Native Char Utilization
Lower Chehalis River and
Grays Harbor Estuary
Aberdeen, Washington

Appendix A

Historical Char References

FISH MIGRATION AND DISTRIBUTION IN THE LOWER CHEHALIS RIVER AND UPPER GRAYS HARBOR

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State of Washington
Department of Game

July 1970

-1-

Table 10. Upper Grays Harbor beach seine catches, Stations 2 and 4, 1966.

Date	3/10	4/14	4/27	4/28	5/5	5/6	5/12	5/20	5/24	6/24	8/4	9/15
Station number[a]	4	4	2	4	4	2	4	2	4	4	4	4
Number of hauls[b]	1	1	7	4	3	3	3	2	4	3	2	7
Number of juvenile salmon												
Chinook salmon	6	0	23	12	18	15	33	100	151	8	39	62
Chum salmon	62	10	124	116	85	16	2	3	9	0	0	0
Coho salmon	0	0	28	37	7	5	29	10	11	0	0	0
Other species present												
Cutthroat trout	0	0	1[c]	0	3	0	2	3	1	3	0	0
Dolly varden	0	0	1[c]	0	0	0	0	0	0	0	0	0
Pacific herring	--	--	--	--	--	--	--	--	X	--	--	--
American shad	--	--	--	--	--	X	X	--	--	--	--	--
Surf smelt	--	--	--	--	X	X	X	X	X	--	--	--
Longfin smelt	--	--	--	--	--	X	--	--	--	X	X	--
Eulachon	X	--	--	--	--	--	--	--	--	--	--	--
Peamouth	X	X	--	--	--	X	X	X	X	--	--	--
Pacific tomcod	--	--	--	--	--	--	--	--	--	X	X	--
Three-spine stickleback	--	--	X	X	X	X	X	X	X	X	X	X
Shiner perch	--	--	--	--	X	X	X	X	X	X	X	X
Arrow goby	--	--	--	--	X	--	--	--	--	--	--	--
Kelp greenling	--	--	--	--	--	--	--	--	--	X	--	--
Prickly sculpin	--	--	--	--	--	--	--	--	--	X	--	--
Pacific staghorn sculpin	--	X	X	X	X	--	X	--	X	X	X	X
Saddleback gunnel	--	--	--	--	--	X	--	X	--	--	--	--
Pacific snakeblenny	--	--	--	--	X	X	X	X	X	X	X	X
English sole	--	--	--	X	X	X	X	X	X	X	X	X
Starry flounder	X	X	X	X	X	X	X	X	X	X	X	X
Sand sole	--	--	--	--	X	X	X	--	X	X	X	X
Dungeness crab	--	--	--	--	X	--	X	--	X	X	--	X
Mysid	X	X	--	X	--	X	--	X	--	--	--	--
Shrimp	X	X	X	X	X	X	--	X	X	X	X	X

a/ Station 2: Cow Point, gravel bar off Naval Reserve Center. Station 4: Moon Island Reach, north side of North Channel to five miles below Hoquiam River mouth.
b/ 50' seine, ¼ inch mesh.
c/ 5-pound male.

GRAYS HARBOR: DOWNSTREAM MIGRANT SALMONID STUDY

ITT Rayonier Inc.
Olympic Research Division

APPENDIX II, Table 3.   Station 3 - 1.15 Statute Miles East of Raymonier Mill.

Species	4/24	5/3	5/17	5/28	6/3	6/14	6/27
Chinook salmon	2	1	5	22	31	31	20
Chum salmon	14	5	0	0	0	0	0
Coho salmon	1	9	1	0	0	1	0
Steelhead trout	0	0	0	0	0	0	0
Cutthroat trout	0	2	1	1	0	0	0
Smelt[1]	0	0	0	0	0	5	0
3-Spined stickleback	47	5	17	16	30	(85)	5
Pacific snakeblenny	0	5	0	0	0	1	2
Perch[2]	0	0	0	4	5	44	40
Flatfish[3]	0	6	(55)	20	3	25	16
Northern anchovy	0	0	0	0	0	0	0
Sculpin[4]	12	(65)	(270)	(150)	20	(200)	5
Shad	0	0	0	0	0	0	0
Dungeness crab	0	0	0	0	0	0	0
Incidental Species							
Peamouth	0	0	0	5	54	(350)	(510)
Dolly Varden trout	0	1	1	1	0	0	0
Greenling	0	0	0	0	0	1	0
Ling cod	0	0	0	0	0	0	0
Saddleback gunnel	0	0	0	0	0	0	0
Tide	L-E	L-E	L-E	Low	L-F	L-F	Low
Time	1515	1215	1130	1030	1400	1245	1120
Temperature (°C.)	-	14.0	14.1	15.8	13.6	17.8	-
DO (mg/l)	-	8.2	5.6	7.6	8.9	7.5	-
SSL (ppm)	34.6	15.8	30.4	15.8	9.6	57.2	-
Salinity (0/00)	7.25	10.17	6.56	2.50	0	2.52	-
Turb. (Jackson units)	-	-	-	-	-	-	-

[1]Includes Surf smelt and Longfin smelt.
[2]Includes White seaperch, Pile seaperch and Shiner seaperch.
[3]Includes Starry flounder, English sole and Sand sole.
[4]Includes Pacific staghorn and Prickly sculpin.
() Estimated numbers.

Supplemental Progress Report
Coastal Salmon Program

1973 STUDIES OF JUVENILE SALMONIDS IN RIVERS TRIBUTARY TO GRAYS HARBOR, WASHINGTON

State of Washington
DEPARTMENT OF FISHERIES
Management and Research Division

Richard Brix
Fisheries Biologist

May 1974

Partially funded under Contract No. E-10221,
Ebasco Services Incorporated, New York, N. Y.

and

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National Marine Fisheries Service, Seattle, Washington

Table 3. 1973 Chehalis River study area seine catches in numbers of fish.

Food fish and game fish	3/5	3/19	4/2	4/16	4/30	5/14	5/28	6/11	6/25	7/9	7/23	8/6	8/20	9/3	9/18	10/1
Number of hauls	11	14	15	12	10	11	12	12	10	12	12	12	12	10	10	10
American shad - 0+ age class												59		81	27	
Chum salmon - 0+ age class	9	17	148	57	3											
Coho salmon - 0+ age class		4	5			1										
- 1+ age class		16	10	333	44	17	7		2							
Chinook salmon - 0+ age class	8	31	177	683	858	1,010	695	194	46	3						
Mountain whitefish[1/]	25	30	1	11			22	15	28	17		30	3	1	12	14
Cutthroat trout (adults)			1													
Trout (*Salmo* spp.)- 0+ age class[2/]							47	160	144	158	153	83		21	13	
- 1+ & 2+ age class[2/]	5	2	3	33	8	4	2	21	3	1	2	3				17
Dolly Varden		1														
Largemouth bass														3		
Yellow perch											1					
White crappie															1	
Other fish																
Peamouth					4	3	1	1	2	2	abund.	abund.		1		16
Northern squawfish			1	8	16	87	8	43	abund.	14	41	abund.	17	5	abund.	abund.
Dace (*Rhinichthys* spp.)	11		3	1	6	94	2	abund.	abund.	abund.	abund.	abund.	abund.	abund.		abund.
Longnose dace														6	18	3
Speckled dace														13	39	1
Redsided shiners		4	43	622	abund.	abund.	36	18	4	17	abund.	abund.	abund.	abund.	abund.	abund.
Largescale sucker	2	9		7		24			11	1	abund.			1	16	13
Threespine stickleback				66	173	abund.	abund.	193	35	abund.	abund.	abund.		abund.	24	
Sculpins (*Cottus* spp.)	7							3	abund.	abund.	abund.					
Coastrange sculpin		6	8	37	8	5	4	1		28			18	abund.	26	44
Torrent sculpin		12	28	2	6	6	3	5	1				9	1	6	

1/ Includes juveniles and adults.

2/ Includes steelhead and cutthroat trout.

Table 7. 1973 Grays Harbor estuary study area seine catches in numbers of fish.

	Date														
	3/4	3/23	4/6	4/20	5/4	5/18	6/1	6/15	6/29	7/13	7/27	8/10	8/24	9/11	9/25
	Number of hauls														
Food fish and game fish	8	9	8	7	9	8	7	8	8	10	9	8	6	7	8
American shad			1												
Pacific herring							176		157			122	12	4	
Northern anchovy						200			7		14	5		2	1
Chum salmon	835	1,167	1,276	618	54	1									
Coho salmon - 0+ age class			1							1					
- 1+ age class			1	3	55	18		1							
Chinook salmon - 0+ age class	1	2	4	1	7		19	52	105	62	52	71	7	5	4
- 0+ age class (marked)			1						14	4					
- 1+ age class		1	1							1					
- 1+ age class (marked)			1												
Trout (*Salmo* spp.) - 0+ age class[1/]										1					
- 1+ & 2+ age class[1/]				2		2			4						
Cutthroat trout				3	1	2		1	4	3					
Steelhead trout					1										
Dolly Varden	1														
Juvenile smelt (*Hypomesus pretiosus*) (*Spirinchus dilatus*)	6	1	2	54							6	40			
Pacific cod							2						1	4	2
Pacific sanddab	2	3	1	28	1										
Juvenile flatfishes	8		237	10	2/										
English sole	3	2			2/		(450)			(75[3/])		(500)	(100)	(100)	(350)
Starry flounder	70	48	137	12	abund.	(642)	(300)	(50)	(50)			(100)	(50)	(150)	(100)
Sand sole						abund.	(350)	(1,600)	(1,200)	(50[3/])	(600)	(400)	(200)	(200)	(100)
Other fish															
Peamouth		1													
Threespine stickleback	30	1	32	176	abund.	abund.	abund.	600	abund.	(750[3/])	abund.	(800)	(600)	abund.	(850)
Shiner perch					abund.	abund.	(600)	abund.	abund.	abund.[3/]	abund.	(450)	(800)	(600)	abund.
Snake prickleback					3	(550)	(200)	(300)	(150)	4[3/]	10	(100)	(100)	(100)	(50)
Unident. gunnels (*Pholis* spp.)				13											
Crescent gunnel			1												1
Saddleback gunnel			2												2
Pacific sand lance		1													
Pacific staghorn sculpin	170	abund.	712	340	abund.	abund.	abund.	(1000)	(750)	(250[3/])	(900)	(350)	(250)	(600)	(550)
Dungeness crab	55	5	1,223	17	(1700)	(1200)	(2400)	(2700)	(1400)	16[3/]	(800)	(450)	(250)	(200)	41

1/ Includes steelhead and cutthroat trout.
2/ Present but no estimate available.
3/ Data from two hauls only.

Data Summary Report
Coastal Investigations

1974 DATA REPORT OF JUVENILE SALMONID SEINING IN GRAYS HARBOR AND TRIBUTARY RIVERS AND ELECTRO-FISHING AND BEACH SEINING IN THE CHEHALIS RIVER IN THE VICINITY OF WASHINGTON PUBLIC POWER SUPPLY SYSTEM'S PROJECT NOS. 3 and 5

State of Washington
DEPARTMENT OF FISHERIES
Management and Research Division

Richard Brix
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November 1974

This study was financed through Contract No. E-10221 with Ebasco Services, Incorporated, New York, N.Y.

Table 7. 1974 Grays Harbor estuary study area seine catches in numbers of fish.

	Date														
	3/8	3/22	4/5	4/22	5/6	5/20	6/3	6/17	7/1	7/14	8/1	8/16	8/30	9/13	9/30
	Number of hauls														
Foodfish and gamefish	5	5	6	5	6	6	4	6	6	6	5	5	5	3	5
American shad	1														
Pacific herring												21	330		2
Northern achovy												21			
Chum salmon															
- 0+ age class	58	1,266	383	3,006	215	319	5	1							
Coho salmon															
- 0+ age class			1	1	3	1									
- 1+ age class			1	7	21	193	7								
- 1+ age class (marked)						8									
Chinook salmon															
- 0+ age class	9	4	2	19	37	153	387	87	106	321	102	31	22	15	12
Trout (*Salmo* spp.)															
- 0+ age class[1/]							3								
Cutthroat trout			1	4	3	5									
Dolly Varden						1			1	1					
Juvenile smelt															
(*Hypomesus pretiosus*)															
(*Spirinchus dilatus*)	1	70	6	145			61	230	7	3	94	83	21		2
English sole					16		105	70	129	114	41	85	123	35	3
Sand sole					41	7	22	11	230	41	34	91	83	31	139
Starry flounder	115	abun.	122	120	310	14	150	49	132	47	74	70	165	47	87
Other fish															
Pacific lamprey							1					3			
Peamouth	1		6				abun.								
Threespine stickleback		abun.	85		abun.	abun.	abun.	104	137	abun.	122	abun.	abun.	75	168
Shiner perch					23		165	112	71	abun.	abun.	abun.	abun.	75	195
Snake prickleback							9	2	55	65	4	302	64	2	
Saddleback gunnel	1												4	2	8
Pacific staghorn sculpin	20	abun.	110	abun.	abun.	abun.	abun.	abun.	71	155	136	132	abun.	80	106
Dungeness crab				7	38		12	4	24	33	79	abun.	63	5	6

1/ Includes steelhead and cutthroat trout.

State of Washington
DEPARTMENT OF FISHERIES

PROGRESS REPORT NO. 141

DATA REPORT OF GRAYS HARBOR JUVENILE SALMON SEINING PROGRAM, 1973-1980

Richard Brix
Fish Biologist

July 1981

App. Table V - 5. 1977 Grays Harbor Estuary Seine Data

Stat. Week #	Date	Temp. (°C)	# Hauls	Lin. Meters	Total Square Meters	Chinook	Coho 1	Coho 0	Chum	Rb 2	Rb 1	Cutt 2	Cutt 1	Trout 0
11	3/18 1/		3	247	2,132	1			442					
13	4/4	8.9	4	475	3,353	8			543					
15	4/18 1/		4	384	2,349	3		2	865					
17	5/2 1/		4	430	3,762	5	5		11	2	2	3		
19	5/16		4	375	3,177	80	77		2			1		
21	5/31		3	342	2,429	300	258	1				3		
23	6/15 1/		5	338	2,312	386	7					1		
25	6/30		5	411	2,007	183	1							
27	7/15		4	402	2,926	222						1		

1/ One dolly varden.

FRI-UW-8116
August 1981

JUVENILE SALMONID AND BAITFISH DISTRIBUTION, ABUNDANCE, AND PREY RESOURCES IN SELECTED AREAS OF GRAYS HARBOR, WASHINGTON

Edited by:

Charles A. Simenstad and Douglas M. Eggers

Fisheries Research Institute
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Final Report to
Seattle District, U.S. Army Corps of Engineers
Contract No. DACW 67-80-C-0102
August 1981

Approved

Submitted August 31, 1981

Robert L. Burgner
Director

3.3.4 Steelhead Trout: A total of 11 steelhead trout, ranging in size between 135 and 384 mm FL, were captured between May 12 and July 25 at the five sites from Cosmopolis to Westport (Table 3-2). Six of the 11 (55%) were captured during beach seine sampling. Those steelhead 135-227 mm FL were probably age 2+ outmigrant smolts, while the two larger fish (337 and 384 mm FL) were probably returning after a year in the ocean. No scales were read to verify this interpretation, however.

3.3.5 Cutthroat Trout: Two cutthroat trout, measuring 164 mm and 196 mm FL were caught during beach seine sampling at Cow Point and Moon Island during the sampling week of July 7-11. These apparently were age 1+ outmigrant smolts.

3.3.6 Dolly Varden: Two Dolly Varden, measuring 550 mm and 440 mm FL, were caught during beach seine sampling at Cow Point and Stearn's Bluff during March. These appeared to be "sea-run" adults.

3.4 Discussion

3.4.1 Patterns and Rates of Migration through Grays Harbor: Figure 3-12 summarizes periods of outmigration of juvenile salmonids in Grays Harbor as documented during the March-October 1980 sampling and, although confirming mark-recapture data is not available, this best illustrates the availability of juvenile salmonids in Grays Harbor during this period. Juvenile chum salmon migrated first, probably beginning in January (Washington State Dep. Ecology 1971), reached greatest abundance in March and April and departed the estuary in early May. Juvenile coho and fall chinook both entered the estuary in mid-April. While the coho outmigration reached an abundance maximum in May and terminated in June, the chinook outmigration did not reach a maximum until June and a portion of the population ("Type III" fish; Reimers 1973) appeared to remain within the estuary through October while the remainder ("Type II" fish) migrated out of Grays Harbor. Steelhead

FRI-UW-8117
September 1981

JUVENILE SALMONID AND BAITFISH DISTRIBUTIONS, ABUNDANCE, AND PREY RESOURCES IN SELECTED AREAS OF GRAYS HARBOR, WASHINGTON -- APPENDICES

by

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Final Report to
Seattle District, U.S. Army Corps of Engineers
Contract No. DACW 67-80-C-0102
September 1981

Approved

Submitted Sept. [illegible], 1981

Roy E. Nakatani
Acting for the Director

Appendix Table 1-1. Occurrence of fish species caught at six sites in Grays Harbor, Washington with beach seine (BS) and purse seine (PS), March-October 1980.

Species, common name	Gear	Life history stage: Adult	Juvenile	Larvae	Sand Island	Cosmopolis	Cow Point	Moon Island	Stearn's Bluff	Westport
PETROMYZONTIDAE - LAMPREYS										
Lampetra ayresi, river lamprey	PS	x	x				x	x		
CLUPEIDAE - HERRINGS										
Alosa sapidissima, American shad	PS,BS	x	x		x	x	x	x	x	
Clupea harengus pallasi, Pacific herring	PS,BS	x	x	x	x	x	x	x	x	x
ENGRAULIDAE - ANCHOVIES										
Engraulis mordax, Northern anchovy	PS,BS	x	x	x		x	x	x	x	x
SALMONIDAE - TROUTS										
Oncorhynchus keta, chum salmon	PS,BS		x		x	x	x	x	x	x
O. kisutch, coho salmon	PS,BS		x		x	x	x	x	x	x
O. tshawytscha, chinook salmon	PS,BS		x		x	x	x	x	x	x
Salmo gairdneri, rainbow (steelhead) trout	PS,BS		x			x	x	x	x	x
Salvelinus malma, Dolly Varden	BS	x					x			
OSMERIDAE - SMELTS	PS,BS		x	x		x	x	x	x	x
Allosmerus elongatus, whitebait smelt	PS	x	x					x		
Hypomesus pretiousus, surf smelt	PS,BS	x	x	x		x	x	x	x	x
Spirinchus thaleichthys, longfin smelt	PS	x	x	x		x	x	x	x	x
CYPRINIDAE - CARPS AND MINNOWS										
Mylocheilus caurinus, peamouth	PS,BS	x	x		x	x	x	x		
Ptychocheilus oregnonensis, northern squawfish	PS,BS	x				x				
Richardsonius balteatus, redside shiner	BS	x			x					
CATOSTOMIDAE - SUCKERS										
Catostomus sp., sucker	BS		x		x					
GADIDAE - CODFISHES										
Microgadus proximus, Pacific tomcod	PS,BS		x					x	x	x
ZOARCIDAE - EELPOUTS	PS		x					x		
ATHERINIDAE - SILVERSIDES										
Atherinops affinis, topsmelt	BS	x								x
GASTEROSTEIDAE - STICKLEBACKS										
Gasterosteus aculeatus, threespine stickleback	PS,BS	x	x		x	x	x	x	x	x
SYNGNATHIDAE - PIPEFISHES										
Syngnathus leptorhynchus, bay pipefish	PS,BS	x	x				x	x	x	
EMBLOTOCIDAE - SURFPERCHES										
Cymatogaster aggregata, shiner perch	PS,BS	x	x		x	x	x	x	x	x
Embiotoca lateralis, striped seaperch	BS	x	x						x	x
Hyperprosopon argenteum, walleye surfperch	BS		x					x	x	x
H. ellipticum, silver surfperch	BS		x							x
Phanerodon furcatus, white seaperch	PS,BS		x						x	x
Rhacochilus vacca, pile perch	BS		x	x			x		x	x

DECADAL DEVELOPMENT OF A CREATED SLOUGH IN THE CHEHALIS RIVER ESTUARY: YEAR 2000 RESULTS

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Report to U.S. Army Corps of Engineers
Seattle District

April 2001

Table 3 Fish species occurring in reference (R) and created (C) estuarine sloughs in Chehalis River estuary, Grays Harbor, Washington, 1990-2000; relative occurrence: A = abundant, C = common, I = infrequent (but often abundant when occurring), and R = rare (and not abundant). Asterisks indicate introduced species. LH = life history distribution: an = anadromous, e = estuarine, fw = freshwater, m = marine.

	1990	1991		1992		1995		2000		LH
Species	R	R	C	R	C	R	C	R	C	
American shad, *Alosa sapidissima**			R							an
chum salmon, *Oncorhynchus keta*	R			C	C	A	A	A	A	an
coho salmon, *Oncorhynchus kisutch*	A	A	A	C	A	C	A	A	A	an
chinook salmon *Oncorhynchus tshawytscha*	A	A	A	A	A	A	A	A	A	an
steelhead trout, *Oncorhynchus mykiss*		C				I	I	R		an
native charr, *Salvelinus* spp.[4]									R	an?
surf smelt, *Hypomesus pretiosus*	C	C	R			I	R		I	e
longfin smelt, *Spirinchus thaleichthys*		R							I	an
eulachon, *Thaleichthys pacificus*	R					R				an
peamouth chub, *Mylocheilus caurinus*	A	A	A	A	A	A	A	A	A	fw
largescale sucker, *Catostomus macrocheilus*	R	R	C			R	R	C	C	fw
northern pikeminnow (squawfish), *Ptychocheilus oregonensis*	R									fw
redside shiner, *Richardsonius balteatus*	R									fw
threespine stickleback, *Gasterosteus aculeatus*	A	A	A	A	A	A	A	A	A	fw-m
bluegill, *Lepomis macrochirus**		R	R					R		fw
shiner perch, *Cymatogaster aggregata*		A	C	A	C	A	C	A	A	e
yellow perch, *Perca flavescens*	R	R								fw
prickly sculpin, *Cottus asper*	A	A	A	C	I	C	C	C	A	fw-e
Pacific staghorn sculpin *Leptocottus armatus*		A	I	C	I	C	R	A	A	e-m
saddleback gunnel, *Pholis ornata*		R				R				m
snake prickleback, *Lumpenus saggitta*		I		I		R			R	e-m
starry flounder, *Platichthys stellatus*		I	R	I		C	R	I	C	e-m
English sole, *Pleuronectes vetulus*									R	e-m
Total Species Richness	12	20	12	10	8	15	12	12	15	

[4] Because we released this fish, we had no feasible means (e.g., genetic) to determine whether it was Dolly Varden, *Salvelinus malma*, or bull trout, *Salvelinus confluentus*, both of which likely occur in coastal Washington watersheds.

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Appendix B

2001 – 2004 Site Photographs

Figure B-1. Native char beach seine survey Site 1, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-2. Native char beach seine survey Site 1, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-3. Native char beach seine survey Site 2, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-4. Native char beach seine survey Site 2, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-5. Native char beach seine survey Site 3, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-6. Native char beach seine survey Site 3, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-7. Native char beach seine survey Site 4, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-8. Native char beach seine survey Site 4, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-9. Native char beach seine survey Site 5, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-10. Native char beach seine survey Site 5, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-11. Native char beach seine survey Site 6, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-12. Native char beach seine survey Site 6, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-13. Native char beach seine survey Site 7, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-14. Native char beach seine survey Site 7, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-15. Native char beach seine survey Site 8, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-16. Native char beach seine survey Site 8, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-17. Native char beach seine survey Site 9, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-18. Native char beach seine survey Site 9, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-19. Native char beach seine survey Site 10/11, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-20. Native char beach seine survey Site 10/11, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-21. Native char beach seine survey Site 12, high tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Figure B-22. Native char beach seine survey Site 12, low tide, lower Chehalis River/Grays Harbor, Aberdeen, Washington, 2001-2002.

Native Char Utilization
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Appendix C

Grays Harbor Native Char
A Literature Review

Report Prepared for
U.S. Army Corps of Engineers, Seattle District
by
HDR Inc.
Bellevue, Washington

GRAYS HARBOR NATIVE CHAR

A LITERATURE REVIEW

1.0 INTRODUCTION

The Grays Harbor federal navigation channel starts in the ocean and continues through Grays Harbor to the Chehalis River near the city of Aberdeen in Grays Harbor County, Washington. The navigation channel is about 23.5 miles long (covering about 1,300 acres) and is broken up into 11 reaches. The U. S. Army Corps of Engineers (Corps) dredges annually to maintain the channel's dimensions. The work usually involves dredging selected areas that have developed shoals as well as maintaining turning basins. The upstream reaches are within the river's thalwag near the mouth of the river. These reaches, especially the turning basins, often require more extensive dredging to meet the target channel dimension because they more easily accumulate the river's bedload.

Concern has been expressed by the U. S. Fish and Wildlife Service (USFWS) that maintenance of this project may impact native char (*Salvelinus confluentus and S. malma*). Specifically the USFWS believes that channel maintenance dredging could exclude fish from their habitat by the reduced water quality associated with the dredging plume and also result in the loss of benthic and fish resources by disturbing the river or estuary bottom. In order to address these concerns, the Corps has agreed to implement several "conservation measures" to minimize any potential impacts to native char.

One of the conservation measures was conducting an in-depth literature search regarding the occurrence of native char in Grays Harbor and to assess the need for a monitoring program for Grays Harbor native char. This paper reports the results of that review supplemented by interviews with U. S. Forest Service, Washington Department of Fish and Wildlife and Grays Harbor Community College researchers that have conducted field studies over the past 35 years in the Chehalis and adjacent basins.

2.0 LIFE HISTORY OF NATIVE CHAR

Compared to other salmonids, native char have more specific habitat requirements (Reiman and McIntyre 1993) that appear to influence their distribution and abundance. Critical parameters include water temperature, cover, channel form and stability, valley form, spawning substrates, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Rieman and McIntyre 1993). Water temperature is especially critical. Water temperatures in excess of 15ºC (59ºF) are thought to limit native char distribution (Fraley and Shepard 1989).

All life history stages of native char are associated with complex forms of cover, including large woody debris, undercut banks, boulder and pools (Oliver 1979; Fraley and Shepard 1989; Goetz 1989). Juvenile and adult native char frequently inhabit side channels, stream margins and pools with suitable cover (Sexauer and James 1997).

Preferred spawning habitat consists of low gradient streams with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9ºC (41-48ºF) in late summer to early fall (Goetz 1989). For the coastal subpopulations of native char, Martin and McConnell (1999) suggest that native char will only be located in streams with a glacial source ensuring that water temperatures will be maintained within their tolerance limits.

Native char typically spawn from August to September during periods of decreasing water temperatures. Migratory native char frequently begin spawning migrations as early as April and have been know to move upstream as far as 250 km (155 miles) to spawning grounds. For successful spawning and egg incubation, native char require very cold water with spawning occurring in the early fall of the year as the temperatures drop below 48°F (9°C) and the successful incubation of the eggs requires temperatures below 40°F (5ºC). In this region, the downstream limit of successful spawning is always upstream of the winter snow line (Kraemer 1999). For successful spawning to occur, reaches in the headwaters of the basin would be used.

Brown (1992) noted that there are four life forms of native char, each exhibiting a specific behavioral or life history pattern. The adfluvial form matures in lakes or reservoirs and spawns in tributaries where juveniles rear for one to three years (Fraley and Shepard 1989; Holton 1990). Fluvial native char stocks have a similar life history except that they move between mainstem rivers and smaller tributaries. Bull trout are anadromous in coastal and Puget Sound drainages but to a lesser degree than Dolly Varden (Leary and Allendorf 1996; Haas and McPhail 1991). Individuals of these three migratory forms often make extensive

migrations (Fraley and Shepard 1989; Holton 1990). Anadromous individuals will migrate between basins (Kraemer 1999).

A good example of native char life history is the Skagit River subpopulations. The Skagit River supports the largest population of native char in Puget Sound. Native char spawn in most if not all of the accessible upriver areas in the drainage. Anadromous, fluvial, adfluvial and resident fish all exist in the watershed and, in many cases, overlap geographically (WDFW 1998).

Life histories of the stocks in the Skagit, in the areas accessible to anadromous and non-anadromous fish are complex. Spawning occurs in the upriver areas as water temperatures decrease to around 8ºC. In many cases, fluvial, anadromous, and resident adults spawn in the same areas. After spawning, while resident adults remain in the area, fluvial adults move throughout the upper river area and remain in pools throughout the winter, spring and early summer. They return to their spawning staging areas in late summer. Anadromous adults, after spawning, begin the downriver migration from late fall through the winter and enter the estuary area in the spring. They remain in the estuary until early to mid-summer to begin the upriver spawning run again. Anadromous native char migrate as smolts in the spring, return to the lower river in the fall, overwinter in the lower river, then move to the estuary in late winter and early spring (WDFW 1998).

The migratory forms of native char are generally of the most concern throughout their southern and inland range. Stream resident native char spend their entire lives in smaller, high elevation streams, apparently moving little and seldom reaching a size of over 300 mm (12 inches)(Brown 1992). Size ranges for stream-resident native char populations in Oregon and Washington are usually form 115 to 300 mm (Goetz 1989). These size ranges are important when determining the origin of native char captured in estuaries and/or the lower reaches of streams and rivers. Native char captured throughout Grays Harbor and in the lower Chehalis Rivers, for example, generally exceed 457 mm (WDFW 1998) suggesting that they are anadromous.

3.0 NATIVE CHAR IN THE GRAYS HARBOR WATERSHED

The Coastal-Puget Sound native char segment encompasses all Pacific coast drainages within Washington, including Puget Sound. No native char exist in coastal drainages south of the Columbia River. Ten native char subpopulations occur in five river basins in the Coastal analysis area: Subpopulations include Coastal Plains-Quinault River (5), Queets River (1),

Hoh River-Goodman Creek (2) and Quillayute River (1). One subpopulation has been identified for the Chehalis River (Federal Register 1999), although there is insufficient information to assign stock status with confidence (WDFW 1998).

Subpopulations of native char in the southwestern portion of the coastal area appear to be in low abundance. Linth (2001), McConnell (2001), Samuelson (2001) and Mongillo (1993) indicate that the information on the presence of a native char subpopulation in Grays Harbor or the Chehalis River is largely anecdotal and that no hard evidence exists to suggest that such a subpopulation exists. There is insufficient information to assign stock status with confidence (Mongillo 1993; WDFW 1998). Because this is the southern extent of coastal bull trout and Dolly Varden (native char), abundance may be naturally low in systems like the Chehalis, Moclips and Copalis Rivers (WDFW 1998). It should also be noted that the Willapa River, the next river to the south, has no native char (COE 2001).

There is a general paucity of information relating to native char in the Chehalis River and Grays Harbor estuary. Although the literature suggests that a subpopulation of native char is found in this area, confirming data are limited (Brix 1974; Brix and Seiler 1977, 1978; Mongillo 1993; Seiler 2001; Linth 2001; McConnell 2001; WDFW 1998; Samuelson 2001).

Seiler (2001) stated that during seining studies conducted in the "mid-70s" along the shoreline of Moon Island (near the Hoquiam Airport), they "routinely caught Dolly Varden". (Bull trout were not recognized as a species until later.) Brix (1974) reported the results of seining surveys on the Chehalis, Satsop, Wynoochee and Humptulips Rivers and in the Grays Harbor estuary. Two fish, identified as Dolly Varden (Salvelinus malma) were captured. One fish was captured from a sampling location near Oakville in the Chehalis River and one was collected at Moon Island in the estuary. Brix (1981) reported capturing a single Dolly Varden on three separate occasions (March, May and June) in the Grays Harbor estuary in 1977. No other Dolly Varden were reported captured in seining efforts between 1973 and 1980. Unfortunately, lengths were not recorded in these studies.

Brix and Seiler (1977, 1978) collected downstream salmonid migrants in the upper Chehalis River at RM50 to evaluate coho production. Four different species of salmonids were collected during the two years of study. It was determined that the trapping effort collected 10% of all downstream migrants. No Dolly Varden were collected.

For the last several years, WDFW has operated smolt traps during the spring of the year in the lower Skagit River near the town of Burlington in order to enumerate migrating juvenile

salmon smolts. During this sampling effort, native char smolts were captured and released as incidental catch. By assuming that trap efficiency is at a lower level (50%) than that measured for coho, a rough estimate for native char smolt out-migration since 1990 was computed. This would probably be a minimum estimate since capture avoidance would be greater because native char migrate at a larger size and probably use lower areas in the water column during migration that coho. Estimates ranged from a low of 14,490 in 1997 to a high of 48,965 in 1994 (WDFW 1998). Thus, it would seem that if native char are present in the basin, trapping efforts for other salmonids would have successfully collected native char.

Native char have been caught in the anadromous zone of the Chehalis River in the spring and fall. Most of the fish collected were 457 mm or larger (WDFW 1998; McConnell 2001) suggesting that these fish are anadromous. These fish appear to be single in or out migrants and could be native to other coastal streams (McConnell 2001).

In recent years, there have been even fewer reports of incidental catches of native char in the Chehalis River Basin. In 1997, a single juvenile native char was captured in a downstream migrant trap on the mainstem of the Chehalis River (WDFW 1998). Samuelson (2001) has been sampling in the Grays Harbor estuary, in the lower Chehalis River and in overwintering side channels in the Wynoochee for the past 10 years and has not yet captured a native char.

Although little historical and current information is known concerning native char in these river basins, habitat degradation caused by farming, logging, water diversions, dams, grazing, roads and mining in the past has adversely affected other salmonids (WDFW 1998). Habitat degradation in these basins is assumed to have similarly affected native char (Federal Register 1999).

Water quality in the Chehalis River is impacted by pulp mills in the lower river which produce effluents that vary from benign to lethal over a period as short as one day. Logging, agriculture and grazing in the Chehalis Basin degrade habitat by removing riparian vegetation, increasing silt loads and decreasing large woody debris. The basin has a relatively low gradient that is not ideal for native char (WDFW 1998).

Water temperature could be limiting, forcing native char spawning to be at higher elevations as they move south. As noted above, water temperature above 15ºC is believed to limit native char distribution (Fraley and Shepard 1989) with preferred spawning temperatures to be below 9ºC (48ºF). Washington Department of Ecology Water Quality Monitoring Stations throughout the Chehalis River basin indicates that as far upstream as RM 101

temperatures exceed 15ºC for the summer and early fall months (the preferred time for spawning) and did not reach 9ºC until November (WDOE 2001). Temperature may be a limiting factor in the successful spawning and rearing of native char within the basin. Thus, bull trout populations are small (COE 2001).

Native char have not been documented in the East or West Forks of the Humptulips (Martin and McConnell 1999). There is one anecdotal report of a single Dolly Varden being caught near Stevens Creek (about 5.5 miles downstream of the confluence of the east and west forks). However, there is general agreement that the Humptulips River watershed is not likely to support native char populations. According to Martin and McConnell (1999), two primary reasons support this conclusion: (1) other north coast stocks are only reported in rivers with a glacial source (e.g. Queets and Quinault Rivers) and the Humptulips does not a glacial source and (2) native char are generally easy to catch (given the proper tackle), yet there is no documentation of historical or current presence in the watershed. In other rivers, adults are seen holding in pools and are easily caught by anglers. This is not the case in either the Humptulips or Chehalis Rivers (McConnell 2001). Seining efforts in the Wynoochee, Satsop, Skookumchuck, Newaukum and Wishkah Rivers between 1973 and 1980 did not collect a single native char (Brix 1981) suggesting that these rivers also do not likely support native char populations.

The Queets and Quinault Rivers support subpopulations of bull trout (WDFW 1998). All four life forms occur in these rivers (McConnell 2001). Some anadromous life forms may migrate from these rivers into Grays Harbor and perhaps into the rivers. These appear to be single fish or small groups of fish that are not local and do not spawn locally (McConnell 2001).

The US Forest Service has conducted summertime and fall spawning ground surveys for a number of years in the Humptulips, Wynochee and Quinault Rivers. If native char were in the rivers in any number they would have been observed. In other rivers, adults are seen holding in pools and are easily caught by anglers (given the proper tackle). This is not the case in the Humptulips or Chehalis Rivers (McConnell 2001).

Further, as suggested by data from the Skagit River, if a subpopulation does exist (in the Chehalis River), smolt traps used for coho enumeration would capture more outmigrants than have been reported. Similarly, seining efforts by Samuelson (2001) over the past 10 years in the estuary, Chehalis and Wynoochee Rivers have not been successful in collecting a single bull trout.

4.0 CONCLUSIONS REGARDING NEW FOR A MONITORING PROGRAM

In the final rule for determination of bull trout as a threatened species, it was noted that ten native char (bull trout) subpopulations occur in five river basins in the Olympic Peninsula/Coastal area of their range. One of these subpopulations is reported to occur in the Chehalis River/Grays Harbor basin (USFWS 1999). Mongillo (1993) stated that there is no information on the population of native char in the Chehalis River other than they are known to exist. Samuelson (2001) has monitored sites in the estuary, in the Chehalis and Wynoochee Rivers and in Grays Harbor for the past 10 years and has not captured a native char.

Monitoring for native char and other salmonid species has been on-going in the estuary and the rivers draining into the estuary for 30 years with the result that very few specimens have been collected. The lack of data indicating the presence of native char would not seem to warrant a sampling or monitoring program for this species. The on-going work by the U. S. Forest Service and Grays Harbor Community College will continue to provide insight into this species. The consensus among these researchers is that although native char may exist in the watershed, there is no evidence to confirm their presence. Thus, establishment of a monitoring program for Grays Harbor native char is not recommended.

5.0 SUMMARY

Very little data exists regarding the presence (or absence) of native char in Grays Harbor and the Humptulips, Hoquiam, Wishkah, and Chehalis Rivers. Single fish have been captured above the anadromous zone of the Chehalis River or in the estuary on only two occasions: at RM 50 in 1997 (WDFW 1998) and near Oakville in 1973 (Brix 1974).

Martin and McConnell (1999) suggest that subpopulations are located only in watersheds with a glacial source. None of the Grays Harbor coastal rivers have such a source. Temperatures in each of these coastal rivers exceed 15ºC (59ºF) during the summer months and temperatures remain above 9ºC (48ºF) until November (WDOE 2001), thus likely limiting habitat available for native char. Further, native char have not been observed in these rivers nor have they been caught by fishers. Thus, it would appear that the native char that have been taken in Grays Harbor are anadromous and are a subpopulation from a different watershed, most likely the Queets or Quinault Rivers.

Thus establishing a formal monitoring program for this Grays Harbor native char is not recommended.

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Appendix D

Native Char Scales

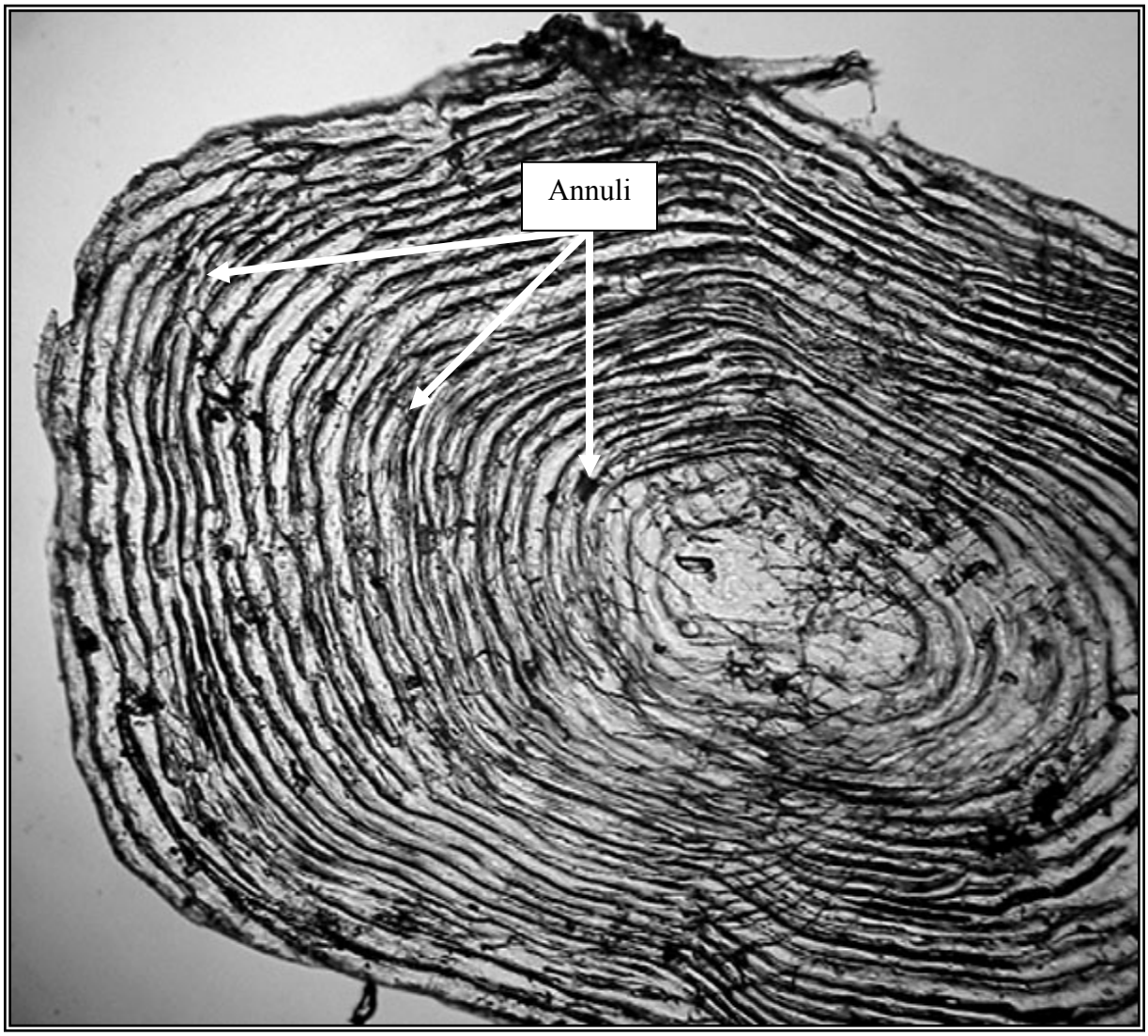

Figure D-1. Scale sample from Char No. 16 (FL=242 mm; age-3+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

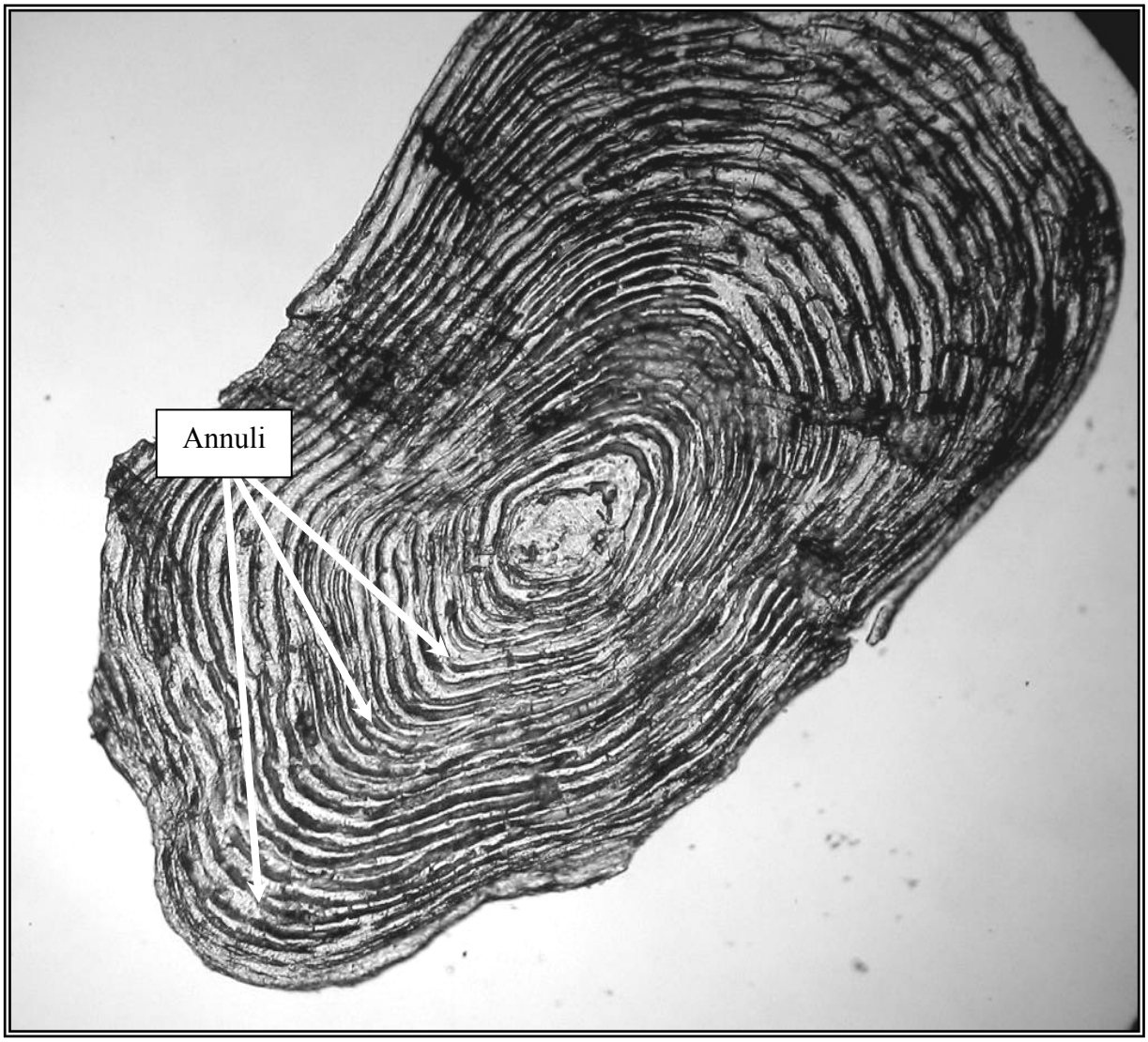

Figure D-2. Scale sample from Char No. 17 (FL=326 mm; age-3+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

Figure D-3. Scale sample from Char No. 18 (FL=224 mm; age-3+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

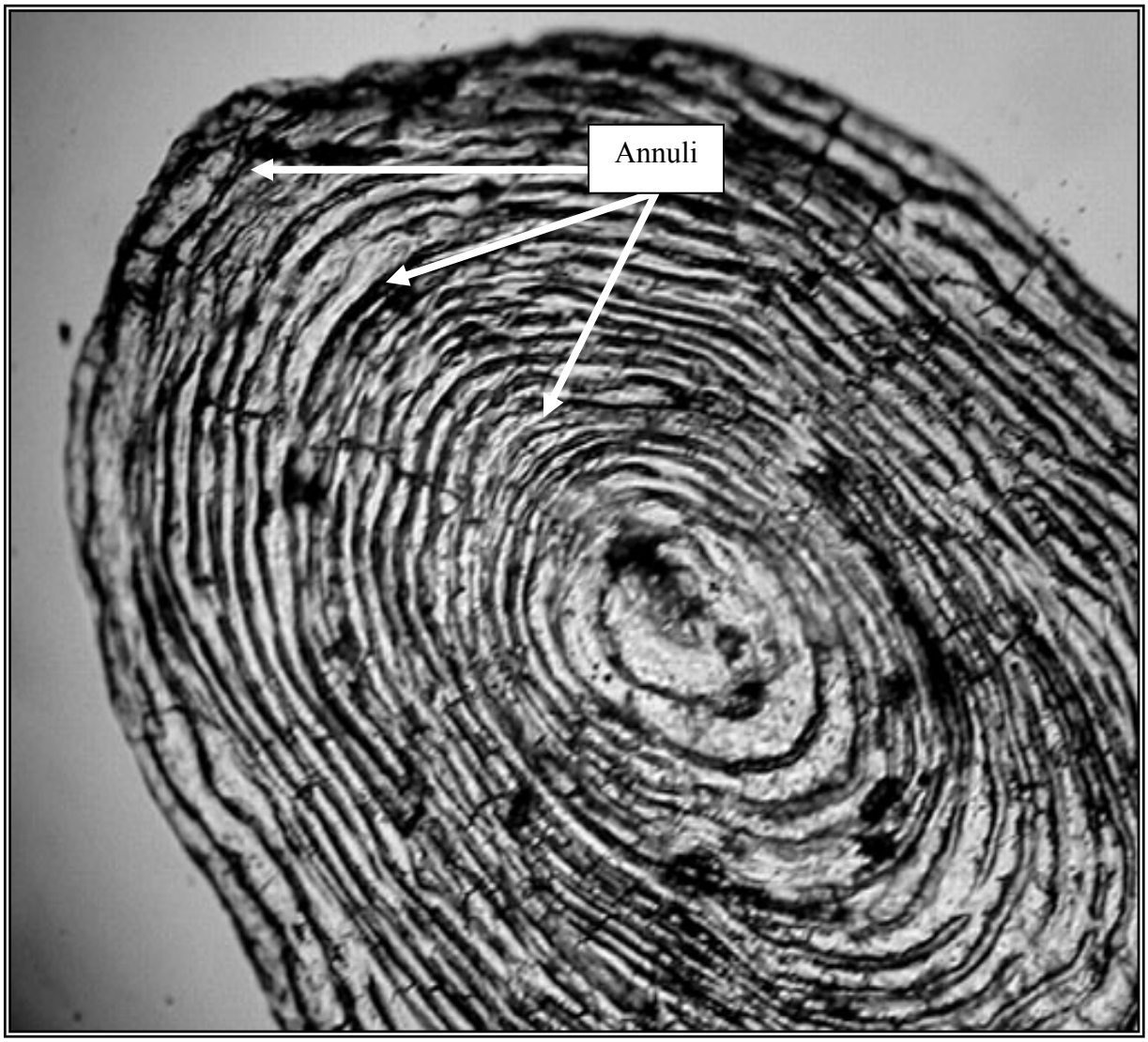

Figure D-4. Scale sample from Char No. 19 (FL=296 mm; age-3+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

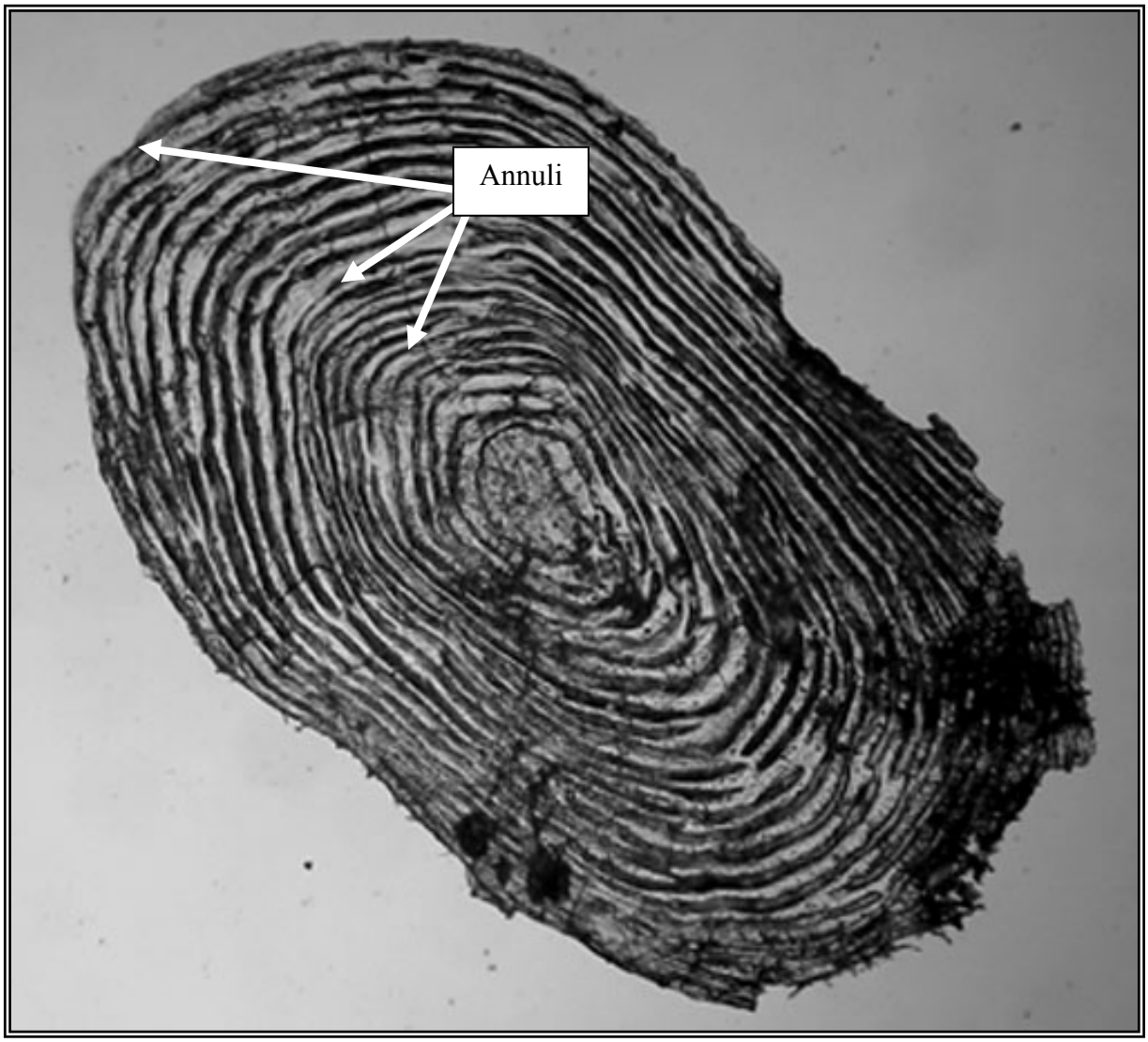

Figure D-5. Scale sample from Char No. 20 (FL=231 mm; age-3+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

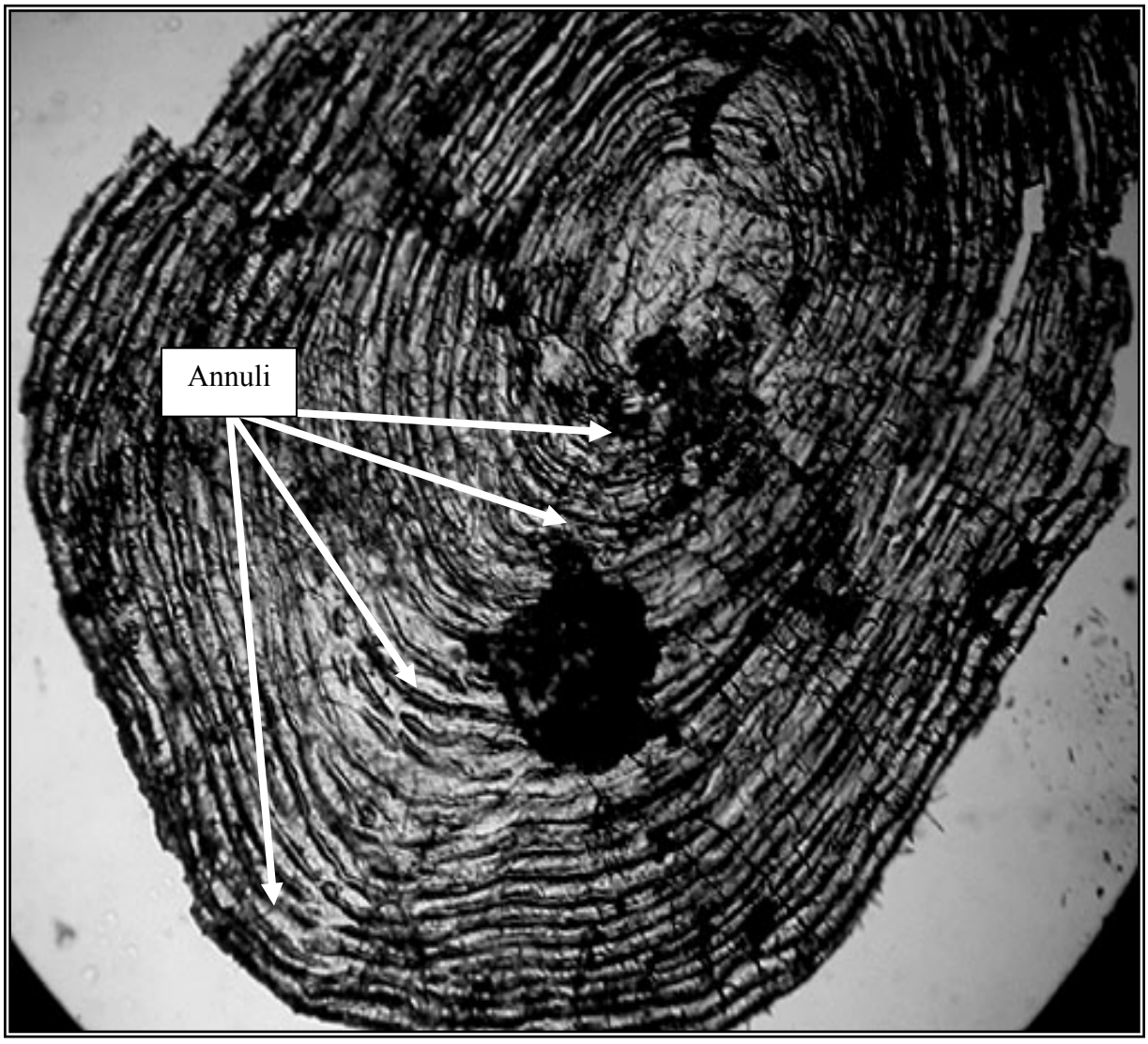

Figure D-6. Scale sample from Char No. 21 (FL=372 mm; age-4+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

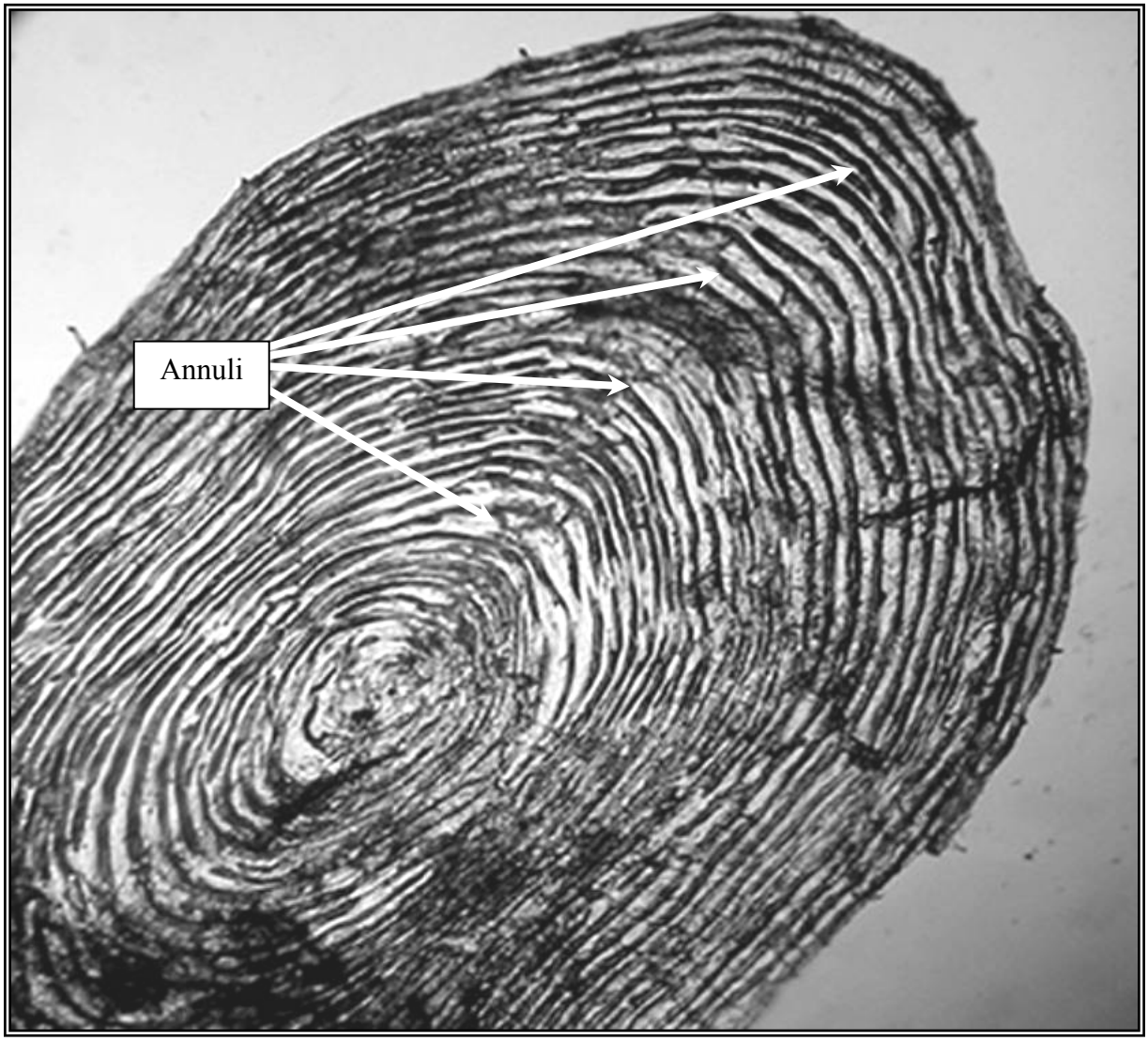

Figure D-7. Scale sample from Char No. 22 (FL=388 mm; age-4+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

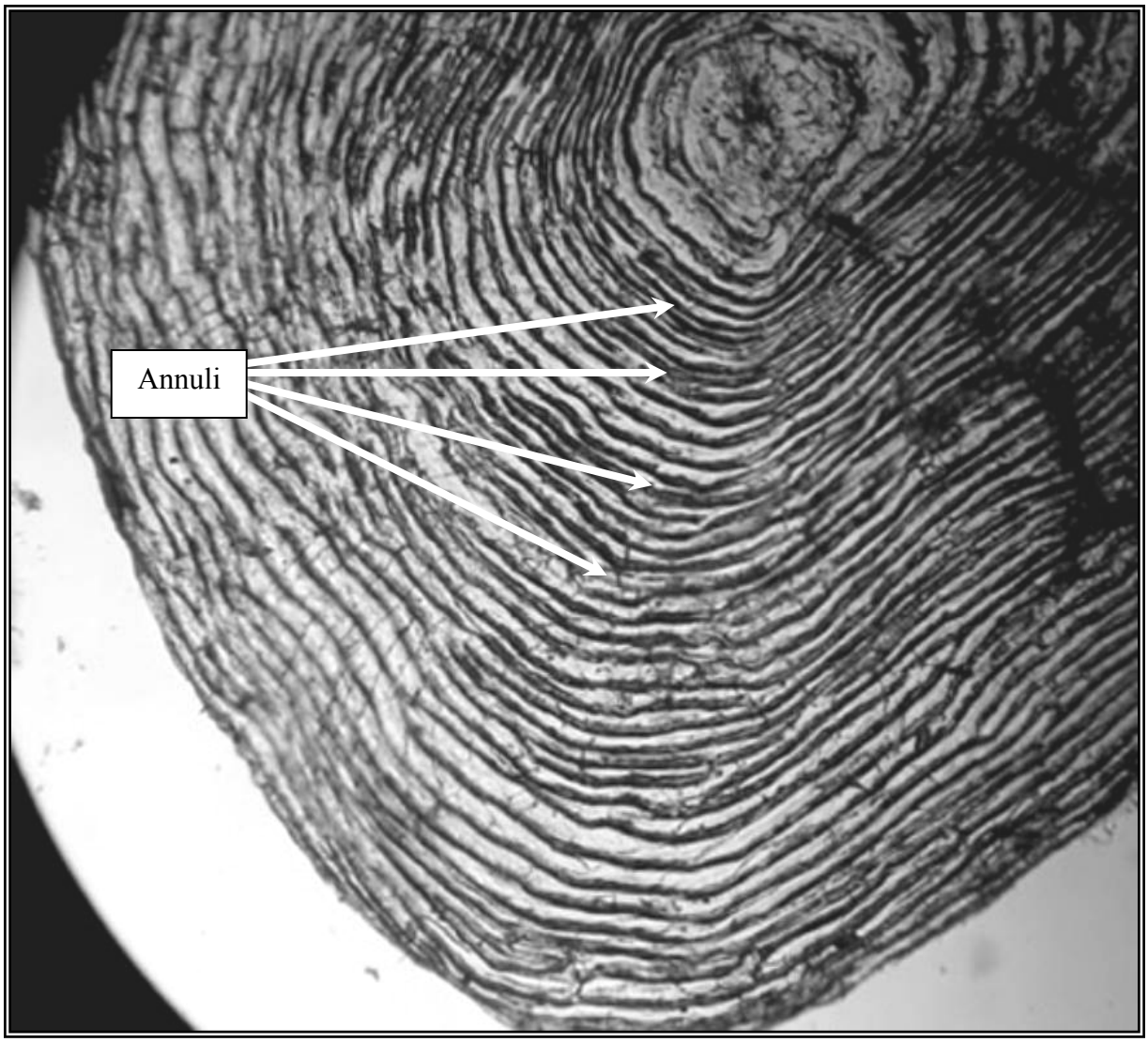

Figure D-8. Scale sample from Char No. 23 (FL=520 mm; age-6+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2002.

Figure D-9. Scale sample from Char No. 24 (FL=405 mm; age-4+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2003.

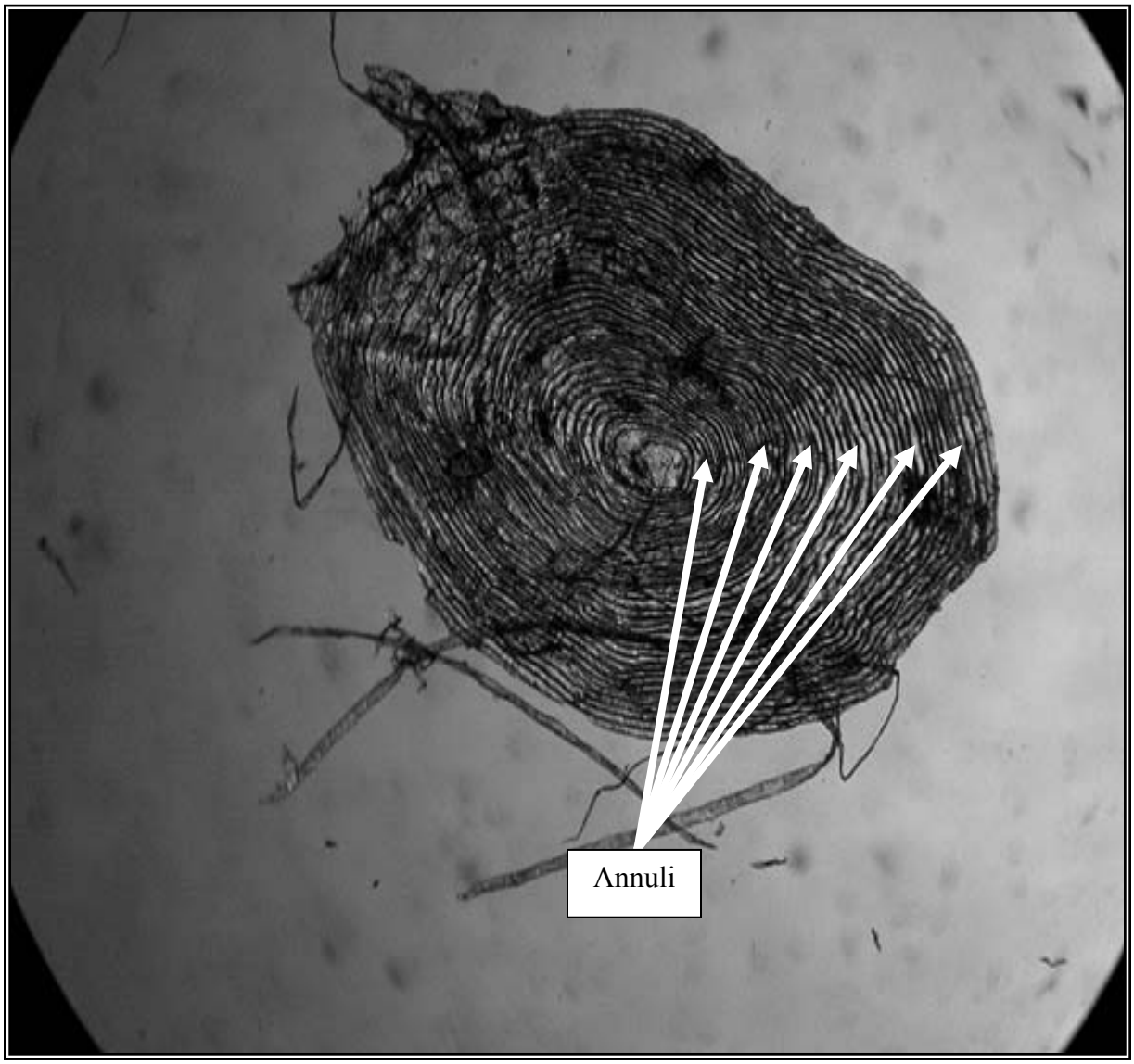

Figure D-10. Scale sample from Char No. 25 (FL=475 mm; age-6+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2004.

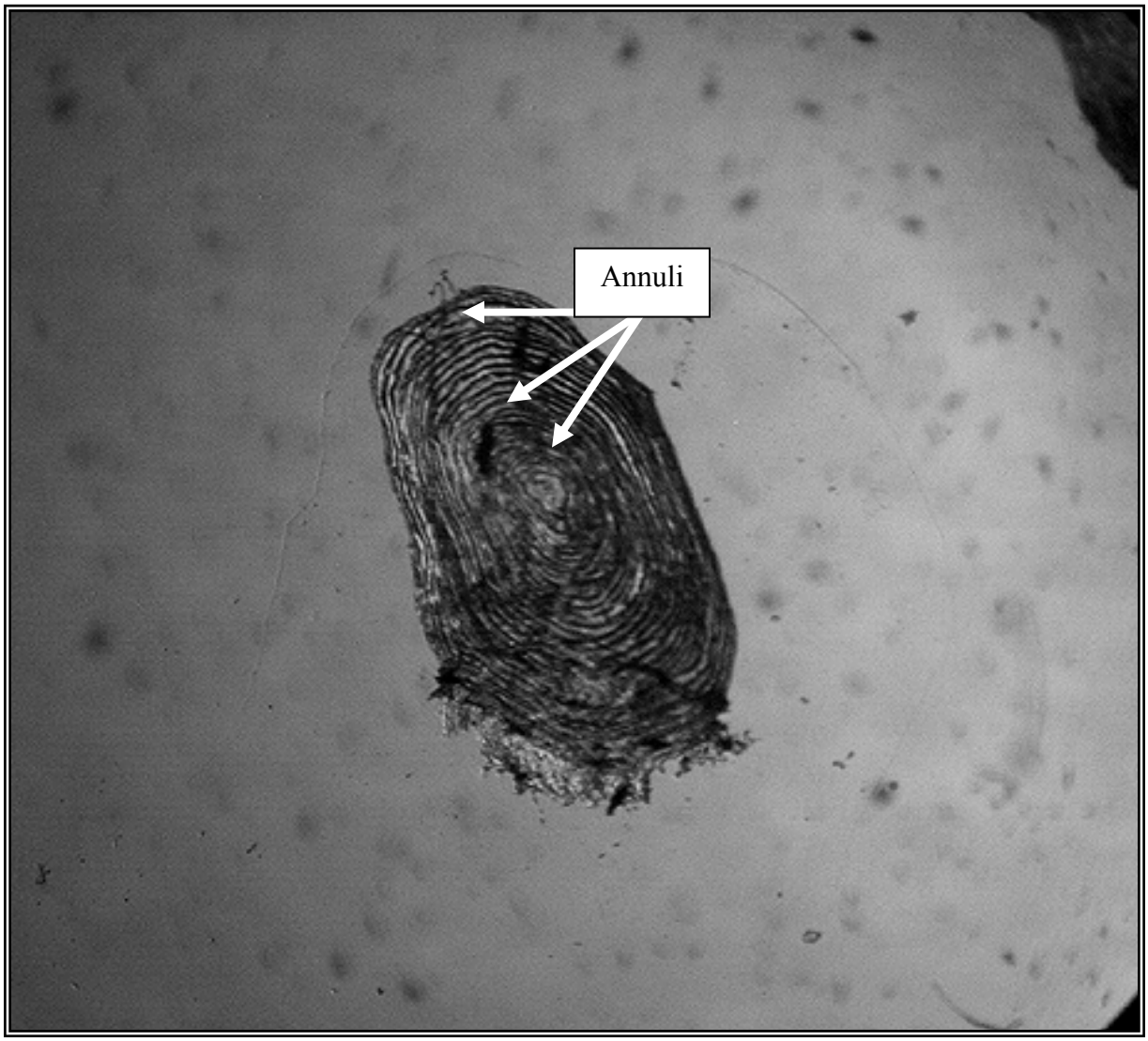

Figure D-11. Scale sample from Char No. 26 (FL=327 mm; age-3+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2004.

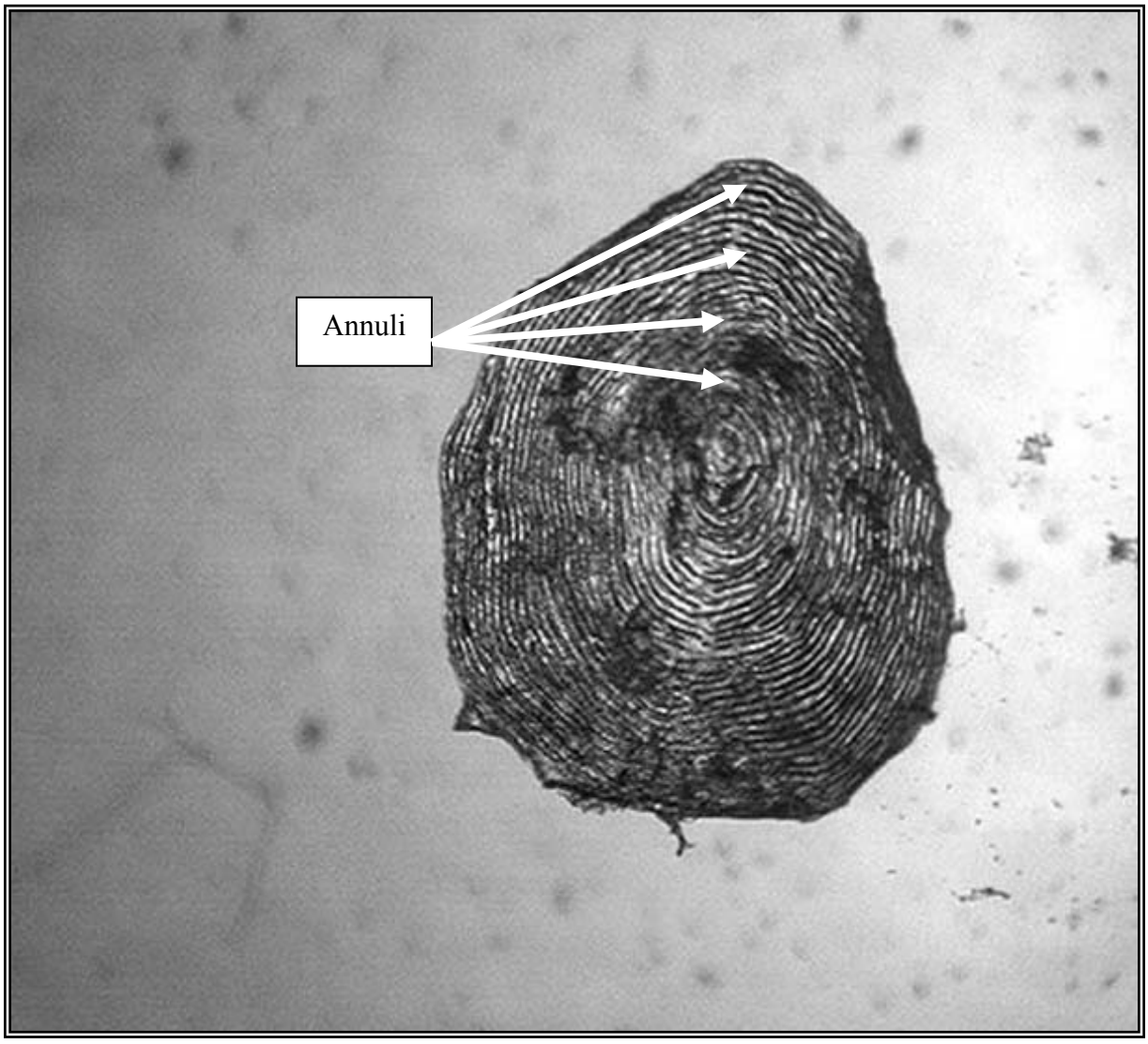

Figure D-12. Scale sample from Char No. 27 (FL=363 mm; age-4+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2004.

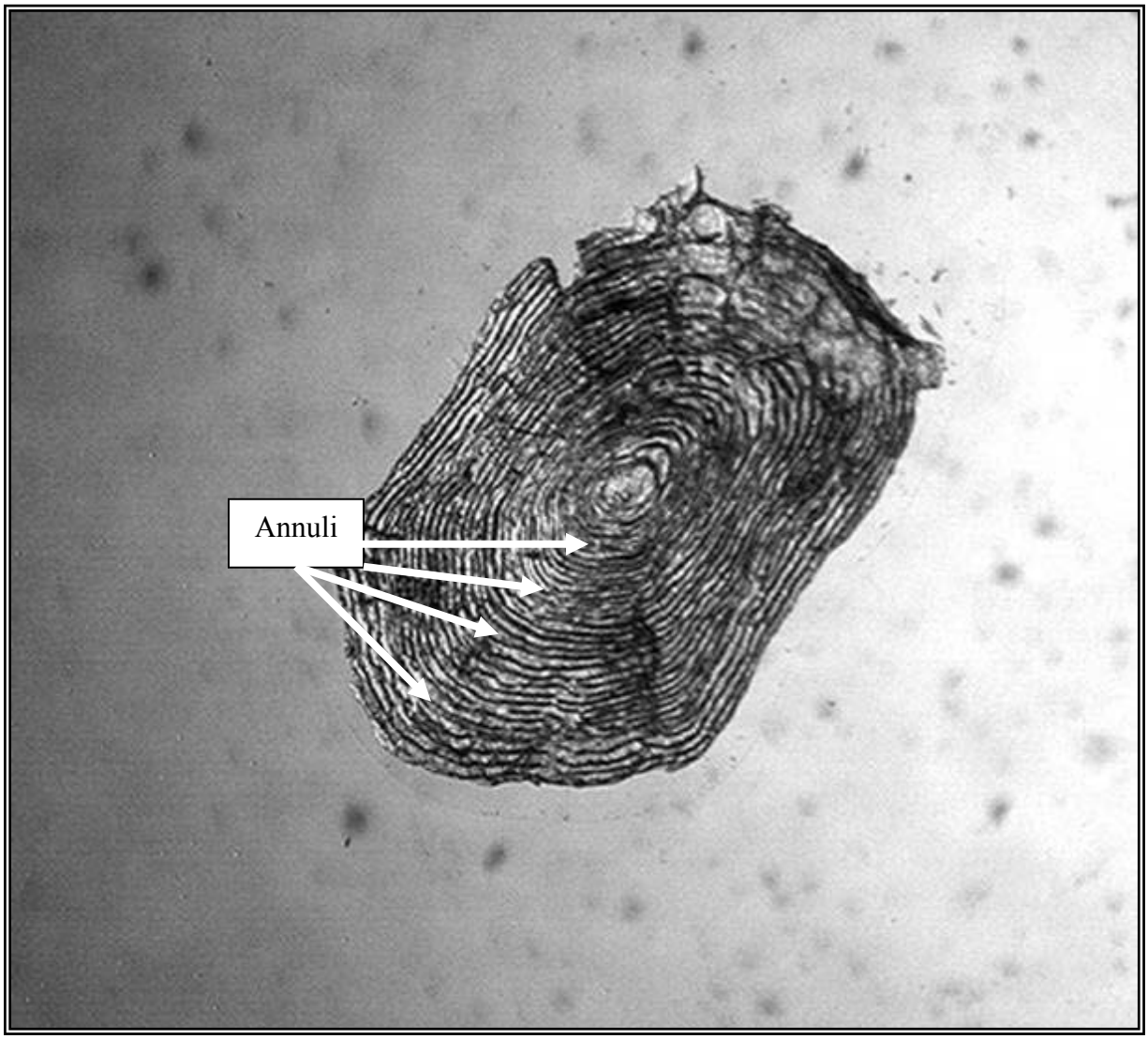

Figure D-13. Scale sample from Char No. 28 (FL=340 mm; age-4+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2004.

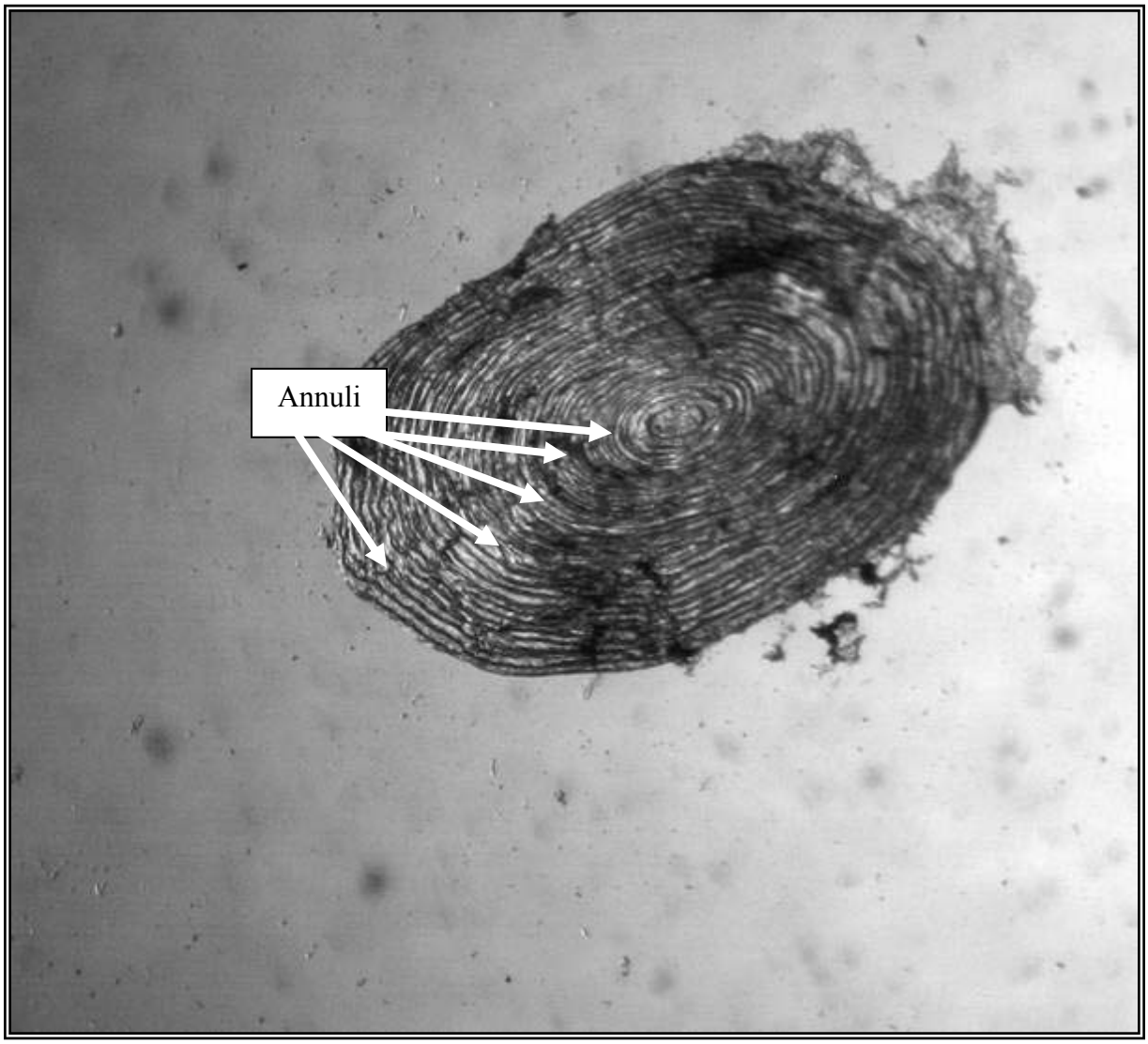

Figure D-14. Scale sample from Char No. 29 (FL=382 mm; age-5+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2004.

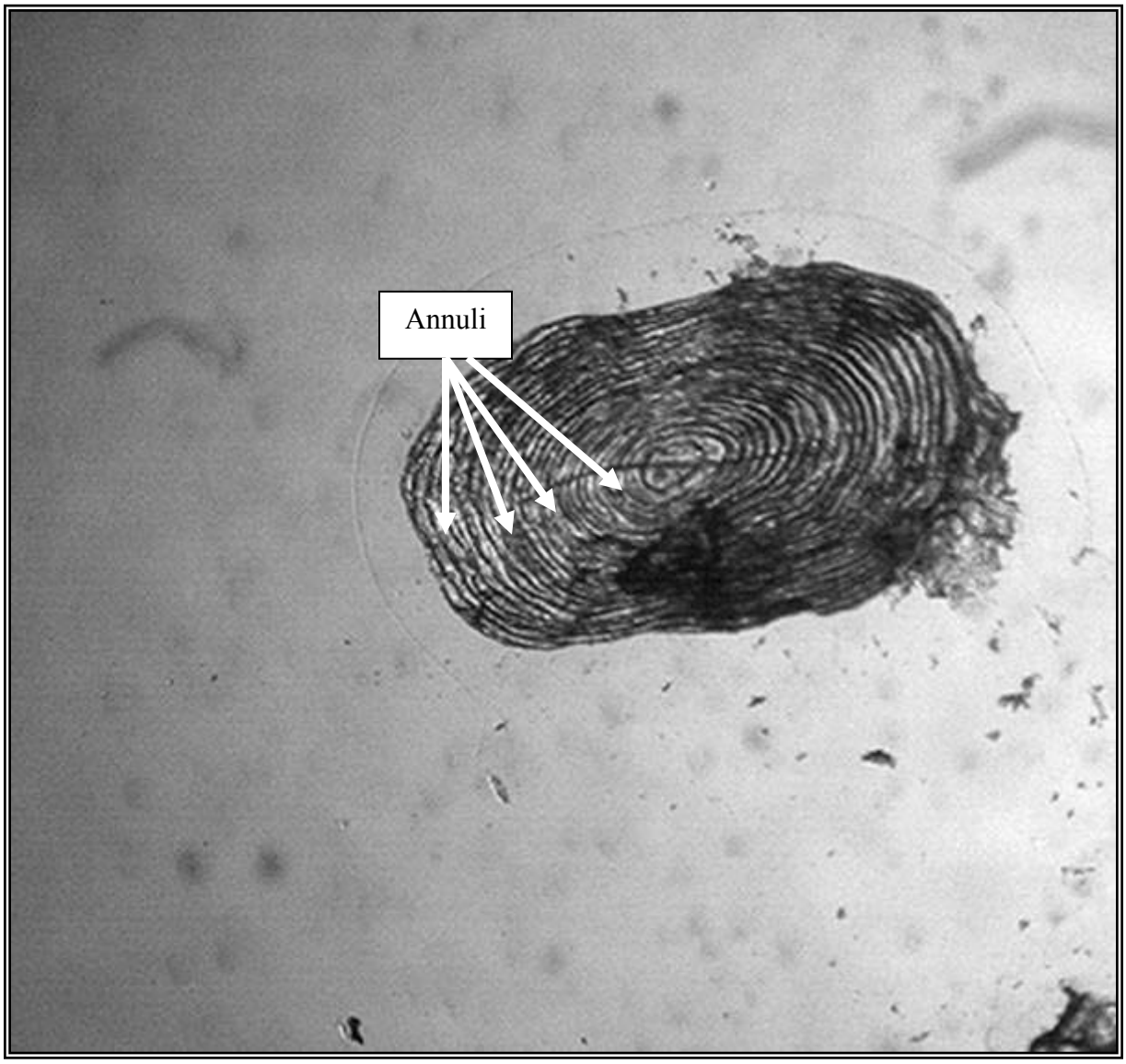

Figure D-15. Scale sample from Char No. 30 (FL=320 mm; age-4+) denoting annuli, captured during beach seine surveys conducted in the lower Chehalis River/Grays Harbor, Washington, 2004.