

nord (van Zyll de Jong 1983; Banfield 1977). La découverte de la Musaraigne fuligineuse à Godbout indique que la distribution de certaines espèces de petits mammifères est encore mal connue. En ce sens, il est permis de croire que de futures découvertes seront faites et permettront de mieux connaître les habitats fréquentés par ces espèces et de préciser leur aire de distribution dans le nord de la province. Il est à noter que cette mention de la Musaraigne fuligineuse figure dans l'Atlas des micromammifères du Québec, sans documentation publié en 2002 (Desrosiers et al. 2002).

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Gulls, *Larus* spp., Foraging at Pink Salmon, *Oncorhynchus gorbuscha*, Spawning Runs

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Small and immature gulls foraged more often on drifting salmon eggs than did large and mature gulls, and large and mature gulls foraged more often on salmon carcasses, at streams in Southeast Alaska. These differences may be related to body size via physical strength and dominance status, as well as foraging experience.

Key Words: Gulls, *Larus* spp., Pink Salmon, *Oncorhynchus gorbuscha*, Southeast Alaska.

Salmon spawning runs attract many foraging birds and mammals (Willson and Halupka 1995) and are clearly an important food resource for wildlife in late summer and fall. Gulls (*Larus* spp.) are among the most numerous predators and scavengers at salmon runs, sometimes occurring in the thousands (Isleib and Kessel 1973). Here I report how four species of gull exploited runs of Pink Salmon (*Oncorhynchus gorbuscha*) at the mouths of streams in Juneau, Alaska.

Study Area and Methods

Most of these observations were made at the mouths of Salmon Creek and Sheep Creek (less than 12 km apart), with some supplementary observations at four other small, nearby streams, within the city and borough of Juneau in Southeast Alaska (ca. 58°30'N, 133°30'W). I observed four species of gulls foraging at or near low tides, usually in the morning, from 27 August to 6 September 2002 (>6 hrs of observation). At any one time, many dozens of gulls were present at the two primary study locations. At low tide, these

creeks flow over intertidal deltas, often with several shallow channels used by incoming salmon. I scanned these deltas with spotting scope and binoculars, noting the foraging activities of the gulls and counting the individuals engaged in several distinctive foraging activities. Birds shifted position frequently, using different parts of the deltas; many individuals of the three larger species also changed foraging activity as I watched. Most scans were made at different locations on different days; if more than one scan occurred on the same day and stream delta, they were separated in time by about 30 min. I recorded foraging observations in three categories: foraging on salmon eggs (drifting eggs are common because later spawners often disturb the gravels over the nests of earlier spawners, foot-paddling by gulls also stirs up poorly buried eggs), foraging on salmon carcasses (including some extraction of eggs from living or dead fish), and searching for invertebrates in *Fucus* mats (where amphipods and isopods were common) and tide pools.

TABLE 1. Foraging activity of four species of gull at salmon spawning runs in southeast Alaska.

Species/age class	Eggs	Salmon	Invertebrates	N (observations)
Bonaparte's Gull	82%	—	18%	353
Mew Gull adults	33%	1%	66%	232
Herring Gull adults ^a	31%	58%	11%	26
Herring Gull immatures	80%	20%	—	15
Glaucous-wing adults ^a	11%	87%	2%	362
Glaucous-wing immatures	44%	55%	1%	222

^aFrequency distributions for adults and immatures were significantly different ($\chi^2_2 = 88.5$ and 7.1 , for the two species respectively; $p < 0.05$ in both cases).

Results

Foraging behavior of each species was very consistent among the observed streams, but there were marked differences in foraging among species and age classes (Table 1). The small (ca. 190 g, Sibley 2000) Bonaparte's Gull (*L. philadelphia*) foraged for salmon eggs chiefly by hovering over the streams and plunge-diving for drifting eggs, but they occasionally sought invertebrates in *Fucus* mats or tide pools. Most birds were in nonbreeding plumage, and adults were not distinguished from immatures.

Mew Gulls (*L. canus*), of intermediate size (ca. 420 g, Sibley 2000), waded in the shallows, searching for drift eggs, or hunted invertebrates in *Fucus* mats. They seldom foraged on fish carcasses and then only if no large gulls were nearby. Too few immatures were present for adequate sampling, so all observations pertain to adults.

Both Herring (*L. argentatus*) and Glaucous-winged (*L. glaucescens*) gulls (body mass about 1000-1100 g for both species, Sibley 2000) foraged chiefly on carcasses and on eggs, only rarely visiting the *Fucus* mats on these deltas. Eggs were commonly obtained while wading, occasionally by foot-paddling. Glaucous-wing adults sometimes pulled live salmon from the stream, poking initially at eyes and at the vent area to force egg extrusion. Immatures of both species foraged more often on eggs than did adults, while adults foraged more often on carcasses. Both of these larger gulls often examined very old, bleached and decayed, carcasses that appeared to offer little or nothing edible.

Discussion

Salmon eggs are rich in lipids (Gende et al. 2001, 2004), offering an easily captured and high-calorie food, and brightly colored, so they are easy to see as they drift downstream. Bonaparte's Gulls, Mew Gulls, and immatures of the larger species foraged heavily on eggs. The demands of imminent fall migration for the smaller gulls may provide added impetus for rapid energy acquisition; most Bonaparte's Gulls left the area before the Pink Salmon runs were completely over. The immatures are less experienced foragers than adults, and eggs may be more easily accessed than

carcasses. Carcasses are probably less accessible to smaller gulls because the skin is tough and hard to breach and also because the larger gulls (and ravens and eagles) can easily dominate the smaller birds. Glaucous-winged Gulls selectively killed and eviscerated female Sockeye Salmon (*O. nerka*) in shallow streams in western Alaska (Mossman 1958). The foraging differences among gull species here are similar to the observations of Moyle (1966) elsewhere in Alaska.

Other species of wildlife also favor salmon eggs. Bears (*Ursus* spp.) often feed selectively on eggs (and other high-lipid body parts) from live-caught fish (Gende et al. 2001). American Dipper (*Cinclus mexicanus*) chicks, juveniles, and adults feed on drift eggs (Obermeyer et al. 1999; K. E. Obermeyer and M. F. Willson, unpublished observations). Foraging on drift eggs by wildlife has no significant effect on salmon populations, because drift eggs do not survive outside the nesting gravels.

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