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**PREDATION, PARTICULARLY BY SCULPINS, ON SALMON FRY IN
FRESH WATERS OF WASHINGTON**

By

BENJAMIN G. PATTEN

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By BENJAMIN G. PATTEN.

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PREDATION, PARTICULARLY BY SCULPINS, ON SALMON FRY IN FRESH WATERS OF WASHINGTON

By

BENJAMIN G. PATTEN, Fishery Research Biologist

National Marine Fisheries Service
Northwest Fisheries Center
2725 Montlake Boulevard East
Seattle, WA 98102

ABSTRACT

Stomach contents of 41 species of fish collected in one lake and 11 streams were examined to determine species that were predaceous on wild and cultured Pacific salmon, Oncorhynchus spp., fry. The only species with salmon in their stomachs were: sculpins, Cottus spp., coho salmon, O. kisutch, chinook salmon, O. tshawytscha, rainbow trout, Salmo gairdneri, and cutthroat trout, S. clarki. Presented are data on the number of salmon in the stomachs of the predators and on body lengths of the predator species.

INTRODUCTION

Pacific salmon, Oncorhynchus spp., are of great value to sport and commercial fisheries of the Pacific Northwest. Effort to increase production of salmon in Washington is mainly by artificial propagation to supplement natural production and by regulatory measures to protect brood stocks. Control or alteration of some biological features of the environment, however, can also help to increase the numbers of natural and artificially produced salmon. Control of populations of predators, for example, might benefit some stocks of salmon.

Information is needed to determine whether control of some populations of fish that prey on salmon during the salmon's juvenile life (particularly when the salmon are recently hatched) in natural river systems (when and where mor-

talinity is highest and control measures are relatively easy to implement) would help to increase the numbers of salmon. I report on this by listing data on predation in some Washington river systems. This report is essentially on predation of wild salmon in 10 streams; however, I also present data on predation of cultured salmon in a lake and two streams. Of the predatory species, sculpins, Cottus spp., were the most abundant and received my greatest attention. Sculpins are widely distributed and known to be predaceous on young salmon (Hunter, 1959; Sheridan and Meehan, 1962^{1/}; Patten, 1962, 1971), eaters

^{1/} Sheridan, W. L., and W. R. Meehan. 1962. Rehabilitation of Big Kitoi outlet stream, Afognak Island, Alaska. Alaska Dep. Fish Game, Div. Biol. Res., Juneau, Inform. Leaflet 11, 13 p. (Processed.)

of salmon eggs (Mattson, Rowland, and Hobart, 1964^{2/}; McLarney, 1964; Phillips and Claire, 1966), and are probably eaters of the same foods as salmon. Additional information on predation by sculpin on salmon of hatchery origin has been reported by Patten (1971).

METHODS OF COLLECTING AND PROCESSING

Fish were sampled from 11 streams and one lake in 1961 and 1962. They were collected from the streams with the Bureau of Commercial Fisheries Type IV electric fish shocker (Patten and Gillaspie, 1966) during daylight and from the lake with a gill-net set on the bottom overnight. All captured fish less than 55 to 60 mm in total length were released because preliminary study had indicated that fish less than 55 to 60 mm long were not feeding on the young salmon. Sample size varied with duration of fishing effort, fish density, stream, and weather conditions.

All fish taken for study were preserved in Formalin in the field and examined later in the laboratory. In the laboratory each fish was identified and measured (snout to fork of tail in mm, or to tip of tail for sculpins) and the ingested salmon counted. Small numbers of salmon fry were collected from each stream and they were examined to determine the species of prey present.

The taxonomic characters of riffle sculpin, C. gulosus, and reticulate

sculpin, C. perplexus, have not been clearly distinguished. I consider specimens of these two species in my collections to be reticulate sculpin, although the data of Reimers and Bond (1967) show overlapping geographic distributions of these two species in some of the areas where I collected fish. Locations of sampling sites in streams presented in the text and tables are given in kilometers (km) from mouth of stream.

PREDATION BY LOCATION

Data on predation in a lake and in two streams stocked with cultured salmon are presented first, followed by data on predation in 10 streams containing wild salmon.

On Cultured Salmon

Lake Wenatchee. -- Sockeye salmon, O. nerka, were released from 27 September to 16 October 1961 into Lake Wenatchee, Chelan County. Sculpins were collected before and after this. The numbers of salmon eaten by prickly sculpin, C. asper, are shown in Table 1 and length frequencies of prickly sculpin are shown in Figure 1.

Abernathy Creek. -- Abernathy Creek in Cowlitz County was sampled in 1961 and 1962 to determine predation on fry of chum salmon, O. keta, released from an artificial spawning channel at km 6.4.

In 1961, about 2,000 chum salmon were collected from an artificial spawning channel and released into the outlet channel. Predatory fish were collected at the mouth of the outlet channel about 2 hr after this release. On 1 and 25 May 1962, two collections of predators were made the day after 8,437 and 33,155 chum salmon fry, respectively, had emigrated into the outlet channel at night. Numbers of salmon eaten by

^{2/} Mattson, C. R., R. G. Rowland, and R. A. Hobart. 1964. Chum salmon studies in southeastern Alaska, 1963. U.S. Fish Wildl. Serv. Bur. Commer. Fish., Biol. Lab., Auke Bay, Alaska, MS Rep. 64-8, 22 p. (Processed.)

sampled fish are given in Table 2; length frequencies of predators are shown in Figures 1 to 6.

Vance Creek. --Vance Creek in Mason County was sampled at the site of a release of hatchery reared fall chinook salmon fry, *O. tshawytscha*. Personnel of the Washington Department of Fisheries released an estimated 403,750 fall chinook salmon fry (1,400/kg) into Vance Creek about 100 m above its confluence with the Skokomish River on 14 March 1962. I collected fish from this section of the stream on 16 March. Fall chinook salmon fry were extremely abundant throughout the stream and most were found hiding under rocks. Numbers of salmon eaten by predators taken in Vance Creek are shown in Table 3; length frequencies of predatory species are shown in Figures 1 to 5.

On Wild Salmon

Piscivorous fish were sampled in 10 streams when salmon fry were emerging from the gravel or were abundant in streams. The salmon fry as prey species, which I collected, were coho, *O. kisutch*, chinook, and chum salmon; I observed few chum salmon fry, however, in the streams where large numbers of adults had spawned the previous fall.

Abernathy Creek. --A collection of fish was taken from Abernathy Creek 1.6 km above its confluence with the Columbia River on 9 April 1962. Coho salmon fry were abundant in the shallows at the time of sampling. Numbers of salmon fry eaten by the collected fish are shown in Table 4; length frequencies are shown in Figures 1 to 5.

Glen Cove Creek. --Chum and coho salmon fry were present in the lower part of this small creek in Pierce County which empties into lower Puget Sound. Data on predation of salmon fry by the

collected fish are shown in Table 5; length frequencies are shown in Figures 1, 2, and 5.

Grays River. --Grays River was sampled in Wahkiakum County, about 3 km above the influence of tides. Sampling was limited to areas of cover inside the channels where coho salmon fry were most abundant. Data on predation of salmon fry by the collected fishes are shown in Table 6; length frequencies are shown in Figures 3, 5, and 6.

Green River. --A sample of fish was taken from Green River in King County, adjacent to Soos Creek and from the mouth of Soos Creek. Coho salmon fry were few, whereas chinook salmon fry were abundant. Data on predation of salmon fry by the collected fishes are shown in Table 7; length frequencies are shown in Figures 2, 5, and 6.

Hamilton Creek. --A collection of fish was made in this Skamania County creek, 2 km from the mouth at a time of flooding and high turbidity. Coho salmon fry were dispersed through the flooded stream channel. Data on predation of salmon fry by the collected fish are shown in Table 8; length frequencies are shown in Figures 1, 3, 5, and 6.

Newaukum Creek. --Newaukum Creek, a tributary of Green River in southern King County, was sampled in the spring of 1961 and 1962 at various times and locations. Abundance of coho salmon fry within an area of the stream was in proportion to the amount of cover and, although fall chinook salmon were observed to spawn in the lower kilometers, fry of this species were not collected. Data on predation of salmon fry by the collected fish are shown in Table 9; length frequencies are shown in Figures 1 to 3 and in 5 and 6.

Raging River. --A collection of fish was taken from the Raging River in King

County, 3 km above its confluence with the Snoqualmie River. At the time of sampling, coho salmon fry were abundant in the shallows. The number of salmon fry eaten by the collected fish are shown in Table 10; length frequencies are shown in Figures 3 and 6.

Rocky Creek. -- Rocky Creek, a tributary to lower Puget Sound in Pierce County, was sampled on four occasions from the tidal zone 0.2 km below the highway (Wash., 302) bridge to 1 km upstream of the bridge. Coho, chinook, and fall and winter chum salmon spawn in Rocky Creek; however, the only salmon fry observed were coho and a few chum. The number of salmon fry eaten by the collected fish are shown in Table 11; length frequencies are shown in Figures 1 to 5.

Yakima River. -- The Yakima River was sampled March-June 1961 in Kittitas County from Cle Elum (km 257) to below Easton Dam (km 286). Identification of coho and chinook yearlings in this collection was difficult; therefore, these fish are combined. The density of coho and chinook fry varied from few to abundant depending upon the amount of cover, and their density decreased with distance downstream from km 286. Salmon fry eaten by predators were treated as one group because species of some salmon taken from the predators' stomachs could not be determined. Numbers of salmon eaten by the collected fish are shown in Table 12; length frequencies are shown in Figures 2 and 3 and in 6 to 8.

Unnamed Creek. -- Predators on salmon fry were collected in the 100 m of the creek above its confluence with the Skokomish River in Mason County. Coho fry were more abundant than chinook and chum. Numbers of salmon fry eaten by the collected fish are shown in Table 13; length frequencies are shown in Figure 1 and in Figures 3 to 5.

ACKNOWLEDGMENTS

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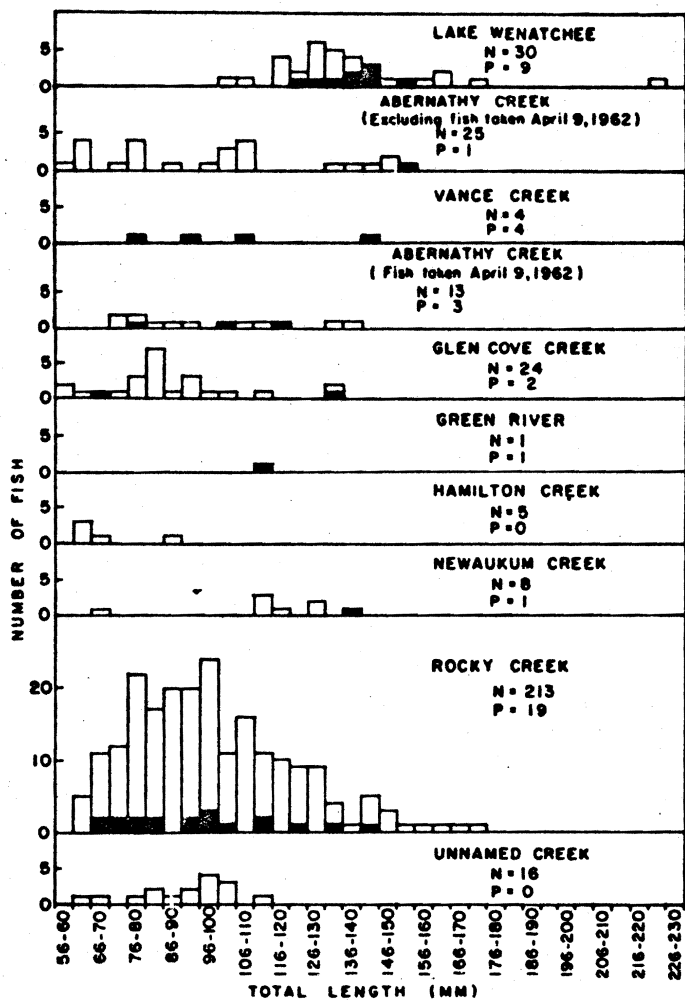


Figure 1. --Length frequencies of prickly sculpin collected in Washington in 1961-62. Salmon predators are shaded and nonpredators are unshaded. N = total number of sculpins in a sample of which P = number of predators. Prey taken by Abernathy Creek predators were presumed to be from an artificial spawning channel except for prey taken 1.6 km from the creek mouth on 9 April 1962.

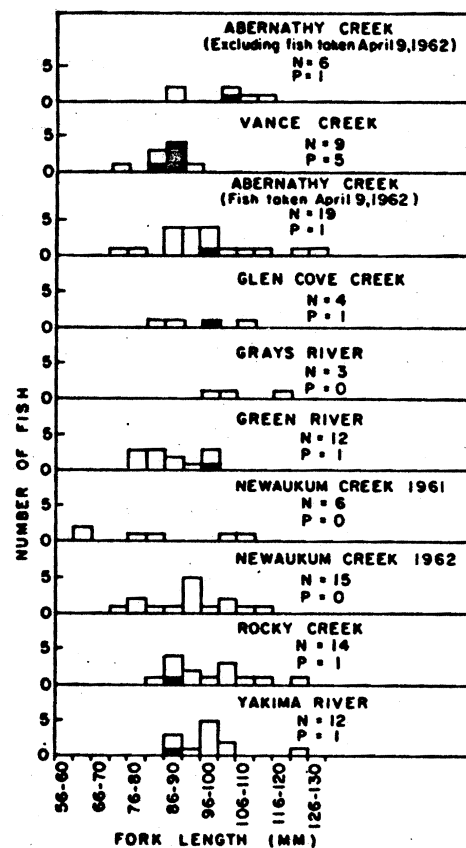


Figure 2. --Length frequencies of coho salmon collected in Washington in 1961-62. Salmon predators are shaded and nonpredators are unshaded. N = total number of coho salmon in a sample of which P = number of predators. Prey taken by Abernathy Creek predators were presumed to be from an artificial spawning channel except for prey taken 1.6 km from the creek mouth on 9 April 1962.

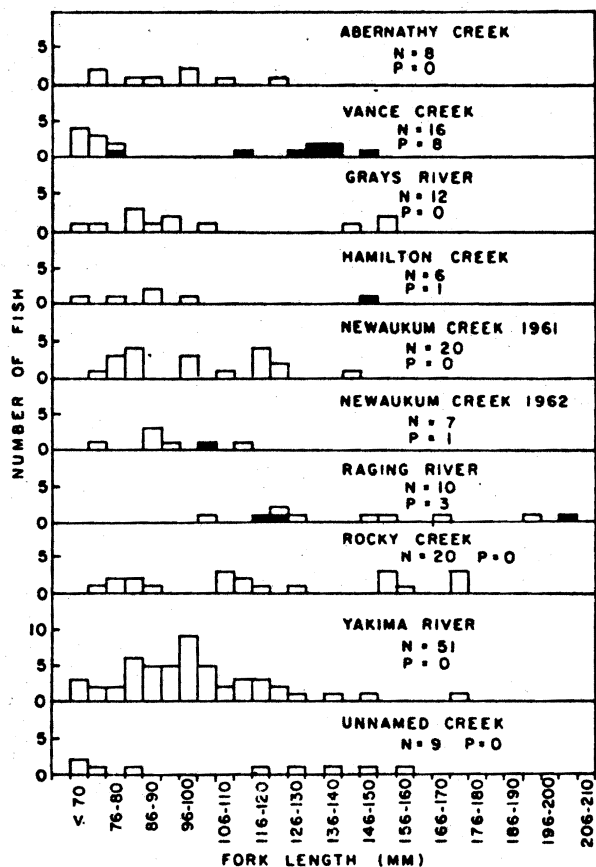


Figure 3. --Length frequencies of rainbow trout collected in Washington in 1961-62. Salmon predators are shaded and nonpredators are unshaded. N = total number of rainbow trout in a sample of which P = number of predators.

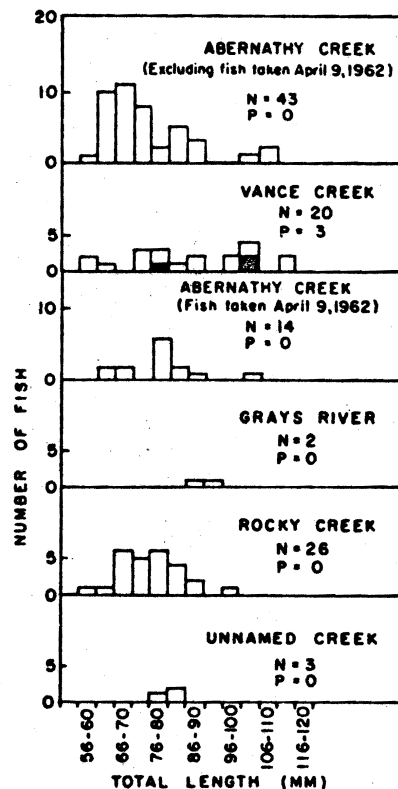


Figure 4. --Length frequencies of coast-range sculpin collected in Washington in 1961-62. Salmon predators are shaded and nonpredators are unshaded. N = total number of sculpins in a sample of which P = number of predators. Prey taken by Abernathy Creek predators were presumed to be from an artificial spawning channel except for prey taken 1.6 km from the creek mouth on 9 April 1962.

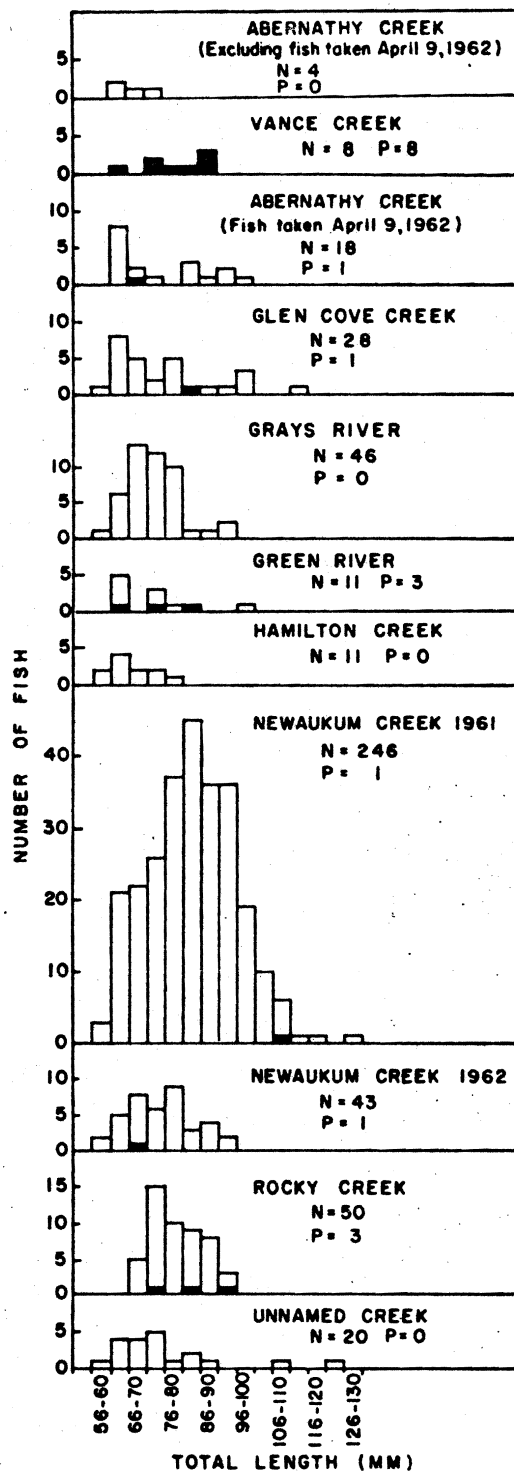


Figure 5. --Length frequencies of reticulate sculpin collected in Washington in 1961-62. Salmon predators are shaded and nonpredators are unshaded. N = total number of sculpins in a sample of which P = number of predators. Prey taken by Abernathy Creek predators were presumed to be from an artificial spawning channel except for prey taken 1.6 km from the creek mouth on 9 April 1962.

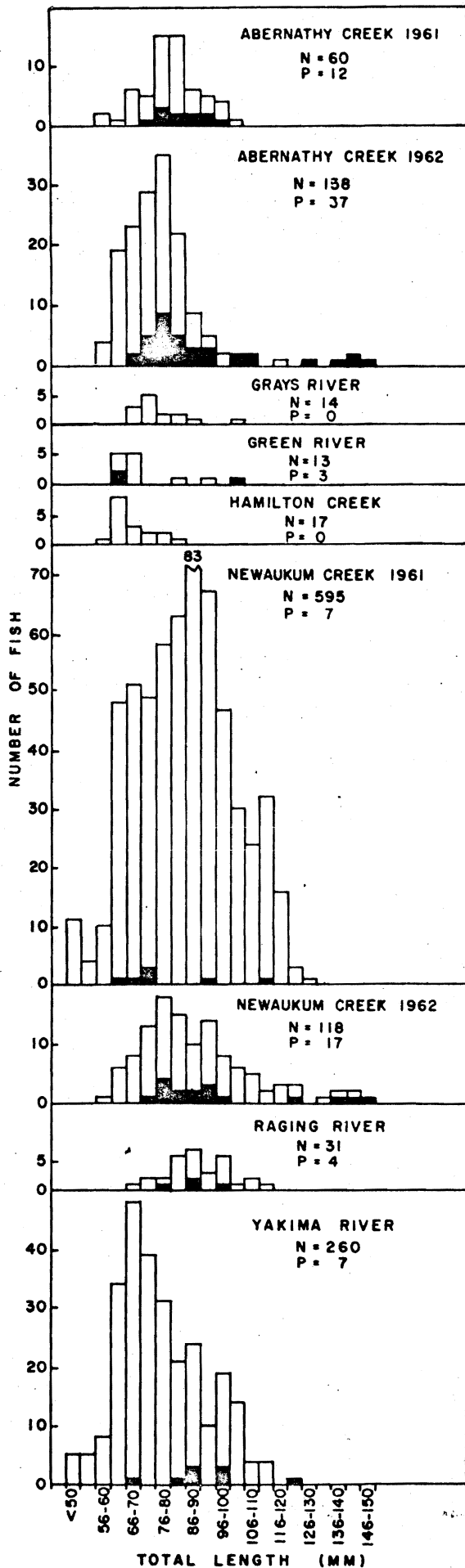


Figure 6. --Length frequencies of torrent sculpin collected in Washington in 1961-62. Salmon predators are shaded and nonpredators are unshaded. N = total number of sculpins in a sample of which P = number of predators. Prey taken by Abernathy Creek predators in 1961 were presumed to be from an artificial spawning channel and prey taken in 1962 were wild.

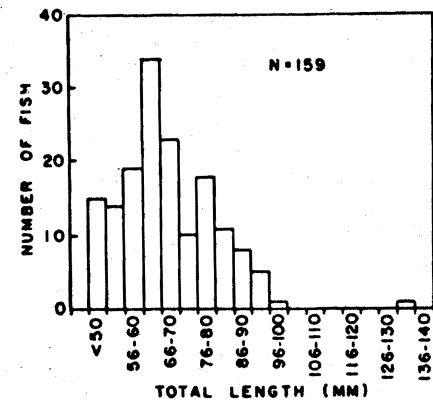


Figure 7. --Length frequencies of mottled sculpin collected from the Yakima River in 1961.

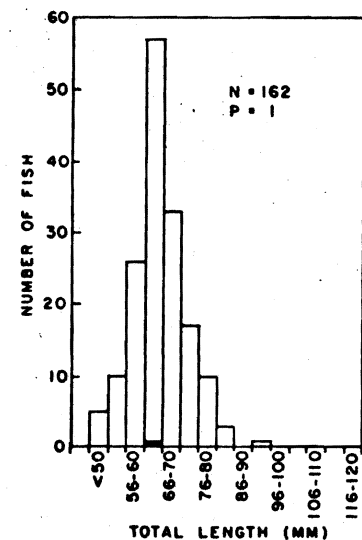


Figure 8. --Length frequencies of Piute sculpin collected from the Yakima River in 1961. The salmon predator is shaded, non-predators are unshaded. N = total number of sculpins in a sample of which P = number of predators.

TABLE 1.--Number of salmon eaten by prickly sculpins collected from Lake Wenatchee in 1961.

Sampling date	Total predators examined	Length range of predators	Predators with salmon in stomachs	Salmon in stomachs of predators
	<u>Number</u>	<u>Mm</u>	<u>Number</u>	<u>Number</u>
September 26	3	132-165	-	-
October 12	6	105-145	1	1
17	15	108-225	8	8
26	<u>6</u>	119-159	<u>-</u>	<u>-</u>
	30		9	9

TABLE 2.--Number of salmon eaten by predators collected from Abernathy Creek in 1961 and 1962.

Predator	Sampling dates	Distance from mouth of creek <u>Km</u>	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
<u>1961</u>						
Rainbow trout	June 6	6.4	1	98	-	-
Torrent sculpin	June 6	6.4	60	58-102	12	13
<u>1962</u>						
Coho salmon	May 1	6.4	6	87-115	1	2
Rainbow trout	May 1	6.4	7	73-121	-	-
Coastrange sculpin	May 1	1.6	38	60-107	-	-
	"	6.4	<u>5</u>	69-107	<u>-</u>	<u>-</u>
Total fish			43		-	-
Prickly sculpin	May 1	1.6	23	60-153	1	1
	"	6.4	<u>2</u>	106-132	<u>-</u>	<u>-</u>
Total fish			25		1	1
Reticulate sculpin	May 1	1.6	3	64-75	-	-
	"	6.4	<u>1</u>	65	<u>-</u>	<u>-</u>
Total fish			4		-	-
Torrent sculpin	May 1	1.6	3	66-74	-	-
	"	6.4	104	60-100	12	15
	May 25	6.4	<u>51</u>	60-147	<u>25</u>	<u>47</u>
Total fish			158		37	62

TABLE 3.--Number of salmon eaten by predators collected near mouth of Vance Creek on 16 March 1962.

Predator	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Coho salmon	9	50-125	5	11
Rainbow trout	16	57-146	8	79
Coastrange sculpin	20	57-111	3	4
Prickly sculpin	4	79-144	4	13
Reticulate sculpin	8	63-90	8	11

TABLE 4.--Number of salmon eaten by predators collected 1.6 km from mouth of Abernathy Creek on 9 April 1962.

Predator	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Coho salmon	19	71-130	1	1
Rainbow trout	2	110-124	1	1
Coastrange sculpin	14	63-101	-	-
Prickly sculpin	13	72-136	3	3
Reticulate sculpin	18	61-97	1	1

TABLE 5.--Number of salmon eaten by predators collected from Glen Cove Creek on 11 April 1962.

Predator	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Coho salmon	4	83-108	1	2
Cutthroat trout	1	320	1	2
Staghorn sculpin	44	170-246	-	-
Prickly sculpin	24	60-135	2	2
Reticulate sculpin	28	60-115	1	1
Starry flounder	1	290	-	-

TABLE 6.--Number of salmon eaten by predators collected from Grays River on 13 April 1961.

Predator	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Coho salmon	3	97-119	-	-
Rainbow trout	12	65-155	-	-
Coastrange sculpin	2	87-92	-	-
Reticulate sculpin	46	59-93	-	-
Torrent sculpin	14	66-104	-	-

TABLE 7.--Number of salmon eaten by predators collected from Green River and mouth of Soos Creek on 3 April 1962.

Predator	Total predators examined	Length range of predators	Predators with salmon in stomachs	Salmon in stomachs of predators
	<u>Number</u>	<u>Mm</u>	<u>Number</u>	<u>Number</u>
Coho salmon	12	77-100	1	1
Rainbow trout	2	95-130	-	-
Prickly sculpin	1	115	1	2
Reticulate sculpin	11	61-97	3	3
Torrent sculpin	13	61-104	3	3

TABLE 8.--Number of salmon eaten by predators collected from Hamilton Creek on 3 May 1962.

Predator	Total predators examined	Length range of predators	Predators with salmon in stomachs	Salmon in stomachs of predators
	<u>Number</u>	<u>Mm</u>	<u>Number</u>	<u>Number</u>
Rainbow trout	6	68-147	1	1
Prickly sculpin	5	61-88	-	-
Reticulate sculpin	11	69-79	-	-
Torrent sculpin	17	60-85	-	-

TABLE 9.--Number of salmon eaten by predators collected from Newaukum Creek in 1961 and 1962.

Predator	Sampling dates	Distance from mouth of creek <u>Km</u>	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
<u>1961</u>						
Coho salmon	May 5	12.9	2	104-107	-	-
	March 17	14.5	1	85	-	-
	May 5	14.5	2	65-77	-	-
	"	16.1	<u>1</u>	61	-	-
	Total fish		6		-	-
Rainbow trout	May 5	6.4	3	77-84	-	-
	April 12	8.0	1	110	-	-
	May 5	11.3	6	75-122	-	-
	June 13	11.3	7	84-146	-	-
	May 5	12.9	1	91	-	-
	June 13	12.9	<u>2</u>	96-116	-	-
	Total fish		20		-	-
Reticulate sculpin	June 13	3.2	40	62-117	-	-
	May 5	4.8	17	60-99	-	-
	May 25	4.8	18	67-111	-	-
	May 26	4.8	24	69-104	-	-
	May 5	6.4	9	64-87	-	-
	April 12	8.0	4	74-96	-	-
	May 5	11.3	2	70-75	-	-
	"	12.9	33	60-110	-	-
	May 26	12.9	28	62-109	-	-
	June 13	12.9	39	62-126	1	1
	March 17	14.5	11	64-100	-	-
	May 5	14.5	8	63-102	-	-
	"	16.1	8	60-106	-	-
	May 25	16.1	<u>5</u>	65-107	-	-
	Total fish		246		1	1
Torrent sculpin	June 13	3.2	70	59-120	1	2
	May 5	4.8	72	59-125	1	1
	May 25	4.8	89	39-114	-	-
	May 26	4.8	21	73-96	-	-
	May 5	6.4	43	59-86	1	1
	April 12	8.0	4	70-112	-	-

TABLE 9.--Number of salmon eaten by predators collected from Newaukum Creek in 1961 and 1962.--Cont.

Predator	Sampling dates	Distance from mouth of creek Km	Total predators examined Number	Length range of predators Mm	Predators with salmon in stomachs Number	Salmon in stomachs of predators Number
Torrent sculpin (cont.)	June 13	8.0	12	73-113	-	-
	May 5	11.3	23	61-96	-	-
	June 13	11.3	7	60-104	-	-
	June 14	11.3	5	69-100	-	-
	May 5	12.9	58	60-115	1	1
	May 26	12.9	9	62-105	-	-
	June 13	12.9	78	57-128	-	-
	March 17	14.5	48	64-119	-	-
	May 5	14.5	53	60-116	2	2
	"	16.1	<u>3</u>	71-109	<u>1</u>	<u>1</u>
Total fish			595		7	8
<u>1962</u>						
Coho salmon	April 27	4.8	4	80-102	-	-
	"	12.9	5	71-97	-	-
	"	14.5	<u>6</u>	90-112	<u>-</u>	<u>-</u>
Total fish			15		-	-
Rainbow trout	April 27	9.7	2	71-101	1	1
	"	14.5	<u>5</u>	86-111	<u>-</u>	<u>-</u>
Total fish			7		1	1
Prickly sculpin	April 8	1.6	8	67-138	1	1
Reticulate sculpin	April 8	1.6	12	58-79	-	-
	April 27	4.8	11	61-87	-	-
	"	9.7	2	77-86	-	-
	"	12.9	9	75-82	-	-
	"	14.5	<u>9</u>	65-95	<u>1</u>	<u>1</u>
Total fish			43		1	1
Torrent sculpin	April 8	1.6	12	65-146	3	3
	April 27	4.8	8	65-102	2	2
	"	8.0	3	82-95	-	-
	"	9.7	19	60-96	1	1
	"	12.9	4	80-91	3	3
	"	14.5	<u>72</u>	62-142	<u>8</u>	<u>9</u>
Total fish			118		17	18

TABLE 10.--Number of salmon eaten by predators collected from Raging River on 6 June 1963.

Predator	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Rainbow trout	10	102-202	3	6
Mountain whitefish	1	270	-	-
Torrent sculpin	31	70-116	4	6

TABLE 11.--Number of salmon eaten by predators collected from Rocky Creek in 1961.

Predator	Sampling dates	Distance from mouth of creek	Total predators examined	Length range of predators	Predators with salmon in stomachs	Salmon in stomachs of predators
		<u>Km</u>	<u>Number</u>	<u>Mm</u>	<u>Number</u>	<u>Number</u>
<u>1961</u>						
Coho salmon	April 12	Tidal	8	84-124	1	4
	May 9	0.5-1.0	3	87-101	-	-
	April 12	0.2-0.5	<u>3</u>	89-106	<u>-</u>	<u>-</u>
	Total fish		14		1	4
Cutthroat trout	April 18	Tidal	1	123	-	-
	"	0.5-1.0	<u>2</u>	129-171	<u>1</u>	<u>2</u>
	Total fish		3		1	2
Rainbow trout	April 12	Tidal	6	72-171	-	-
	"	0.2-0.5	9	80-174	-	-
	May 9	0.5-1.0	<u>5</u>	84-130	<u>-</u>	<u>-</u>
	Total fish		20		-	-
Coastrange sculpin	April 18	Tidal	1	89	-	-
	April 12	Tidal	3	59-96	-	-
	May 9	0.5-1.0	<u>22</u>	64-87	<u>-</u>	<u>-</u>
	Total fish		26		-	-
Prickly sculpin	April 18	Tidal	24	63-131	8	16
	May 20	Tidal	9	77-150	-	-
	April 12	Tidal	74	61-146	3	7
	May 9	Tidal	41	85-168	-	-
	April 12	0.2-0.5	60	65-160	7	8
	May 9	0.5-1.0	<u>5</u>	76-82	<u>1</u>	<u>1</u>
	Total fish		213		19	32
Reticulate sculpin	May 9	0.5-1.0	<u>50</u>	68-92	<u>3</u>	<u>3</u>
	Total fish		50		3	3

TABLE 12.--Number of salmon eaten by predators collected from the Yakima River in 1961.

Predator	Sampling dates	Distance from mouth of river <u>Km</u>	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Coho and chinook salmon	March 20	282	5	86-105	1	1
	March 31	282	2	91-97	-	-
	March 21	287	2	88-103	-	-
	March 30	287	<u>3</u>	98-126	<u>-</u>	<u>-</u>
Total fish			12		1	1
Rainbow trout	April 28	262	2	83-104	-	-
	May 19	262	1	123	-	-
	April 28	266	8	64-109	-	-
	May 18	266	4	102-149	-	-
	April 28	270	3	87-139	-	-
	May 18	270	3	90-101	-	-
	April 27	274	6	88-112	-	-
	May 18	274	4	98-124	-	-
	April 27	277	1	82	-	-
	May 18	277	2	84-100	-	-
	March 31	282	2	83-174	-	-
	May 18	282	2	93-129	-	-
	April 26	284	2	67-77	-	-
	May 17	284	2	103-114	-	-
	March 21	287	1	95	-	-
	March 30	287	3	90-115	-	-
	March 31	287	1	73	-	-
	April 26	287	2	67-101	-	-
	May 17	287	<u>2</u>	85-118	<u>-</u>	<u>-</u>
Total fish			51		-	-
Mountain whitefish	April 27	274	1	197	-	-
	May 18	277	2	198-243	-	-
	May 17	284	1	195	-	-
	March 21	287	2	87-160	-	-
	May 17	287	<u>4</u>	216-264	<u>-</u>	<u>-</u>
Total fish			10		-	-

TABLE 12.--Number of salmon eaten by predators collected from the Yakima River in 1961.--Cont.

Predator	Sampling dates	Distance from mouth of river Km	Total predators examined Number	Length range of predators Mm	Predators with salmon in stomachs Number	Salmon in stomachs of predators Number
Brook trout	April 28	264	1	80	-	-
	May 18	266	2	110-120	-	-
	May 18	274	1	171	-	-
	April 26	284	2	103-116	-	-
	March 31	287	1	211	-	-
	April 26	287	1	106	-	-
	May 17	287	1	162	-	-
	Total fish		9		-	-
Mottled sculpin	May 19	259	10	56-132	-	-
	April 28	262	5	62-80	-	-
	May 19	262	19	58-95	-	-
	April 28	264	9	67-92	-	-
	April 28	266	8	61-91	-	-
	May 18	266	10	46-97	-	-
	April 28	270	4	57-79	-	-
	May 18	270	10	62-77	-	-
	May 18	274	50	45-81	-	-
	April 27	277	2	73-81	-	-
	May 18	277	2	60-68	-	-
	March 21	282	1	87	-	-
	March 30	282	1	88	-	-
	March 31	282	10	63-89	-	-
	May 18	282	5	60-76	-	-
	April 26	284	2	62-78	-	-
	May 17	284	5	59-88	-	-
	March 30	287	2	72-88	-	-
	April 4	287	1	79	-	-
	May 17	287	3	66-79	-	-
	Total fish		159		-	-

TABLE 12.--Number of salmon eaten by predators collected from the Yakima River in 1961.--Cont.

Predator	Sampling dates	Distance from mouth of river <u>Km</u>	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Piute sculpin	May 19	259	1	70	-	-
	April 28	262	7	60-76	-	-
	May 19	262	1	61	-	-
	April 28	264	1	69	-	-
	April 28	266	24	60-80	-	-
	May 18	266	13	50-82	-	-
	April 28	270	6	60-94	-	-
	May 18	270	3	63-75	-	-
	April 27	274	29	60-79	-	-
	May 18	274	13	47-82	-	-
	April 27	277	8	60-83	-	-
	May 18	277	2	70-80	-	-
	March 31	282	5	62-68	-	-
	May 18	282	5	59-66	-	-
	May 17	284	22	54-73	1	1
	March 30	287	12	50-82	-	-
	March 31	287	5	61-71	-	-
	April 26	287	1	60	-	-
	May 17	287	4	50-71	-	-
	Total fish		162		1	1
Torrent sculpin	May 19	259	6	66-114	-	-
	April 28	262	6	60-80	-	-
	May 19	262	4	90-103	-	-
	April 28	264	17	60-96	-	-
	April 28	266	10	62-90	-	-
	May 18	266	12	43-102	-	-
	April 28	270	15	64-79	-	-
	May 18	270	22	64-114	-	-
	April 27	274	20	62-84	-	-
	May 18	274	18	64-94	-	-
	April 27	277	13	62-90	-	-
	May 18	277	4	69-112	-	-
	April 27	280	12	64-103	-	-
	March 21	282	3	67-90	-	-
	March 30	282	8	87-109	-	-
	March 31	282	15	66-114	1	1
	May 18	282	9	60-87	1	1
	April 26	284	11	60-85	-	-

TABLE 12.--Number of salmon eaten by predators collected from the Yakima River in 1961.--Cont.

Predator	Sampling dates	Distance from mouth of river <u>Km</u>	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Torrent sculpin (cont.)	May 17	284	13	64-122	-	-
	March 21	287	6	90-104	1	1
	March 30	287	10	58-111	-	-
	March 31	287	8	66-100	2	3
	April 26	287	4	65-90	-	-
	May 17	287	10	63-109	-	-
	June 2	287	<u>4</u>	83-99	<u>1</u>	<u>1</u>
Total fish			260		7	8

TABLE 13.--Number of salmon eaten by predators near mouth of an un-named creek (near Vance Creek) on 28 March 1962.

Predator	Total predators examined <u>Number</u>	Length range of predators <u>Mm</u>	Predators with salmon in stomachs <u>Number</u>	Salmon in stomachs of predators <u>Number</u>
Coho salmon	1	76	-	-
Rainbow trout	9	63-159	-	-
Coastrange sculpin	3	77-83	-	-
Prickly sculpin	16	65-111	-	-
Reticulate sculpin	20	60-122	-	-