

and sockeye use them largely as migration corridors. Pink salmon are more intermediate in their usage. Estuaries provide a number of functions important to salmonids, including 1) areas for physiological transition, 2) productive foraging habitats, 3) refugia from predation, and 4) as staging and migration areas for migrating juveniles and adults. Neritic habitats of Puget Sound also provide important transition zones for outmigrating as well as resident salmon. The importance of these functions varies among the coastal areas and Puget Sound and some have been altered dramatically. Salmon cultural practices have also changed the usage of estuaries by Pacific salmon. The importance of these differences to salmon production has not been appreciated in fisheries and shoreline management.

Temporal Use of an Oregon Estuary by Hatchery and Wild Juvenile Salmon

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Since the advent of private salmon ranching in Oregon (1971), concern has been expressed that juvenile hatchery salmon, released in large numbers into Oregon estuaries, may remain for extended periods of time and compete with wild fish. This paper reports on the temporal use of Yaquina Bay, Oregon (July 1977-December 1978) by accelerated growth (age 0) hatchery coho (*Oncorhynchus kisutch*) and wild salmon (0. sp.) juveniles. Nearshore and channel study areas were periodically sampled with a 100- x 3-m beach seine and a 222-m lampara net, respectively. Length of residence of hatchery coho juveniles at nearshore study areas was modelled by equations of the form: $N = N_0 e^{-kt}$. "Residency half-life" ($N/N_0 = 1/2$) ranged from 2 to 9 days for different release groups, and was longer for fish released earlier in the year (June-August) than for groups released later in the year (September-October). Wild populations of chum (0. *keta*) and coho were present at the study areas for 2-3 mo (March-June), and wild chinook (0. *tshawytscha*) were present during 9 mo (January, April-November). Lack of overlap in peak abundances of wild chum (early April), coho (mid May), and chinook (mid July-early August) suggests interspecific temporal partitioning. Releasing hatchery salmon after periods of peak abundance of wild salmon should be considered as a means of decreasing overlap in temporal use of the estuary by hatchery and wild salmon juveniles.

Behavior of Coho Salmon Smolts (*Oncorhynchus kisutch*) in the Columbia River and its Estuary

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Beach seine catches indicate a majority of the coho smolt migration reaches the upper estuary between late April and early June. Annual comparisons indicate peak occurrence of coho is between 6 May and 16 May. Coho length measurements reveal large individuals tend to migrate downstream first and small individuals later. Based upon size most Columbia River coho smolts are hatchery rather than natural spawning ori-

gin. The principal prey organisms utilized by smolts appear to be insects in the river, amphipods in the middle estuary, and amphipods with marine organisms near the mouth. Timed release experiments show rate of coho downstream movement increased from late March to mid-May. The results of beach seine catches suggest most migratory movement is associated with daylight. Marked coho recoveries within the estuary indicate an association with water exceeding 4 m depth and the absence of a distinct migratory route through the estuary.

Juvenile Pacific Sandfish, *Trichodon trichodon*, Associated with Pink Salmon, *Oncorhynchus gorbuscha*, Fry in a Rocky Nearshore Area, Southeastern Alaska

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On 15 May 1980, we found a large school of juvenile Pacific sandfish (*Trichodon trichodon*) near Point Howard (135°3'00"W-58°20'00"N) in the northern part of southeastern Alaska. While we were watching, this school of nearly 5,000 juvenile Pacific sandfish remained densely-packed, adjacent to a vertical bedrock wall. The school stayed near the wall even when we collected 93 specimens (fork length, 23-55 mm) with one scoop of a dip net. In June 1980, at Funter Bay (134°54'20"W-58°14'00"N) and Point Dundas (136°16'50"W-58°18'55"N), we saw schools of juvenile Pacific sandfish (fork length, 35-61 mm) mixed with pink salmon (fork length, 34-68 mm). These schools were sampled with a dip net or beach seine. The stomach contents of 10 Pacific sandfish (fork length, 37-47 mm) and 10 pink salmon (fork length, 44-65 mm) were examined. Both species shared the same food supply of planktonic crustacean zooplankters such as euphausiid larvae and calanoid copepods, as well as epibenthic harpacticoid copepods and the larvaceans *Oikopleura*.

Utilization of Estuarine Areas by Salmonids in Southeastern Alaska and the Potential Impact from Logging

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Southeastern Alaska is a complex of mountainous islands and fiords. Most of this archipelago is in the Tongass National Forest which contains the largest stand of old growth forest in the United States. Over 250,000 acres of the Tongass have been clearcut and logging is continuing at a rate of about 18,000 acres annually. Over 2,500 identified salmon streams flow from this Forest into adjacent estuaries; these ecosystems produce about 30% of the Nation's salmon resource. Physical and biological characteristics of these estuaries are variable and dependent upon adjacent watershed topography and geology. Use of estuarine areas by salmonids appears to be related to stream gradient and amount of stream/estuary ecotone. This ecotone provides habitat for spawning pink salmon and