

NOTES ON THE MARINE LIFE OF
THE RIVER LAMPREY, *LAMPETRA AYRESI*,
IN YAQUINA BAY, OREGON, AND
THE COLUMBIA RIVER ESTUARY¹

The river lamprey, *Lampetra ayresi*, although uncommon in Oregon, is collected occasionally in the surface waters of the ocean and in estuaries. The species appears to be most abundant in the Columbia River estuary and is often found in Yaquina Bay. Systematic sampling programs in those two estuaries, carried out by the National Marine Fisheries Service (NMFS) in the Columbia River estuary and by Oregon State University in Yaquina Bay, have provided sufficient specimens (225) so that a preliminary assessment of the saltwater life of the species in Oregon can be attempted and comparisons made with its life history in British Columbia as reported by Beamish (1980).

The capture of river lampreys and the sampling program by which specimens were obtained are described or outlined by Dawley et al.,² Durkin et al.,³ and Myers (1980). River lampreys were usually caught incidentally in studies of other species and were taken by means of beach seine, purse seine, lampara net, and

bottom trawl. Mesh sizes of the nets employed were usually 6.5 mm or 9.5 mm bar measure, thus selection for larger individuals was probable. Additional specimens were obtained from a variety of sources. Specimens are held in the fish collection of the Department of Fisheries and Wildlife, Oregon State University (OS).

Downstream Migration

In British Columbia, river lampreys entering saltwater from late April to early July averaged 110 mm total length (TL); the range of lengths was 40-190 mm (Beamish 1980). We have no downstream migrants from freshwater, but we have two lots (OS 7320-1) that include specimens 115 mm long taken in marine waters on 21 May 1980. The earliest collection of the year of marine specimens in Oregon was made 5 May. One specimen measuring 161 mm long (OS 7370) from the Pacific Ocean and another measuring 206 mm (OS 4630) from Yaquina Bay were collected on that day. Both were immature and had been feeding. Because early May corresponds to the spawning season, the two feeders must have migrated early and apparently would have matured after the summer feeding season.

From mid-May to mid-June, specimens taken from Yaquina Bay with a 9.5 mm-mesh seine ranged in length from 141 to 245 mm (Table 1). In the same period, specimens taken by various nets (including some of 6.5 mm mesh) from the Columbia River estuary ranged from 115 to 278 mm. Specimens captured in the Pacific Ocean between mid-May and 25 June ranged from 145 to 237 mm. The distribution over the size range is sparse so that modes are difficult to recognize, except that in the Columbia estuary series (OS 6852, 6856, 6857) for 4 June ($n = 110$) 62% of the specimens fall between 160 and 210 mm.

¹Technical Paper No. 6201, Oregon Agricultural Experiment Station, Oregon State University, Corvallis, OR 97331.

²Dawley, E. M., C. Sims, R. D. Ledgerwood, D. R. Miller, and J. G. Williams. 1981. Study to define the migrational characteristics of chinook and coho salmon in the Columbia River estuary and associated marine waters. Progress report of coastal zone and estuarine studies, Pacific Northwest Regional Commission and Coastal Zone and Estuarine Studies Division. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, Seattle, WA 98195.

³Durkin, J. T., T. C. Coley, J. T. McCabe, Jr., W. D. Muir, K. Verner, and R. L. Emmett. 1981. Non-salmonid, salmonid fishes. In Columbia River Estuary Data Development Program, 1979-80 Annual Report, Vol. 2, p. 1-24, Pacific Northwest River Basins Commission. National Marine Fisheries Service, NOAA, Hammond, OR 97121.

TABLE 1.—Ranges and means of total length of river lampreys captured in saltwater off Oregon (by half-month periods, all years combined).

Period	Columbia estuary			Yaquina Bay			Pacific Ocean		
	<i>n</i>	Range	\bar{x}	<i>n</i>	Range	\bar{x}	<i>n</i>	Range	\bar{x}
5/1-15	2	157-200	178.5	4	160-206	179.0	1	161	161
5/18-31	22	115-285	157.7	2	184-185	184.5	3	124-187	163
6/1-15	110	120-278	186.0	3	141-245	192.7	—	—	—
6/16-30	2	163-167	165.0	1	255	255	4	145-237	198
7/1-15	9	125-171	214.3	4	159-231	179.0	—	—	—
7/16-31	—	—	—	8	133-241	179.6	—	—	—
8/1-15	5	192-310	243.1	4	193-255	217.8	—	—	—
8/16-31	25	176-304	236.1	8	184-247	215.9	—	—	—
9/1-15	6	259-282	267.7	1	260	260	—	—	—
9/16-30	—	—	—	1	240	240	—	—	—
10/1-15	—	—	—	—	—	—	—	—	—
11/1-15	—	—	—	1	205	205	—	—	—

Maturation

Individuals captured May through August in saltwater show little development of the gonads, except for specimens >250 mm taken 31 August 1979 (OS 6858). These specimens have gonads visibly larger than those of smaller individuals. In addition, at least one of the allometric changes associated with sexual maturity is evident. The eyes of this 250-304 mm group constitute <25% of the preorbital length, whereas in 181-245 mm specimens from OS 6858 the eye constitutes between 25 and 33% of preorbital length. One specimen (OS 17) of 205 mm TL captured 14 November 1949 in Yaquina Bay had developing gonads. The season of spawning in the Columbia and Yaquina systems is deduced to be April and May, based on four specimens as follows: OS 112, 267 mm, March 1940, mature migrant, Bonneville Dam, Columbia R.; OS 343, 263 mm, 30 April 1958, mature migrant, Tongue Point, Columbia R.; OS 537, 181 mm, 15 April 1959, spawner, Yaquina R.; OS 471, 203 mm, 9 May 1959, spawner, Simpson Cr. (trib. Yaquina R.). Vladykov and Follett (1958) suggested that spawning of the species took place in April and May. Beamish (1980) reported spawning in holding tanks during May.

Growth and Upstream Migration

Although occasional adult specimens of the river lamprey have been taken from Yaquina Bay during October and November, no river lampreys have been captured in the Columbia River estuary from early September to May. The Pacific lamprey, *Lampetra tridentata*, has appeared December to June in catches from the Columbia estuary, intimating that the gear used during the winter is capable of capturing lampreys and that the absence of the river lamprey from the catch indicates their absence from the estuary. We suggest the absence means that river lampreys move into freshwater in early autumn.

Judging from the specimens caught from mid-August on, adult river lampreys must move into freshwaters of the Columbia system at lengths of about 200 mm to >300 mm. Those that feed in Yaquina Bay probably leave saltwater at similar sizes, although the largest specimen captured there was 260 mm. Specimens up to 255 mm have been taken in Yaquina Bay in June, thus lengths of 300 mm could be reached by September or

October if these animals grow at the rate observed by Beamish (1980) in British Columbia. In that study, an increase of 100 mm from mid-June to mid-August was noted. In the present study, a rough estimate of growth in the Columbia can be made by comparing early June samples ($n = 110$), which had a mean length of 186 mm, with combined samples from 31 August and 2 September ($n = 31$), which averaged 242 mm.

In a system such as the Columbia, assessment of size and growth is complicated by factors other than sampling problems. Some individuals may spend more years as larvae than others, some may transform and migrate to saltwater earlier in the year than others, some may feed in freshwater before entering saltwater (Beamish 1980), and those destined to migrate back to distant tributaries might have the genetic capacity for rapid growth and early departure from the feeding grounds. Kan (1975) noted that Pacific lampreys showed a rough correlation between size and distance of migration in the Columbia, but in that species large size can be reached not only by fast growth but by spending up to 3 or 4 yr in marine waters, rather than the few to several months spent by the river lamprey.

Ecological Observations

All but two of the eight ocean-caught river lampreys were taken in tows or hauls made within 34 m of the surface. The remaining two were taken close to the surface by anglers. Specimens from Yaquina Bay were taken by seine (3 m deep), but usually by lampara net (21 m deep) from subtidal channels. Specimens from the Columbia estuary were taken from shallow water by purse seine and beach seine. "Pelagic" coloration of blue to black on the back and silver on sides and belly appears to be typical of actively feeding *L. ayresi*, as reported by Kan (1975) and Beamish (1980). This contrasts sharply with the grey coloration of the deep-dwelling Pacific lamprey.

Water temperature in Yaquina Bay at times of capture of river lampreys ranged from 13° to 21°C. Salinity ranged from 12 to 29‰ (Myers 1980). Associated fishes in Yaquina Bay were usually American shad, *Alosa sapidissima*; Pacific herring, *Clupea harengus pallasi*; juvenile coho salmon, *Oncorhynchus kisutch*; juvenile chinook salmon, *O. tshawytscha*; surf

smelt, *Hypomesus pretiosus*; and shiner perch, *Cymatogaster aggregata*. Scars from attacks by lampreys were occasionally seen on juvenile salmonids, usually just below the dorsal fin. Scars were noted less commonly on other species, but some were noticed on a wide range of sizes of fish, including adult pile perch, *Rhacochilus vacca*. Two of the ocean-caught lampreys were taken while attached to a herring and a smelt of unknown species that anglers were using for bait.

Feeding Habits

Beamish (1980) presented data on the feeding habits of the river lamprey, mentioning salmonids and *Clupea* as common prey. Miller⁴ observed what he considered significant predation by the river lamprey on chinook salmon 60-120 mm long in Elliott Bay, Wash.

In the present study, 141 of the 225 specimens from marine water were examined for evidence of feeding. Only four had empty guts. Gut contents of 30 specimens (OS 6857) captured 4 June 1979 from the Columbia River estuary were examined for identifiable material. Fragments of muscle tissue, intestine, liver, ovary, scales, and bones were present in some combination in all guts examined. Scale and bone fragments identified as clupeid were found in 14 guts, one of which also contained a worn lamprey tooth lamina and a scale from a salmonid. The salmonid scale had an ocean-type nucleus and resembled scales of chum salmon, *Oncorhynchus keta*. Clupeid scales from five guts were identified as being from American shad, which migrate up the Columbia in great numbers during June. Scale fragments from six guts were thought to represent Pacific herring. One gut had no recognizable clupeid remains, but held a small salmonid scale with two freshwater annuli, thus probably being from a smolt steelhead, *Salmo gairdneri*.

The guts of 9 of 10 specimens (OS 6858) taken 31 August 1979 from the Columbia estuary contained recognizable clupeid remains. One contained an American shad scale and three held fragments thought to be from Pacific herring scales. Seven contained forked intermuscular bones. In addition to clupeid remains, two guts held fragments of unidentified salmonid scales.

Acknowledgments

We are grateful to Terry Durkin, Greg Hamman, Richard Ledgerwood, David Miller, and Walter Receconi for their help in supplying information and specimens. James D. Hall, Howard F. Horton, and Richard A. Tubb reviewed the manuscript and made helpful suggestions.

Literature Cited

- BEAMISH, R. J.
1980. Adult biology of the river lamprey (*Lampetra ayresii*) and the Pacific lamprey (*Lampetra tridentata*) from the Pacific coast of Canada. *Can. J. Fish. Aquat. Sci.* 37:1906-1923.
- KAN, T. T.
1975. Systematics, variation, distribution, and biology of lampreys of the genus *Lampetra* in Oregon. Ph.D. Dissertation, Oregon State Univ., Corvallis, 204 p.
- MYERS, K. W.
1980. An investigation of the utilization of four study areas in Yaquina Bay, Oregon, by hatchery and wild juvenile salmonids. M.S. Thesis, Oregon State Univ., Corvallis, 234 p.
- VLADYKOV, V. D., AND W. I. FOLLETT.
1958. Redescription of *Lampetra ayresii* (Günther) of western North America, a species of lamprey (Petromyzontidae) distinct from *Lampetra fluviatilis* (Linnaeus) of Europe. *J. Fish. Res. Board Can.* 15:47-77.

CARL E. BOND

Department of Fisheries and Wildlife
Oregon State University
Corvallis, OR 97331

TING T. KAN

Department of Fisheries and Wildlife
Oregon State University
Corvallis, OR 97331
Present address: Papua New Guinea University of Technology
Lae, Papua New Guinea

KATHERINE W. MYERS

Department of Fisheries and Wildlife
Oregon State University
Corvallis, OR 97331
Present address: Fisheries Research Institute
University of Washington, Seattle, WA 98195

⁴Denny M. Miller, formerly Research Assistant, University of Washington, Seattle, WA 98195, pers. commun. April 1968.