucescens*) occasionally dug for sand-lance by moving sand to the side with their bills, but they were not seen to capture fish successfully this way. Northwestern Crows (*Corvus caurinus*) and Common Ravens (*C. corax*) also dug for sand-lance in the intertidal, scooping the sand to the side with their bills. Corvids dug 1-8 holes per sand-lance captured ($N = 10$ observations). Prey was sometimes eaten at the site of capture, but crows often flew several meters away from any other birds to consume their prey. Unlike most of the other foragers, crows usually ate their prey piecemeal and therefore required more time to consume the entire fish. Moving away from the other birds probably reduced the risk of prey theft. Other local observers have also noted fish-digging by crows: a group of about 20 crows digging intently for sand-lance was seen by P. Porter (personal communication) at the mouth of Peterson Creek on Douglas Island in Juneau in May 1994. Ravens often carried sand-lance to their nests in nearby forests and probably also stored them in trees near the nest, as they do with other small fishes (herring and eulachon, our observations). By carrying marine prey to the nest, ravens contribute to the flow of marine-derived nutrients to terrestrial ecosystems (Willson et al. 1998).

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