Estuaries, Energy Flow, and Biomass Extraction in Gwaii Haanas

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The coastal marine waters around Gwaii Haanas (South Moresby) National Park Reserve in British Columbia receive two major pulses of fish migration during the year: in autumn, when salmon return from the high seas and in late winter, when herring congregate. Associated with these seasonal pulses are large concentrations of marine mammals and birds, which forage on the salmon and herring.

Approximately 100,000-300,000 salmon return yearly to some 70 streams in the region. During this activity, numerous sealions, seals, black bears, eagles, and gulls congregate in the estuaries and forage on the salmon. My investigations at Bag Harbour show a consistent pattern of energy flow. From 50% to 80% of the salmon (primarily spawned-out fish) are transferred from the stream to the riparian habitat by black bears, with the remainder drifting into the estuary. Approximately one-half of the salmon tissues transferred to the forest floor are taken by secondary scavengers including pine marten, eagles, crows, ravens, gulls, and soil invertebrates. Of the carcasses that drift into the estuary, about one-half of the tissues are taken by sub-tidal invertebrates (primarily gastropods, secondarily crabs, prawns, bat stars). The remaining tissues gradually soften and begin to enter solution after 4-5 days. These nutrients, including nitrates and phosphates, are potentially a major source of stream and estuarine primary production.

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Because the numbers of salmon returning from the high seas to the streams in the 1990s are up to an order of magnitude less than numbers seen in the 1940s, which themselves may be substantially lower than

those observed at the turn of the century before the expansion of the commercial fishing fleets, the current entry of nutrients into the estuaries from the carcasses may be greatly limiting potential productivity.

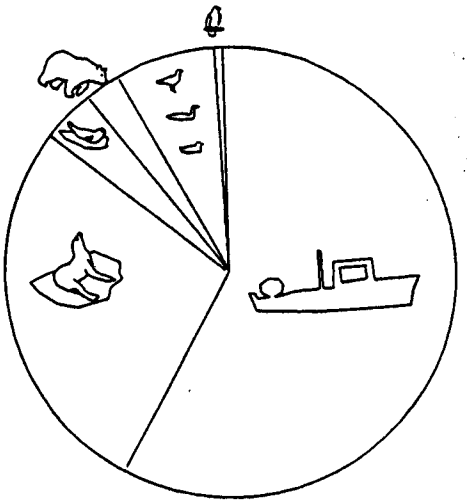

Figure 1. Relative annual biomass removal from marine waters of Gwaii Haanas in 1990.

General estimates were made for the annual consumption of fish throughout Gwaii Haanas by sea lions, seals, eagles, and sea birds based on daily caloric requirements Commercial fisheries data were also summarised from marine waters adjacent to Gwaii Haanas. Annual commercial extraction by the fleets was 12 million kg in 1990. This comprises about two times the total annual consumption by all pinnipeds and birds. (Figure 1)

Major taxonomic groups extracted by the commercial fishing fleets are herring, salmon, halibut, rockfish, lingcod, and invertebrates such as sea urchin, sea cucumber, geoduck, octopus (Figure 2). The migratory groups (herring and salmon) account for three-quarters of the commercial extraction.

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On the Serengeti Plain, huge migrating herds of wildebeest largely structure the distribution and abundance of many top level consumers and associated species in this protected area. The herring and the salmon, which return to Gwaii Haanas from the open seas, are ecologically equivalent to these massive herds.

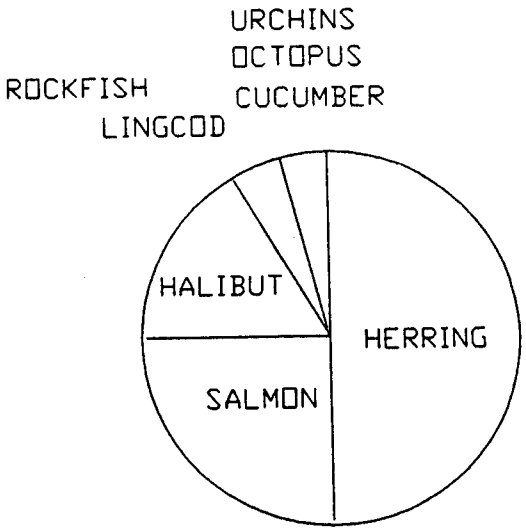

Figure 2. Commercial Fishery extraction from Gwaii Haanas, 1990. Total : 11,650,000 kg.

Commercial extraction of salmon and herring directly limits the carrying capacity in the area and is not an acceptable activity within such an important internationally recognised area. A 10% yearly phased reduction of existing quota for all species down to the pre- European contact levels would provide a realistic framework for the restoration of the marine ecosystem and allow a reasonable time frame for the commercial fishing industry to seek alternative opportunities.