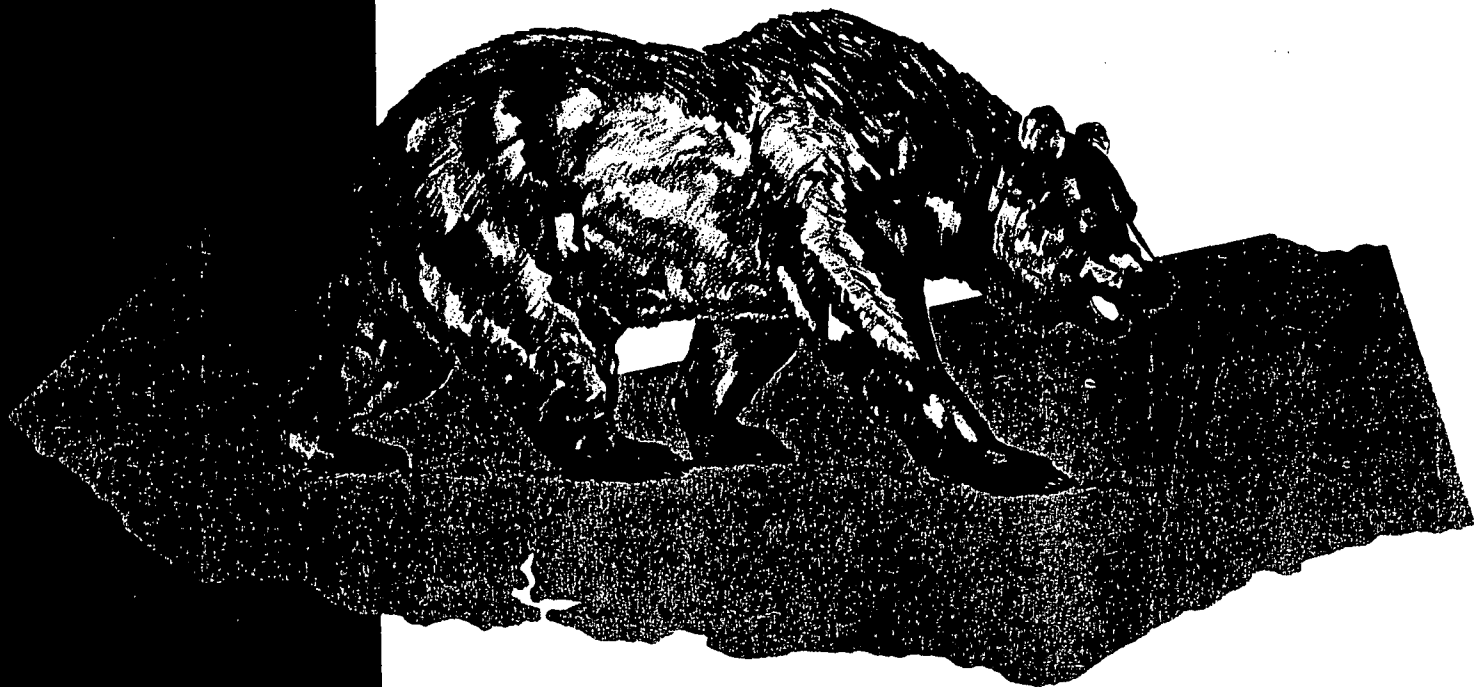


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VOLUME III
SUPPORTING DATA

PART B - INVENTORY
SALMON-STEELHEAD
& MARINE RESOURCES

CALIFORNIA
and Wildlife Plan



"The land was ours
before we were the land's."

October 1, 1965

CALIFORNIA FISH AND WILDLIFE PLAN

VOLUME III

Supporting Data

PART B

INVENTORY (SALMON-STEELHEAD AND MARINE RESOURCES)

STATE OF CALIFORNIA - Edmund G. Brown, Governor

THE RESOURCES AGENCY - Hugo Fisher, Administrator

DEPARTMENT OF FISH AND GAME - Walter T. Shannon, Director

THE FISH AND GAME COMMISSION

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METHODS USED IN ASSEMBLING THE INVENTORY

Because of time limitations, almost no field work was undertaken in connection with this Inventory, and this report is largely a compilation of existing information. On streams where accurate figures were available, they were used. When they were not available, the men most familiar with the problem made the best estimates they could by various methods including comparison with more carefully studied streams.

RATING THE QUALITY OF CATCH, EFFORT, AND ESCAPEMENT DATA

An estimate of the catch, effort and spawning run of each stream and a rating of the quality of each estimate is given in Table S-3. The quality of the information is designated as follows:

- A = The most reliable. Includes catch studies involving several years of intensive field work; also population studies involving years of fish-way counts or tag and recovery experiments.
- B = Less reliable because of shorter duration, less precise methods, or less complete coverage. Includes population estimates made annually for several seasons by field survey crews.
- C = Estimates made by men who are familiar with the stream and who made comparisons with better-studied streams. C+ is used when the men making the estimate had some data to assist them.

The estimates are also given in the text, but the rating of estimate quality is given only in Table S-3.

NEED FOR LATER STUDIES

It should be kept in mind that those estimates given here which are based on little or no data should be used only in outlining the major and critical factors of the resource. Adequate studies must be made in the future and doubtless will change the picture in some places.

DATE OF COUNTS, ESTIMATES, AND MEASUREMENTS IN THIS INVENTORY

It is the intent of this inventory to show conditions as they existed at about 1963. Because salmon and steelhead runs are notoriously erratic, the use of a single year would in many instances give a very erroneous impression. Whenever it was available and seemed appropriate, an average of the period from 1959 through 1963 was used. In most instances, five years of data were not available so we used what was available or made estimates as described under "CATCH AND USE ESTIMATES" and under "SPAWNING POPULATIONS". In other instances, some figures were available but were from considerably before 1959. We included such material if, in our estimation, it gave a good picture of present conditions, otherwise we used it to assist in giving an estimate of more recent conditions. In some instances where there were data, the conditions had changed so much since 1959 that a five-year average would give an entirely erroneous impression of present conditions. For example, the San Joaquin tributaries had good salmon runs in 1959 but conditions degenerated very rapidly after that date. In this instance, we used an average over a shorter period.

In a few instances where conditions have drastically and irreversibly

changed since 1963, it seemed advisable to describe 1965 conditions. (The Oroville Dam project partially blocked the Feather River salmon and steelhead runs in 1963 and was a total block in 1964.)

AMOUNT OF HABITAT

It was necessary to develop a quantitative measure of the habitat present in 1963. This quantitative value is to be used to compare the amount of habitat from river to river and species to species. It will also be used to compare the 1963 habitat with the amount expected to be present in 1980.

The habitat listed for each stream includes the lineal miles of stream habitat in each of 5 width categories and the miles of stream available to fishermen.

Procedure

Regional staff members, using U.S.G.S. 15-minute topographic maps, located as nearly as possible the upstream limit of migration for adult king salmon, silver salmon, or steelhead in each stream in their area.

Lineal Miles of Habitat

A wheel-type map measure was used to measure the total number of stream miles (including tributaries) downstream from the upper limits. This stream mileage total was a measure of the gross habitat utilized by the species.

On a majority of the streams, we do not know how much of this gross habitat is used as spawning grounds for the adults, as nursery areas for the juveniles, as travel routes between the spawning grounds and the sea, or as a combination of these.

As the stream miles of habitat were measured, they were recorded in tabular form by estimated stream-width categories. The points at which anglers had physical access to the stream were also noted, and the number of miles that were accessible were recorded. Tabulation is by river system. The data were sent to the Research Analysis Section where statewide summaries were made.

Stream Width

The stream width in mid-summer was first chosen as the standard for measuring the habitat of all inland and all anadromous species of fish discussed in this Inventory. This period was chosen because, in general, summer flows are lowest and most constant. Summer is also the most critical period for most species including steelhead and silver salmon, but excluding fall-run king salmon. In California, most young kings leave the streams in late winter or in spring, and some good king salmon streams are completely devoid of these fish in summer. A stream which is dry or intermittent in the summer is placed in the 0-7 foot width category regardless of whether the drying is due to a diversion or to natural causes. It is usually far wider than seven feet when the adult kings arrive in the fall.

Using this system to categorize the widths of king salmon streams has one advantage -- it makes possible a direct comparison of the lineal miles of stream frequented by each of the three anadromous species. It gives a very poor picture of the size of streams when actually inhabited by king salmon. To provide this additional information, we have also included the king salmon habitat available during the fall spawning season for this species.

The percent of the habitat accessible to anglers was also calculated.

Fishermen Access

For anadromous species, a point on a stream was considered accessible only if it was within $\frac{1}{2}$ mile of a road that was both passable by a two-wheel drive passenger car and open to public use ^{1/}. Because of the way in which the fish move upstream, salmon and steelhead fishermen normally do not have to hike very far to get good fishing. It was therefore assumed that most of these people will fish for anadromous species within a half mile of an access point. A section of stream is considered accessible if either bank is accessible. Because many North Coast roads are not passable by passenger car during the steelhead season, roads were considered to provide steelhead access only if they normally remain open during the majority of the fishing season. Angling regulations were not considered in determining accessibility.

Area of Watershed

The U. S. Geological Survey Water Supply Papers list the area of watershed upstream from many gaging stations. The area above the lowest usable station on each stream was taken from these publications, when it seemed appropriate and practical to do so.

^{1/} In many areas, landowners post their property and refuse permission to those who ask to fish, but make no effort to eject those who fish without asking. Such streams may be well known and well fished, but in this Inventory we have classed them as "closed to public use."

METHODS USED TO ESTIMATE SPAWNING POPULATIONS

DEFINITION OF SPAWNING POPULATION

The estimates of numbers of spawners given in this Inventory are exclusive of all catches. They are intended to include only those fish which escaped all hazards and spawned. "Jacks" or precocious male salmon are included in the total.

SOURCE OF ESTIMATES

Whenever fish populations have been determined by fishway counts, by tag and recovery experiments, by aerial redd counts, or by estimates based on carcass counts, such data were used. Most of the fall-run salmon population estimates in the Central Valley were based on several years of carcass counts^{2/}.

On the coastal streams, fishway counting stations are scattered and counts usually include the run of only a part of the river. Tag and recovery experiments of some magnitude have been made on the Eel and Trinity rivers. Most of the estimates on the coast have involved no field work done for this specific purpose; they were made by men who are familiar with the streams in question and who compared them with similar streams on which more studying had been done.

CATCH AND USE ESTIMATES

Illegal Fishing

Catch and use estimates given in this inventory refer to legal fishing only. They do not include fish taken illegally or time spent in illegal fishing.

Snagging, spearing and gaffing on the spawning beds are a serious threat to many salmon runs. The threat is most serious in small streams and during periods of low flow. Poachers have little trouble taking spawning fish when the entire riffle is shallow. Fish on a deep, fast riffle are much safer. Even if they are spawning in shallow water near the bank, they are only a tail flip away from safety.

A small run often suffers much more from poaching than a large one. The poachers take what they want and if the run is small, this may exceed half the available spawners.

Adequate law enforcement can make the difference between an adequate run and a pitiful remnant of a run in some streams. The enforcement depends in part on the local warden, the stream patrolling he does or does not do, and the arrests he does or does not make. It depends in part on the local judge and the punishment he does or does not hand out. Most of all, it depends on public education and public opinion. If the public wants conservation, it will get it. Much of this public sentiment is influenced by the local warden.

^{2/} Survey crews make several trips per season over the spawning beds, count (and cut in half) each spawned-out carcass, and estimate the proportion of carcasses not seen. The method is not used on steelhead and is of little use on most coastal streams where erratic turbid floods often sweep most of the carcasses into deep water.

Protection of spawning salmon and steelhead in California ranges from very good to very poor. No master plan for anadromous salmonids can succeed without adequate consideration of the law enforcement and public opinion problems involved.

Inland Catches

The catch and use (effort) estimates given here cover a wide range of accuracy and reliability. Several years of creel count data are available on the Sacramento and the lower Klamath rivers. Shorter studies and spot checks were made on about 20 other streams (including tributaries). Where no catch and effort figures were available, men who were familiar with the area compared each stream with others on which some studies had been made, and estimated the total catch, total effort and catch per angler-day.

Ocean Catches

The commercial ocean catches recorded in this Inventory are based on the total weight of salmon landed as recorded on fish landing receipts. The weights are converted into numbers of fish and split into species by use of an extensive sampling system. The period used is 1959 through 1963.

The sport ocean catch figures are about as accurate as the best of the inland data. They are based on partyboat catches (as counted daily by the boat captains) plus the private boat catch as estimated from samples.

Sport ocean effort figures can only be approximated at present.

REDWOOD CREEK

Redwood Creek drains about 300 square miles, all in Humboldt County. The stream is relatively narrow and straight, with few tributaries. It flows in a northwesterly direction and empties into the Pacific Ocean near the town of Orick. It has one major tributary, Prairie Creek, which joins with Redwood Creek about three miles upstream from its mouth.

Amount of Habitat

There are 69 stream miles of king salmon, 110 miles of silver, and 112 miles of steelhead habitat in the Redwood Creek drainage.

Estimated Abundance of Spawners (Exclusive of Catch)

King salmon 5,000 fish per year.

Silver " 2,000 fish per year.

Steelhead 10,000 fish per year.

The above are the present runs of salmon and steelhead. According to local residents and occasional observations by Department personnel, they represent a drastic decline from former years.

Availability

Redwood Creek has only 9 percent of its king salmon and 7 percent of its silver salmon and steelhead habitat accessible to the angler. The lack of access and private holdings limits the use of this stream by anglers.

Present Use

Salmon fishing : About 700 angler-days per year.

Steelhead fishing : About 1,300 angler-days per year.

Little effort is placed on the downstream migrant fishery of Redwood Creek itself, but Prairie Creek receives considerable pressure from vacationists visiting Prairie Creek State Park. About two-thirds of Prairie Creek drainage lies within the park boundaries.

Present Yield

Salmon : About 150 fish per year at approximately .2 fish per angler-day.

Steelhead: About 500 fish per year at approximately .4 fish per angler-day.

Critical Factors in the Habitat

As with many of the smaller coastal streams, sand bars usually form at the mouth of Redwood Creek each summer. The mouth does not open until the first good fall rain, thereby limiting the entrance migration of anadromous species. On occasion, fish are not able to ascend the river for a long period of time. Even though able to enter the estuarine area, the natural flow of the main stem is so low at times that upstream migration is seriously hampered.

Although logging debris constitutes some impairment of tributary streams, the general overall condition of the basin in this respect is good. Natural falls occur on four tributary streams but do not block any appreciable amount of anadromous fish habitat.

Although logging has affected the productivity of the Redwood Creek drainage, the limiting factor appears to be the extremes in natural flows. Low flows during the summer and early fall months limit the year-around habitat for silver salmon and steelhead.

TABLE S-2 ANADROMOUS HABITAT (page 3 of 5)

Stream Name	MILES OF STREAM					Total Stream Miles	ACCESSIBLE TO ANGLERS		DRAINAGE AREA SQUARE MILES (Approx)
	Stream Width in Feet						Miles	%	
	Up to 7	8 to 20	21 to 100	101 to 300	Over 300				
COASTAL RIVER SYSTEMS TOTAL									
King Salmon (fall flows)	220	586	996	502	-	2304	918	40	
" " (summer flows)	696	495	697	416	-	2304	918	40	
Silver " (" ")	2026	643	651	400	-	3720	1112	30	
Steelhead (" ")	4835	1026	1013	427	-	7301	2163	30	
TRIBUTARIES TO OREGON TOTAL									
King Salmon (fall flows)	-	25	-	-	-	25	16	64	
" " (summer flows)	14	11	-	-	-	25	16	64	
Silver " (" ")	20	13	-	-	-	33	18	55	
Steelhead (" ")	22	22	-	-	-	44	26	59	
SMITH RIVER									
King Salmon (fall flows)	-	130	132	26	-	288	54	19	700 (Esti- mated)
" " (summer flows)	80	122	60	26	-	288	54	19	
Silver " (" ")	112	142	68	26	-	348	56	16	
Steelhead (" ")	130	144	68	26	-	368	56	15	
KLAMATH RIVER SYSTEM TOTAL									
King Salmon (fall flows)	-	109	342	354	-	805	530	66	12,100 (3.3 Mi. E. of Klamath)
" " (summer flows)	62	165	271	307	-	805	530	66	
Silver " (" ")	156	151	199	307	-	813	489	60	
Steelhead (" ")	664	302	343	307	-	1616	602	37	
Main Klamath (Trib. to ocean ^{1/})									
King Salmon (fall flows)	-	44	69	194	-	307	210	68	
" " (summer flows)	36	50	27	194	-	307	210	68	
Silver " (" ")	95	77	32	194	-	398	246	62	
Steelhead (" ")	264	124	54	194	-	636	316	50	
Shasta R. (Trib. to Klamath)									
King Salmon (fall flows)	-	2	32	-	-	34	8	24	796 (.5 mi. from mouth)
" " (summer flows)	2	20	12	-	-	34	8	24	
Silver " (" ")	2	20	12	-	-	34	8	24	
Steelhead (" ")	32	20	12	-	-	64	8	12	
Scott R. (Trib. to Klamath)									
King Salmon (fall flows)	-	9	50	-	-	59	23	39	662 (10.5 mi. downstream from Fort Jones)
" " (summer flows)	-	19	40	-	-	59	23	39	
Silver " (" ")	48	38	40	-	-	126	41	33	
Steelhead (" ")	92	38	40	-	-	170	49	29	
Salmon R. (Trib. to Klamath)									
King Salmon (fall flows)	-	12	61	17	-	90	72	80	746 (1.5 mi. from mouth)
" " (summer flows)	3	9	78	-	-	90	72	80	
Silver " (" ")	11	14	80	-	-	105	82	78	
Steelhead (" ")	40	19	92	-	-	151	103	68	
Trinity R. (Trib. to Klamath)									
King Salmon (fall flows)	-	42	130	143	-	315	217	69	2846 (Near Hoopa)
" " (summer flows)	21	67	114	113	-	315	217	69	
Silver " (" ")	-	2	35	113	-	150	112	75	
Steelhead (" ")	236	101	145	113	-	595	126	21	
REDWOOD CR. (Trib. to Ocean)									
King Salmon (fall flows)	-	11	58	-	-	69	6	9	278 (Near mouth)
" " (summer flows)	11	30	28	-	-	69	6	9	
Silver " (" ")	52	30	28	-	-	110	8	7	
Steelhead (" ")	54	30	28	-	-	112	8	7	
MAD RIVER (Trib. to Ocean)									
King Salmon (fall flows)	-	21	25	19	-	65	18	28	485 (2.8 mi. NE Arcata)
" " (summer flows)	21	2	42	-	-	65	18	28	
Silver " (" ")	41	2	42	-	-	85	18	21	
Steelhead (" ")	45	2	42	-	-	89	18	20	

^{1/} Includes Klamath tributaries not listed separately.

TABLE S-3 (Page 2 of 2 pages)

SALMON AND STEELHEAD IN COASTAL STREAMS
CATCH, EFFORT, AND SPAWNING POPULATION ESTIMATES

	ANGLER DAYS		CATCH PER ANGLER DAY		TOTAL CATCH		QUALITY OF CATCH AND EFFORT INFORMATION 1/		SPAWNING ESCAPEMENT			QUALITY OF ESCAPEMENT INFORMATION 1/		
	Salmon	S.H.	Sal.	S.H.	Salmon	S.H.	Salmon	Steelhead	King Salmon	Silver Salmon	Steelhead	King Salmon	Silver Salmon	Steelhead
GRAND TOTAL COASTAL STREAMS	114,300	260,100	.38	.43	43,860	111,600			256,200	99,400	573,250			
Streams Tributary to Oregon	200	200	.5 ‡	.5 ‡	100	100	C	C	500	1,000	2,000	C	C	C
Smith River	11,500	16,600	.4	.4	4,600	6,600	C+	C+	15,000	5,000	30,000	C	C	C
TOTAL KLAMATH RIVER SYSTEM	64,400	84,300	.43	.74	27,830	62,000			168,000	15,400	221,000			
Shasta River	Closed	100*	-	.3	0	2/	-	C	20,000	800	6,000	A	C+	C+
Scott River	200**	1,000	.4	.3	80	300	C	C	8,000	800	5,000	C	C	C
Salmon River	1,200	1,200	.3	.4	350	500	C	C	10,000	800	10,000	C	C	C
Trinity River	16,000	13,000	.4	.4	6,400	5,200	C+	C+	80,000	5,000	50,000	B	C	C
Main Klamath	47,000	69,000	.45	.8 ‡	21,000	56,000	B	C+	50,000	8,000	150,000	B	C	C
Redwood Creek	700	1,300	.2	.4	150	500	C	C	5,000	2,000	10,000	C	C	C
Mad River	1,300	3,700	.2	.4	250	1,500	C+	C+	5,000	2,000	6,000	C+	C+	C+
TOTAL EEL RIVER SYSTEM	8,600	32,200	.40	.40	3,480	12,900			55,500	14,000	82,000			
Van Duzen River	700 †	3,000	.4 †	.4	300	1,200	C+	C+	2,500	500	10,000	C+	C+	C+
South Fork Eel River	2,700	15,000	.4	.4	1,100	6,000	C+	C+	27,000	13,000	34,000	C+	C+	C+
North Fork Eel River	0	0	-	-	0	0	-	-	0	0	5,000	-	-	C
Middle Fork Eel River	200	1,700	.4	.4	80	700	C	C	13,000	0	23,000	C	-	C
Main Eel	5,000	12,500	.4	.4	2,000	5,000	C+	C+	13,000	500	10,000	C	C	C
Mattole River	600	700	.7 ‡	.7 ‡	400	500	C	C	5,000	2,000	12,000	C	C	C
Ten Mile River	500	1,200	.4	.3	50	350	C	C	0	6,000	9,000	-	C	C
Noyo River	2,400	1,500	.5	.4	1,200	600	C	C+	2/	6,000	8,000	C	C	C
Big River	1,000	1,600	.4	.3	400	500	C	C+	0	6,000	12,000	-	C	C
Navarro River	800	1,500	.3	.4	250	600	C	C+	0	7,000	16,000	-	C	C
Garcia River	500 †	1,800	.4 †	.4	200	700	C	C+	0	2,000	4,000	-	C	C
Gualala River	700 †	3,000	.4 †	.4	300	1,200	C	B	0	4,000	16,000	-	C	C
Russian River	10,000 †	60,000	.2 †	.2	2,000	12,000	C	C+	500	5,000	50,000	C	C	C
San Lorenzo River	3,000	20,000	.13	.2	400	4,000	C	C	0	1,600	19,000	-	C	C
Pajaro River	0	1,000	-	.2	0	200	-	C	0	0	2,000	-	-	C
Salinas	0	600	-	.06	0	2/	-	C	0	0	500	-	-	C
Carmel River	0	1,500	-	.1	0	150	-	C	0	0	1,500	-	-	C
Little Sur	0	200	-	.15	0	2/	-	C	0	0	500	-	-	C
Big Sur	0	300	-	.17	0	50	-	C	0	0	250	-	-	C
TOTAL SMALLER TRIBS. TO OCEAN	8,100	26,900	.28	.27	2,250	7,150			1,700	20,400	71,500			
Del Norte County	200	200	.1	.1	2/	2/	C	C	200	400	500	C	C	C
Humboldt County	1,200	800	.4	.4	500	300	C	C	1,500	1,500	3,000	C	C	C
Mendocino County	2,000	3,000	.3	.3	600	900	C	C	0	10,000	20,000	-	C	C
Sonoma County	500 †	3,000	.3 †	.3	150	900	C	C	0	1,000	4,000	-	C	C
Marin County	1,600	3,700	.3	.3	500	1,100	C	C	0	5,000	8,000	-	C	C
San Francisco County	0	0	-	-	0	0	-	-	0	0	0	-	-	-
San Mateo County	1,400	3,500	.14	.11	200	400	C	C	0	1,000	8,000	-	C	C
Santa Cruz County	1,200	5,000	.25	.3	300	1,500	C	C	0	1,500	5,000	-	C	C
Monterey County	0	1,700	-	.15	0	250	-	C	0	0	3,000	-	-	C
San Luis Obispo County	0	6,000	-	.3	0	1,800	-	C	0	0	20,000	-	-	C

1/ QUALITY OF INFORMATION IS DESIGNATED AS FOLLOWS:

A = The most reliable. Includes catch studies involving several years of intensive field work; also, population studies involving years of fishway counts or tag and recovery experiments.

B = Less reliable because of shorter duration, less precise methods, or less complete coverage. Includes population estimates made annually for several seasons by field survey crews.

C = Estimates made by men who are familiar with the stream and who made comparisons with better-studied streams. C+ is used when the estimates had some data to assist them.

2/ Less than 50 fish.

‡ This figure is raised by the large "half-pounder" catch. These are small steelhead averaging about a pound in weight.

‡ Remote area, fished mostly by anglers who know the stream well.

† Much of salmon catch is made by steelhead fishermen. The same catch per angler-day was arbitrarily assigned to both species.

* No winter steelhead season. Catches made during trout season.

** Fished after the end of the salmon spawning season closure.