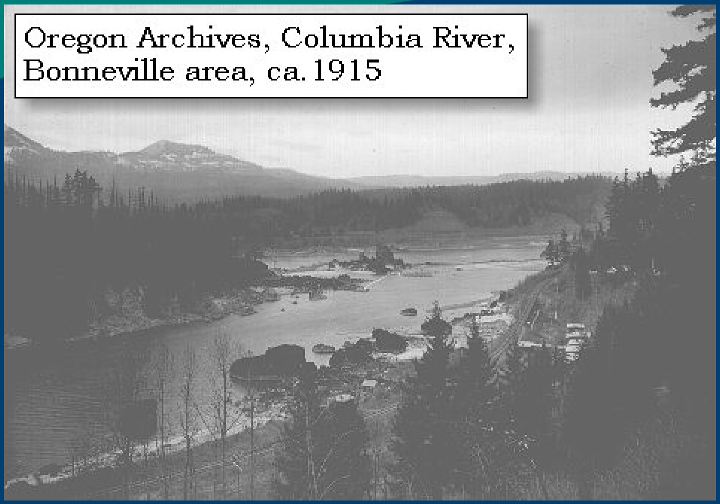
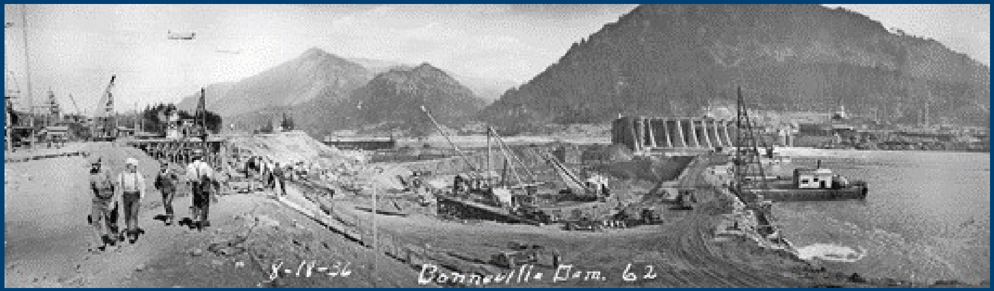
Science, Service, Stewardship





Eulachon:
State of the Science and Science to Policy Forum

August 20, 2015

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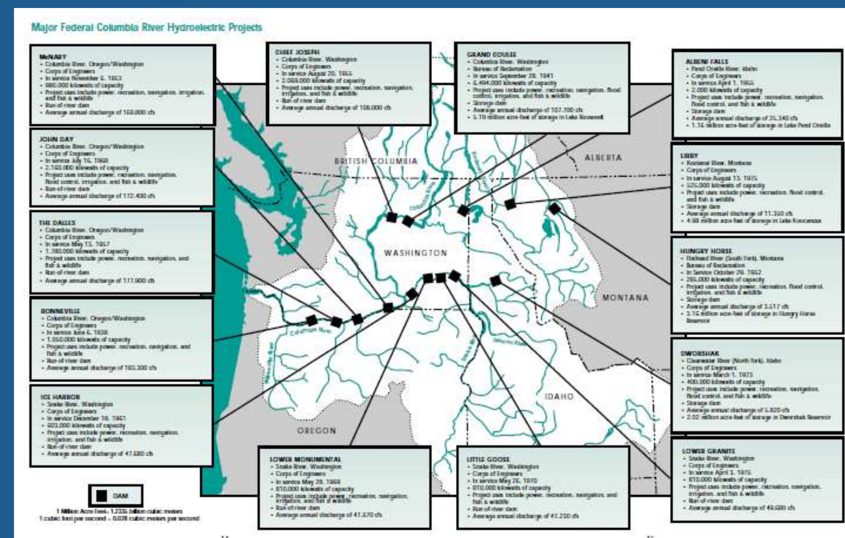
National Marine Fisheries Service

NOAA FISHERIES SERVICE

FCRPS, Dams, and Water Management in the Columbia Basin and Effects on Eulachon

Columbia River Basin

FCRPS



Threats/ Limiting Factors/Factors for Decline

Eulachon qualitative threats rankings by subpopulation (BRT 2010), and ESA Section 4(a)(1)(b) Factors.

Threats	Klamath	Columbia	Fraser	BC	§4 Factor
	Ranking				
Climate change impacts on ocean conditions	1	1	1	1	A
Dams/water diversions	2	4	8	11	A
Eulachon by-catch	3	2	2	2	E
Climate change impacts on freshwater habitats	4	3	4	4	A
Predation	5	7	3	3	C
Water quality	6	5	5	8	A
Catastrophic events	7	8	10	5	A
Disease	8	11	11	7	C
Competition	9	12	12	9	E
Shoreline construction	10	10	9	6	A
Tribal fisheries	11	14	13	10	B
Nonindigenous species	12	15	15	13	E
Recreational harvest	13	13	14	14	B
Scientific monitoring	-	16	16	15	B
Commercial harvest	-	9	6	-	A
Dredging	-	6	7	12	A

Eulachon at Bonneville Dam…and Beyond

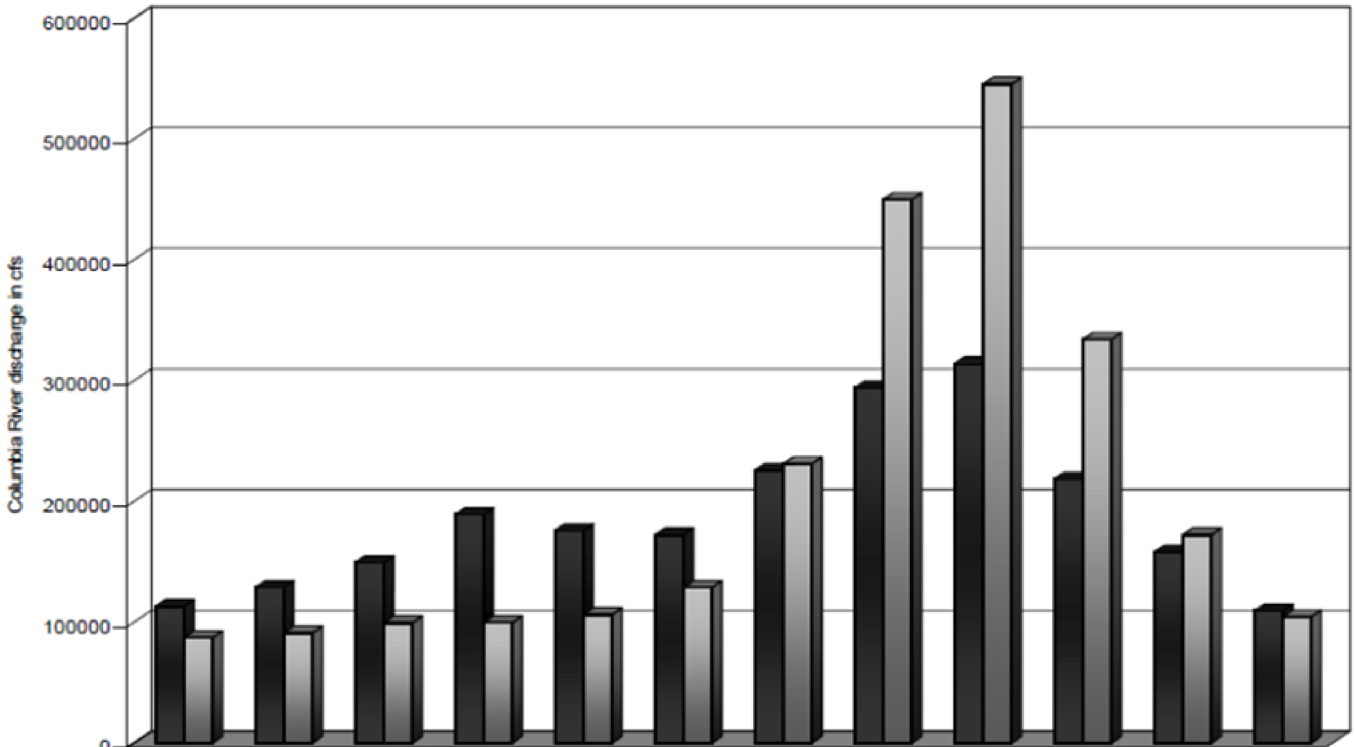
There have been reports of adult eulachon ascending Bonneville Dam, both before and after construction of Bonneville Dam at RM 146.1,with some runs large enough to support recreational harvest (OFC 1953; Smith and Saalfeld 1955; Stockley 1981).

Cascade Rapids, at RM 148.5, was likely a natural barrier to eulachon migration in the Columbia River (OFC 1953). A ship lock constructed at Cascade Locks in 1896 allowed fish to circumvent the rapids and subsequently eulachon were reported as far upstream as Hood River, Oregon at RM 169, and the Klickitat River at RM 180 (Smith and Saalfeld 1955). Following completion of Bonneville Dam, both Cascade Rapids and Cascade Locks were submerged, removing the rapids as a passage barrier.

The Oregonian April 6, 1945—Columbia river smelt somehow have passed Bonneville dam. Lt. Col. Ralph A. Tudor of the United States Army engineers Thursday reported seeing some of the little migrant fish in the pool above the dam, though how they got there he could only guess. A conjecture—and Col. Tudor said it was no more than that—was that the smelt had passed around the dam through the Tanner creek by-pass, built to enable fingerling salmon to escape downstream. It was the first time smelt had been reported above Bonneville dam since 1938, when they passed through an opening left before the dam went into final operation. Millions of smelt Thursday were battling their way upstream through the Bonneville fish ladder on the Washington side of the river, engineers reported, but the vanguard there was only about one-third of the way through the ladder. Engineers reduced the flow of water to give them a better chance.

Eulachon have been documented upstream of Bonneville dam in several years including 1936, 1938, 1945, 1953, 1988 (fall-back estimate of 95,500 eulachon), 2003, 2005, and 2014.

Simulated mean monthly Columbia River flows at Bonneville Dam under current conditions and flows that would have occurred without water development (water years 1929–1978).

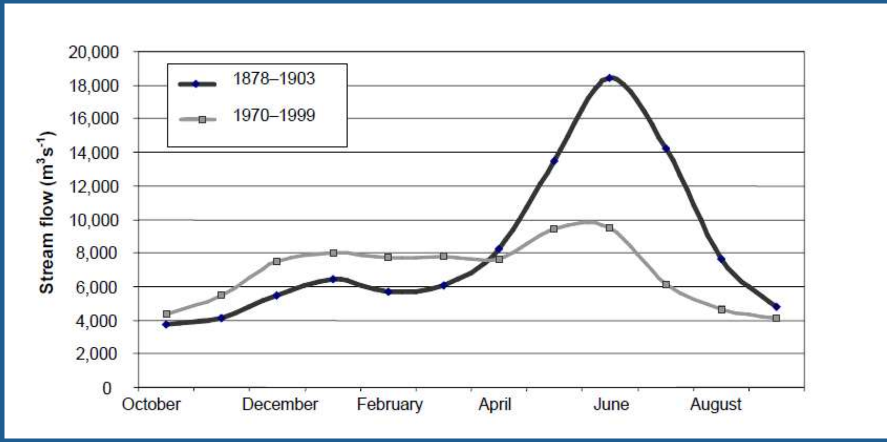


	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Current	113017	128641	149403	189076	175921	172150	225689	293948	313930	218523	157935	109020
Natural	87115	91029	99387	99496	106033	128580	231047	450040	545561	334238	172430	104310

Effects of Dams on Eulachon

Dams can change downstream flow intensity and flow timing, reduce transport of fine sediments and cut off the source of larger sediments for downstream habitats…

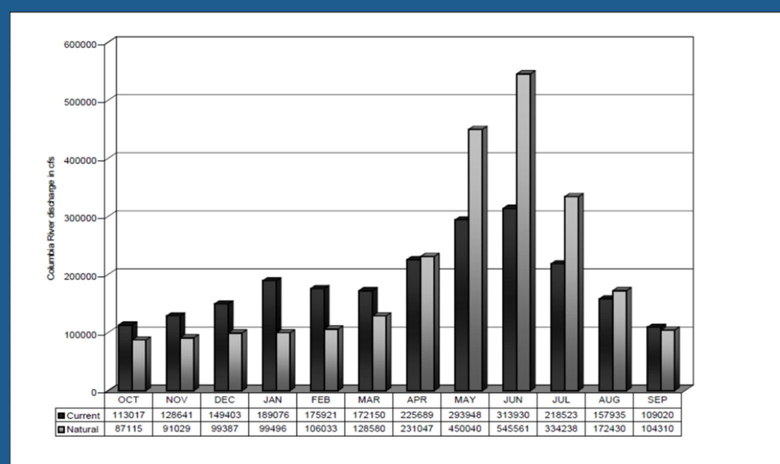
Columbia River — operation of dams and water withdrawals for irrigation have significantly altered the natural hydrologic pattern of the Columbia River. Flow regulation has shifted the peak spring freshet in the Columbia River such that it occurs approximately 2 weeks earlier now than it did prior to 1900, in addition to a decrease in the magnitude of the spring freshet by approximately 41%. These shifts in flow intensity and timing may result in reduced egg and larval survival of eulachon, which are dependent on precise synchronization with river conditions and subsequent availability of preferred juvenile prey species in the ocean (Gustafson et al. 2010).



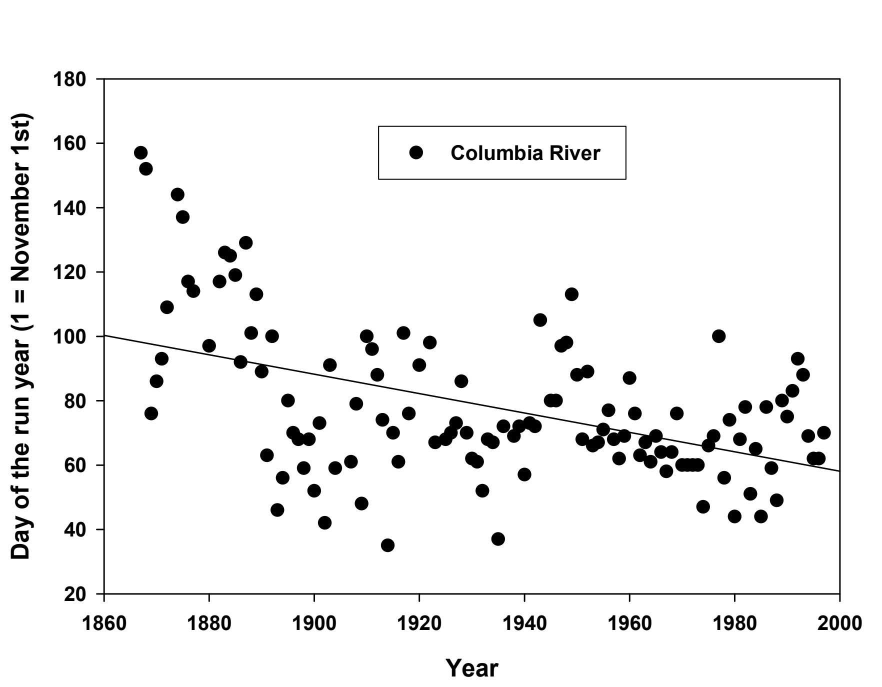
Changes in the annual flow cycle of the Columbia River at the Beaver Army Terminal, 1878–1903 versus 1970–1999, Bottom et al 2005.

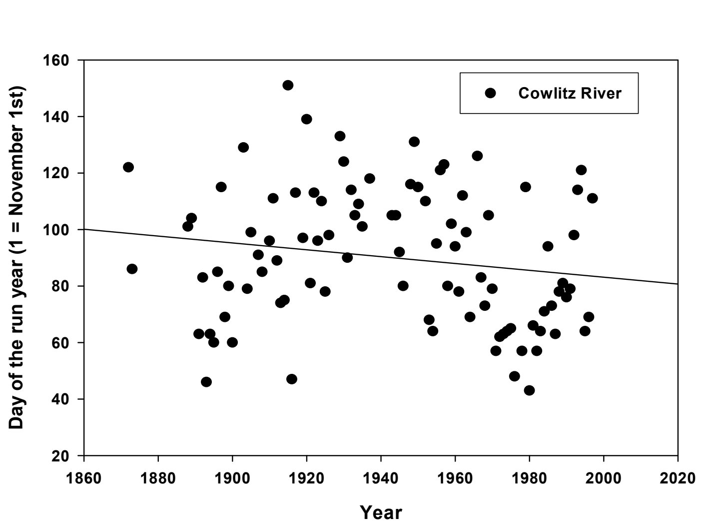
Simulated mean monthly Columbia River flows at Bonneville Dam under current conditions, flows that would have occurred without water development (water years 1929–1978), Flow Changes and Amounts Attributed to the FCRPS, Non-FCRPS, and Timing Range of Eulachon Life History Events.

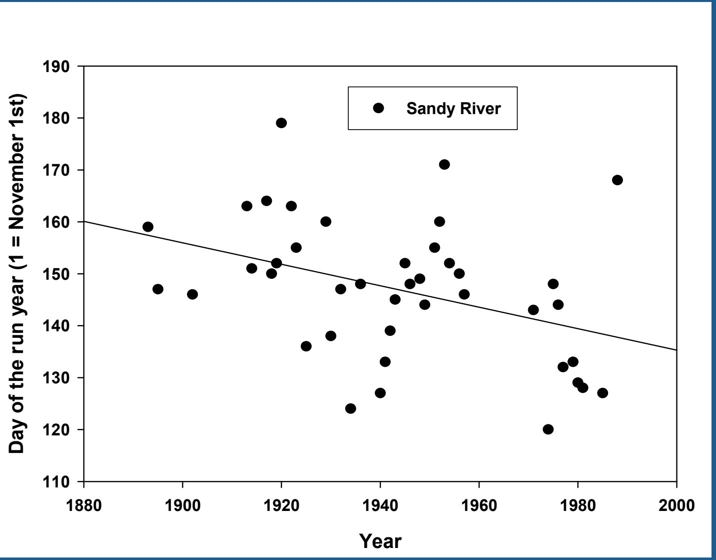
Eulachon	Life Stage	Subpopulation		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Adult migration [1,2]	Columbia River													
	Spawning [1,2,3]	Columbia River													
	Eggs/Larval (incubation,hatching, transportation-drift) [1, 2,3]	Columbia River													
FCRPS Flow Change Direction and Amount-cfs [4]		**Increase**	**Decrease**	26874	20966	13071	1607	46828	69489	34715	4349	1413	7771	11254	15029
FCRPS Flow Change Direction and Amount-Precentage[4]				27.0%	19.7%	10.2%	0.7%	10.4%	12.7%	10.4%	2.5%	1.4%	8.9%	12.4%	15.1%
							Peak Flow Period								
(1) LCFRB 2004. Lower Columbia Salmon and Steelhead Recovery and Subbasin Plan. Tech Foundation.															
(2) Gustafson et al. 2010. Table A-9.															
(3) Ramono et al. 2002															
(4) NOAA Fisheries 2008 - SCA															
Activity Level - Peak															
Activity Level - Non-Peak															



Day of Initial Arrival—pre-1949 data from Newspaper Records





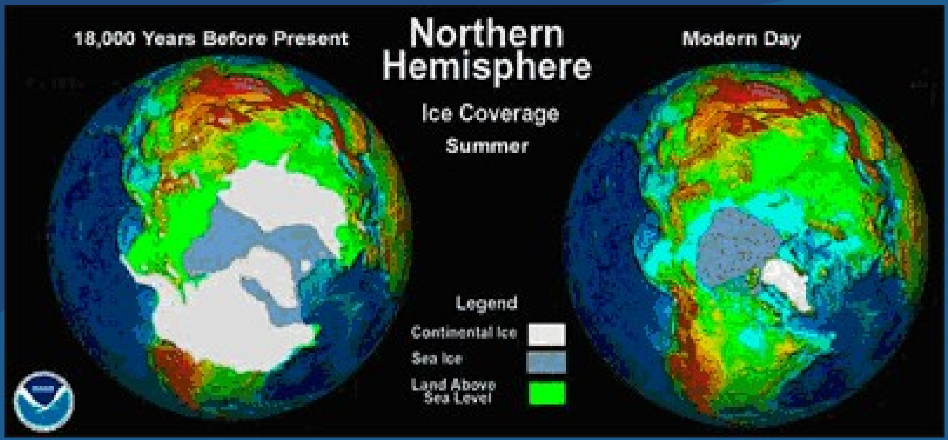


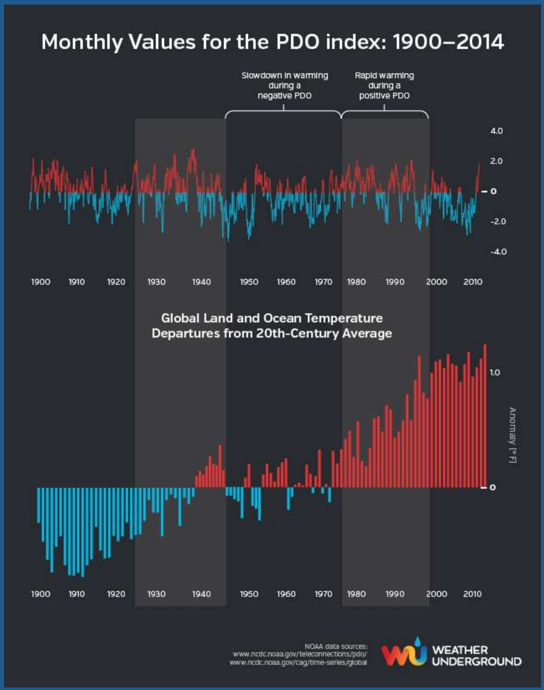
This study has extended the record of eulachon commercial fishery landings back to 1888 and extended initial run timing information back to 1866 in the Columbia River Basin…this study determined that the average first day of arrival of eulachon during the recent period from 1949 to 1997 occurred 15 days earlier in the Columbia River and 14 days earlier in the Cowlitz River than it did historically from 1867 to 1948 (Gustafson, pers. com., unpublished).

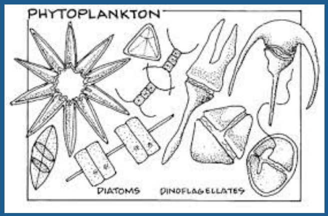
Water Management Effects of the FCRPS on Eulachon

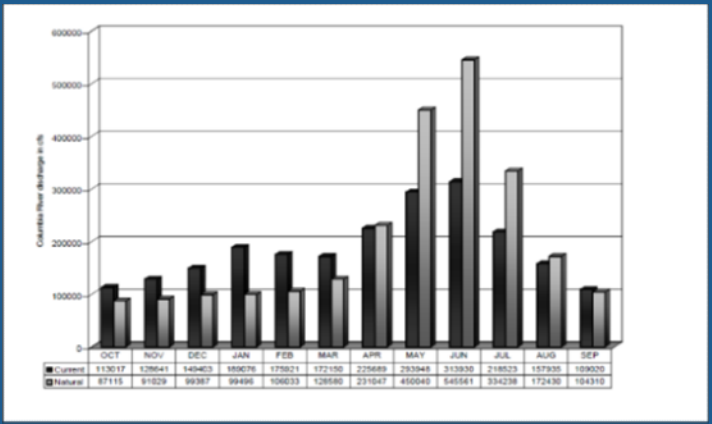
- Water management operations will continue to alter the hydrograph in a manner that increases flows during the fall-winter (October through March), and diminish flows during the spring-summer (April through September). Potential effects: Spawning production, egg incubation, and larval and juvenile growth, development, and survival in the estuary-plume environment.
- Water management operations will continue to alter water quality (increased water temperatures and reduced turbidity), water quantity (seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, and municipal purposes.
- Water management operations, especially during the April through July period, a period that coincides with eulachon larval ocean entry and residence timing, is likely to affect the chemical and physical processes of the estuary–plume environment, and therefore may have negative impacts on marine survival of eulachon larvae and juveniles during the freshwater–ocean transition period.
- Changes in flow, as a percent of total discharge attributable to the FCRPS are, overall, substantial, particularly as these effects are long term (decades).

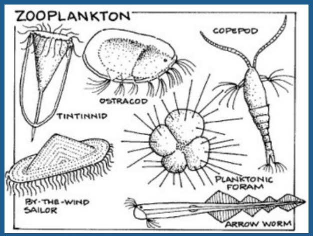
Natural Climate Variability, Anthropogenic-Forced Climate Change, Water Management…and Eulachon

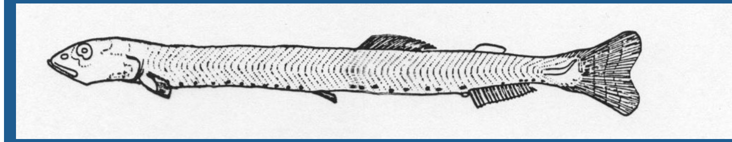












Questions?

of small fish which now begin to run and are
taken in great quantities in the Columbia R.
about 40 miles above us by means of skiming
or scooping nets. on this page I have drawn
the likeness of them as large as life; it
as perfect as I can make it with my
pen and will serve to give a
general idea of the fish. the
rays of the fins are boney but
not sharp tho' somewhat pointed.
the small fin on the back
next to the tail has no
rays of bones being a
membranous pellicle.
of the eye is black and the iris of
white. the under jaw exceeds the upper;
the mouth opens to great extent, folding
that of the herring. it has no teeth.
the abdomen is obtuse and smooth; in this
differing from the herring, shad, anchovey
&c of the Malacapterygious Order & Class
Clupea