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Docket Entry 346C - Filed Deposition of James L. Heckman - Volume III

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IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON
SOUTHERN DIVISION

UNITED STATES OF AMERICA, et al, Plaintiffs, -vs- STATE OF WASHINGTON, et al, Defendants.	CIVIL NO. 9213

DEPOSITION OF JAMES HECKMAN. VOLUME III

BE IT REMEMBERED that Volume III of the deposition upon oral examination of JAMES HECKMAN was taken on Thursday, April 26, 1973, at 612 Rust Building, Tacoma, Washington, before Elmer F. Groshong, Notary Public in and for the State of Washington;

Said deposition being taken on behalf of Defendant Department of Fisheries by:

Mr. Earl R. McGimpsey,
Assistant Attorney General,
State of Washington,
Temple of Justice,
Olympia, Washington.

Appearing on behalf of Plaintiffs:

Mr. George Dysart,
Assistant Regional Solicitor,
U.S. Department of Interior,
P. O. Box 3621,
Portland, Oregon.

TO BE UNSEALED BY ORDER OF THE COURT ONLY.

346C

The following proceedings were had:

MR. McGIMPSEY: Let the record show that this is the continuation of the deposition of James Heckman begun on April the 24th. And that the parties present are Mr. George Dysart, representing the plaintiffs, and Mr. Earl McGimpsey, representing the Defendant Department of Fisheries.

MR. DYSART: Let the record also show that Mr. James Hovis, representing the Yakima tribe, who was present at the first two days of the deposition, is unable to be here today and has had to return to his office in Yakima.

JAMES HECKMAN, having been previously sworn, deposed and testified as follows:

DIRECT EXAMINATION

BY MR. McGIMPSEY:

Q Jim, we were talking at the time that we broke yesterday about the Puyallups, and specifically about the Puyallup regulation of their fishing season and the seasons for 1971 and '72, and just to recap it, I think we had established or were willing to stipulate that the Department of Fisheries had promulgated some regulations for the Puyallup Indian Fishery for those seasons, but that there had not been enforcement of those regulations, and that the Indians themselves had promulgated their own regulations to regulate the fishery; is that --

A With one exception, Earl.

Q Okay.

A I recognized that the Fisheries Department did not enforce regulations, I believe it was last year, 1972, but I am not sure that I was aware that they had promulgated regulations.

Q Okay. Now, I think some of these questions may be a little bit repetitious because I can't quite remember what we established yet or not. But did you assist the Puyallups in 1971 or 1972 in adopting regulations by providing them biological technical information or advice?

A We met with them in 1971 and this was following our review of the record and information pertaining to the stock, and as I recall, I had discussed the situation with Al Lassiter, and he was encouraging that the tribe be encouraged to reduce their efforts on fall Chinook salmon, and I did meet with them and relayed this information to them and suggested that they reduce their fishing effort.

Q Do you know whether this was before or after the Puyallups had adopted their regulations?

A It was before they had adopted their regulations for 1972.

Q Do you recall specifically whether the amount of fishing that the Department felt the Puyallups could do during the fall Chinook season, in number of days -- do you recall specifically the number of days that the Department felt that the Puyallups could do?

A I don't recall exactly, but relatively, the tribe I think initially had intended to fish five days a week, it seemed to me that the State, in conversations with Al, indicated it would be desirable to cut it down to two or three days a week, somewhere more in that neighborhood. Does that fully answer you?

Q Thank you. Did you actually suggest any regulations to the Puyallups or did they adopt their own regulations?
A They adopted their own regulations. I did suggest the reduction.
Q At the time?
A Yes.
Q Do you know when they adopted their regulations whether they considered any of these lists of desired information that we talked about yesterday, such as -- and I will show you the list again --
A In their manner, I assumed that they did consider some of these things.
Q Do you know specifically of your own knowledge whether they considered any particular one of these things; for example, did they have any spawning escapement counts?
A No, they were relying on us to make an interpretation.
Q Okay. In making your recommendations, did you have any spawning escapement counts for the fish that would be coming back, I mean, did you have, did you make any attempt to predict the run size, in return, other than your reliance on Mr. Lassiter, that it would be a small run?
A No, we did not have any information on the escapement that would have produced the 1972 run.
Q And did you have any specific information on catch

statistics, that had been taking place on that run to make any kind of a determination as to the size of the run as it reached the river, or did you --

A We had partial catch statistics. We didn't have any idea of how much of that run had been taken in the ocean or Puget Sound and Straits of Juan de Fuca net fishing.

Q You said you didn't know whether or not there were regulations promulgated by fisheries; is that correct?

A I don't recall that there were. It seems to me, Earl, that, because I think at that time it was considered an on-reservation fishery that the Department of Fisheries did not propose to regulate it. Or --

Q In any event, your recommendations to the Puyallups did not take into account any regulations that had been promulgated for their fishery by the Department?

A Only -- no, no, not regulations that were promulgated.

Q Just the oral discussions you had had with Mr. Lassiter, okay. Were you requested by the Department of Fisheries to provide it with any data or information on the Puyallup Fishery during the 1972 or '71 seasons?

A Yes.

Q And what data was that?

A The Department requested that we attempt to secure information on the Indians' river catch.

Q And did you provide the Department with that data?
A No.
Q Was there a reason for not providing the Department with the data?
A Yes.
Q And what was the reason?
A The reason was that we had not been invited, upon bringing this to the attention of the tribe, and disclosing to them our feeling on the importance of securing this data, and providing it to the management agency, we did not get an affirmative response from the tribe, and therefore, we did not impose ourselves on them, for the simple reason that we felt if we did we would not get the information, and that it might harm the relationship that we were able to establish with the tribe to that point.
Q Was the information you were requested to provide, did it have to do with marked salmon returning?
A My recollection is that Fisheries was tagging some of the incoming stock at the Discovery Bay, and elsewhere, and that some of these might be picked up in the Puyallup net fishery.
Q And this would have been probably -- to your knowledge, would this have been part of a research project of the Department of Fisheries, that they used marked fish?

A It was definitely a part of the Department's activities, attempting to analyze the run situation.
Q In your opinion, as a biologist, is it important to conduct the type of marked studies and that to determine the fishery better management?
A It would be highly valuable.
Q Did you observe the fishery in Puyallup during the season as it progressed at all?
A No, I was not able to.
Q Do you know if there was any problem with over-escapement?
A No, I don't.
Q So you don't know whether there was an over-escapement or not on the Puyallup River, under the Indian regulations?
A You are speaking of a spawning escapement?
Q Spawning escapement, yes.
A No, I don't know whether there was an over-escapement or not.
Q Do you have any idea of how the Indians determined what the necessary escapement would be or if they made that determination?
A No, they haven't conducted any studies that I am aware of or that they have made available to me concerning their knowledge of the spawning escapements.

Q I see. Getting back to those marked fish that the Department had requested to be counted, do you know whether those markings had anything to do with identifying hatchery stock in the Puyallup?

A Well, I would have to check the files, Earl, but I guess it's possible that they were expecting a return of marked fish that year in addition to those tags that they were placing on the fish in the sound.

Q If it were for hatchery stock, this would be for the purpose of -- what purpose would it be for; that should be the question?

A I suppose for several purposes. One might be to attempt to determine where the stocks are today in the various fisheries. Another might be to evaluate their hatchery program on the basis of success of production.

Q And we would agree that this would be valuable information to the management of the fishery?

A Yes.

Q Are there any Indian fisheries on Puyallup runs other than the Puyallups?

A There are Indian fisheries up-sound that fish on mixed stocks, and through those fishing areas I presume the Puyallups' stocks might migrate.

Q Now, these fisheries up-sound that fish on Puyallup stocks, what fisheries would those be?

A I am not exactly sure of the migration route of fall Chinook salmon destined for the Puyallup River, but there is the possibility that the Makahs would take them.

Q Are there any other fisheries on the rivers, or on rivers that feed into the Puyallup River that also would fish on stocks that would pass through?

A Pardon me, I lost you, would you start over?

Q Are there any other Indian fisheries on the Puyallup River or on rivers that feed into the Puyallup River or its watershed that would fish on stocks that pass through the Puyallup Indian fisheries?

A Yes, the Muckleshoot Indians fish on White River and elsewhere in the Puyallup drainage.

Q Do you know whether the Muckleshoot catch declined on its fishery in the White River,if stocks that passed through the Puyallup declined in the year 1971-72?

A Declined, I don't know, declined from what?

Q Declined from what it had been previously in the seasons immediately prior to those years?

A I do not know that it did, no.

Q Are you aware of any complaints by Muckleshoot Indians as to the fishing activities of the Puyallup Indians during the 1971 and '72 --

A I don't recall any formal complaints.

Q Did any Muckleshoot Indians informally complain to you or any members of your staff regarding the Puyallup fishery for those years?

A I don't recall a specific incident.

Q Okay. Do you know whether or not the Muckleshoots were allowed to appear or in any way influence the regulations that were adopted by the Puyallup Indians for their fishery?

A No, no, only very indirectly do I, am I aware of any meeting between those two groups, and the fisheries.

Q What was the indirect meeting between them?

A Going back to our White River Fishery Improvement Committee during our last meeting or two we have included as membership in that committee the representatives of the Puyallup Tribe, and in discussions of the general problems relating to the White River fisheries, fish populations, there seemed to be some agreement, mutual understanding and interest between those two groups, as accounted for in statements made by them. One expressing concern for the other.

Q Okay. Do you know if the Puyallups, in adopting their regulations, considered, consciously considered the Muckleshoot fishery and made any allowance for escapement for the Muckleshoot fishery?

A I don't recall any conversation of this effect, nor any evidence in their regulations that they were specifically considering that.

Q Do you have any knowledge, or could you describe the process by which the Puyallup Tribe adopted its fishing regulations?

A I couldn't go much beyond, as far as the technicalities are concerned, the meeting of the tribal fish committee, their consideration of the problem, and the presentation of their proposal to the tribal council. From there it gets into administrative technicalities of the tribe and bureau affairs that I am not closely associated with.

Q Do you know whether the individual Indian fishermen are allowed to appear before the fish committee and express their views as to the regulations being promulgated?

A The committee is comprised, I think, almost entirely of Indian fishermen.

Q I see. And is it essentially the fish committee that formulates the regulations and then the tribal council acts as an approving agency, more or less?

A That is my understanding.

Q That is your understanding. And is it correct, as far as you know, you don't know whether the Puyallups at all considered run size in setting those regulations for those seasons?

A I am sure they considered run size.
Q They did, okay. And to the extent that they did, was it based on the information that you had relayed to them that the run size would be smaller this year than --
A I am sure of that.
Q Do you know if they considered any other information in determining run size?
A I am sure they did.
Q And what information would that be?
A I am sure they considered that the run would have been much larger if a lot of other people hadn't been fishing on it before it got to the river.
Q Okay. Do you know if the Puyallups at any time during their season restricted fishing because of this reduced run size?
A Restricted fishing other than in 1972?
Q Other than, no. In 1972 do you know whether they restricted fishing that year after they had initially promulgated their regulations, because of reduced run size?
A In their final regulations for 1972 they included a reduction in the fishing time during the Chinook season, a reduction from the preceding years.
Q From the preceding years?
A Yes. Of from their generally established weekly fishing

time.

Q After they promulgated those regulations, though, did they subsequently ever restrict it even more than what they had restricted it in the initial regulations, to your knowledge?

A I didn't stay that close to it, we weren't able to keep that close an eye on it.

Q Are you aware of any enforcement activities by the Puyallup Indians or by federal officers,of the Puyallup regulations during the 1972 or '71 seasons?

A I am not familiar with the techniques of enforcement by the Puyallups.

(Off the record.)

MR. McGIMPSEY: Back on the record.

Q Jim, we have just had a discussion about certain regulations promulgated by Indian tribes regarding their fishing, and these regulations have been provided to the defendants by the plaintiffs, and I would like to review with you just briefly the extent of your knowledge as to any of the given regulations that I will mention. Are you familiar with the Nisqually regulations of October 30th that were approved, and the dates that I will use are the dates on which they received their final approval?

A Could we go off the record?

Q Yes.

(Off the record.)

Q Jim, have you worked with the tribe, either in adopting or in modifying or in advising them of their current appropriateness, the following tribal fishing regulations: the Nisqually Regulations dated October 30, 1968?

A I was not involved in that.

Q The Quinault Regulations of March 29, 1969?

A No.

Q The Squaxim, of October 27, 1967?

A No.

Q The Makah of July 8, 1970?

A Yes, I worked with the tribe on those.

Q The Muckleshoot Regulations of March 6, 1971?

A Yes, we have worked with the Muckleshoots on those.

Q The Quileute, of October 11, 1941?

A No, I wasn't there.

Q The Skokomish, of January 21, 1964?

A No.

Q The Puyallup, of April 17, 1973?

MR. DYSART: Counsel, as you indicated, that is the date of approval by the BIA. This was originally enacted by the tribe in 1971, the tribe was under the impression that it had been approved and was in effect, and when our records indicated some doubt on that point, they reenacted it and obtained either a re-approval or initial approval as of the '73 date, so the '73 date may be a little bit misleading in that instance.

MR.McGIMPSEY: Okay.

A As requested, yes, we worked with them on that.
Q The Yakima, of March 23, 1966?
A No.
Q And the Lummi, of April 9, 1964?
A No.
Q Okay. Now, in those regulations that you have assisted in or worked with the tribes in, has your experience in assiting them in the adoption of those regulations been similar to your experience, recent experience in the adoption of the Puyallup regulations?
A In the degree to which we feel we can express our professional opinion to the individual tribes and be successful or helpful because those will be accepted, it varies considerably from tribe to tribe, depending upon our acquaintance and familiarity with the tribal people, and taking into consideration the individual policies of the tribe, and the present or past political complexities of the tribal entity, and other things.
Q Then, are you saying that your visit to tribes then is largely based upon the political and social pressures

of the Indian fishery of a given tribe, and so that the type of information you might be providing any tribe would vary, depending on the political or social pressures?

A Not necessarily the type of information. But the manner in which we present it to them would vary, depending upon our relationship to that individual group.

Q What type of information then would you present pretty much to all of these tribes in advising them of the fishing regulations?

A In regard to their general regulations, which would be roughly the same from year to year, we would advise them on such points as the inclusion of emergency clauses, which would empower the tribe, some part of the tribe, to change the regulations, the time of the run, the time of the fishery, to either curtail their fishing if the run size indicators so indicate the necessity to do so to protect the spawning stock, or in the reverse, perhaps to increase their intensity to take advantage of a larger harvestable stock and avoid an over-escapement. That would be an example of what we would provide to them there. As far as the annual regulations where we have the advantage of knowing more, in more detail the condition of the runs that might be taken in the next following few months, we relay to them any information from whatever sources we are able to gather it, that

will help them prepare the regulations for that season.
Q Okay.
A The status of the stocks.
Q Oh, go ahead.
A That is all.
Q When you say any information from whatever sources you gathered, do you have any specific information that you provide to all of them or try, I mean, any specific information that you think that it's necessary for them each to have, each year as they do this?
A It varies, it varies from tribe to tribe. Some have fisheries that will be harvested by other fisheries under jurisdiction of other bodies, such as international bodies, interstate bodies. If we are providing information to the tribes on the coast, we don't necessarily have to consider that those fish will be taken in any significant numbers, perhaps by the Inter-Puget Sound Gill Net Fishery; if we are giving information to the Nisqually, we would have to take into consideration the fact those will be taken in the Inter-Puget Sound Fisheries. In talking to the Makahs, we have to consider all the information available to us through International Pacific, through the state fisheries, through national marine, we have to consider all the regulations from the various entities who have jurisdiction over the fisheries

taking those stocks.

Q When you advise these tribes in the adoption of their annual regulations, do you provide them with any written report as to, for example, containing the information that we have earlier stated would be desired information for a manager to have?

A I would say by and large it's been orally presented to them at the time of the meetings.

Q When it's orally presented, do you specify in your information, for example, in spawning escapement, do you provide actual counts or -- and do you break down your counts for each species of fish that will be running, or is it a general type of information?

A We definitely have not had the advantage of the information or any lengthy record of our own to be able to convey the status of the stocks as we interpret it, based upon spawning count.

Q Are you aware now for these tribes whose regulations you said you were familiar with or assisted in the adoption of, of whether, for example, the Makahs, since the promulgation of their regulations and the approval of their regulations in July 6, 1970, whether they have promulgated annual regulations since then?

A I am sure they have. Pardon me, did you say 1970?

Q 1970.

A Yes, they have.
Q And the Muckleshoots, since their promulgation of regulations on March 6th or approval of their regulations on March 6, 1971?
A Yes, their regulations are prepared annually.
Q The Quileutes, you said you didn't know about Quileutes?
A I am aware that they are updating regulations dating back to the 1940's.
Q The Puyallups, whether their regulations have been annual since --
A I believe they have since 1970, thereabouts.
Q Now, are Indian regulations effective if they are not approved by the BIA?
A Yes.
Q And what would be the legal effect of those regulations? For example, could a --
A Pardon me, but you didn't say legal in your first question.
Q Okay, I am sorry.
A You said effective.
Q Are Indian fishing regulations legally effective, binding on Indian fishermen if they have not been approved?
A I can't answer that.
Q Thank you. You would agree, and I think the joint biological statement has stipulated that enforcement

of fishing regulations is a necessary part of the proper management of fishery?
A I believe it does.
Q Of the tribal regulations with which you have expressed familiarity, do you know whether those regulations provide for penalties for violations?
A I believe they consistently provide for penalties.
Q And are you aware in any specific instance of what the penalties are?
A Oh, generally, it's,in some areas it's a fine, of varying, depending upon the occurrence or re-occurrence of the --
Q Okay, are you --
A (Cont'g.) -- of the occasion. Also there is limitations to the individual fishermen as to his rights to fish following a citation.
Q Are you aware of the enforcement activity of those tribes with whose regulations you are familiar?
A Not in any detail.
Q Well, for the Makahs, do you know if they have enforcement overseers?
A I don't know that they are actually called that. A lot of the tribes have what they call conservation officers who handle this task.
Q For the Muckleshoots, do they have conservation or enforcement officers who enforce their fishing regulations?

A I believe they do.
Q Do you know how many?
A No, I don't know.
Q Or who they are?
A No.
Q For the Puyallups, do they have enforcement overseers?
A I don't know how they handle it.
Q Are you aware at all of the Puyallup enforcement, of their regulations in the last two fishing seasons, 1971-72?
A I am aware that they have regulations and I assume that they are enforced. Now, how they are enforced --
Q You have no knowledge of whether they are enforced or whether they even have the capability of enforcing them?
A When you say enforce, I assume you are implying total enforcement, total absolutely successful enforcement of the regulations;is that right?
Q Now, that is not what I mean. I am implying, whether the tribal, the tribe has enforcement overseers who engage in the activity of enforcing the regulations.

MR. DYSART: Counsel, unless his knowledge of the kind of subject questions that you have been asking here lately is somehow relevant to something that you want to bring out that he is doing or that is in his jurisdiction, I really think you are asking a lot of questions that are more appropriately addressed to other agencies or tribes rather than to him. Now, if somehow his knowledge of whether these conditions do or don't exist influence his decisions that he makes, maybe so, but --

MR. McGIMPSEY: He has testified that enforcement, and we have agreed that it's stipulated in the joint biological statement that enforcement of fishing regulations is a necessary part of a proper management of a fishery. He has also testified that he advises these tribes in the adoption of their regulations. It would seem to me that it would be important if the person advising the tribe in the adoption of the regulations is a manager, a biological manager, it would be important to find out whether he knows whether these regulations are being enforced or not.

MR. DYSART: Well, it seems to me, and particularly the way many of these questions have been phrased, that they are phrased in terms of getting out or attempting to get out the factual information of whether there are enforcement overseers and whether they are enforced, and what are the procedures, and I think this kind of factual information can much better come from people who are more charged with duties in that responsibility.

MR. McGIMPSEY: And I am at least implying in my questions and if I have failed to in the future state the word, do you know of the enforcement activity or --

MR. DYSART: I would just --

MR. McGIMPSEY: That is --

MR. DYSART: I would just caution the witness to keep in mind in the answers to these questions that he is asking you for your knowledge, and if you don't know, then say so, then we can speed this whole thing up rather than trying to grope for things that really don't influence your actions, if in fact they don't.

THE WITNESS: I will probably respond very briefly to any more of those kinds of questions. I would like to say, though, that my experience with Indians in general tells me that they have other ways of enforcing, they have other ways of communicating than we recognize, we non-Indians recognize, as necessary to implement this phase of our management picture.

Q And do you know what these other ways are and how does that affect your --

A Only vaguely familiar.

Q No specific knowledge?
A I have never been able to fully interpret the code, means of communication between Indians.
Q Do you have any opinion as to what the Department of Fisheries could do in its management of the fisheries within the territorial waters of the State to enhance the Indian fisheries on the rivers and Puget Sound?
A What they could do?
Q Yes.
A In the management?
Q Right.
A Probably two general areas where they might concentrate would be to make some readjustment of the overall major fisheries affecting the stocks taken by Indians, to allow a greater number to return to the Indian fishing area; and another--now, I believe they have already made some degree of attempt to do this. And the other, I am aware of that they also are working hard to accomplish, is to increase the production from the streams.
Q Do you have any specific opinions as to how the fishery might be readjusted to enhance an Indian river fishery on Puget Sound?
A Not in specifics, no.
Q Do you have any opinion as to any types of restrictions that might be placed on non-Indian fisheries that are not

placed upon them at this time which could enhance fisheries on rivers and Puget Sound?

A Just exactly how they would do it, I believe they could better devise than I could, but very simply, it would involve a reduction in the numbers of fish, reduction in the catch of the numbers of fish by other fisheries so that greater numbers would return to the Indian fishing areas.

Q Now, referring you to the diagram entitled Puget Sound Commercial Salmon Fishing Area and Preserve, 1972, contained in the joint biological statement, would you indicate in what areas that this restriction on the non-Indian fishery should occur, in your view?

A As areas controlled by the Fisheries Department?

Q As areas controlled by the Fisheries Department.

A I would say all of those areas in Puget Sound, and the Straits of Juan de Fuca controlled by the Fisheries Department.

Q Okay, let's be a little bit more specific. If fishing were restricted in area -- well, would you indicate what areas now that you are saying all areas controlled by fishing -- I take it that we are including in this the exception of areas 1 and 2?

A I said all.

Q Okay. If fishing were restricted, if non-Indians were restricted in areas 1 and 2, what Indian fisheries would be enhanced, Indian river fisheries would be enhanced by those restrictions?

A By enhancement, what do you mean?

Q I mean that Indians would be capable of catching increased numbers of fish without endangering the escapement for spawning.

A Restriction in areas 1 and 2, it's possible that restrictions in area 1 could affect the fisheries of all of the tribes in Puget Sound. Restrictions in area 2, it couldn't be that encompassing because all of the stocks that migrate to a large number of Puget Sound tribes would not necessarily go through area 2.

Q Okay. If restrictions were placed in area 2, would you advocate that those restrictions also apply to the troll fisheries in that area?

A Not necessarily.

Q Okay. And is it agreed that areas 1 and 2 are areas under the jurisdiction during certain periods of the year by the International Pacific Salmon Commission?

A Yes.

Q And so that the regulation of those areas during the period of which we discussed yesterday would be controlled by the International Pacific Salmon Commission; is that correct?

MR. DYSART: To the extent that you know.

MR. McGIMPSEY: To the extent that you know.

MR. DYSART: I think the answer calls for a legal conclusion, but --

A Yes, to the extent that I know.

Q Now, if fishing were restricted in areas 4 and 4-A, what fisheries would benefit?

A I would say there was a good chance that the Indian fishery located south of Whidbey Island would definitely be affected, and it's possible that stocks in 4, possibly 4-A, would also be taken by Indian tribes to the north of that in Puget Sound.

Q You are familiar with the salmon preserves stipulated to in the Joint Biological Statement; are you not?

A Generally.

Q Okay. Do you have any disagreement with the concept of salmon preserves?

A No disagreement with the concept.

Q Do you have any disagreement with the location of the salmon preserves in the waters of the State of Washington?

A I didn't catch the --

Q Do you have any disagreement with the location of the salmon preserves as established by the Department of

Fisheries in the waters of the State of Washington?
A I have not made a thorough examination of their locations or purposes or effects, and therefore, I don't believe I could at this time answer that question.
Q Are there any salmon preserves that you feel would, that would restrict the Indian fishery or fishing, that would restrict an Indian fishery in a way unnecessary for conservation?
A It's possible.
Q Do you know of any specific preserve, and what fishery is restricted by it?
A No, I think I had better leave it in the realm of possibility, I don't know specific details, as I said.
Q Do you advocate restrictions or enclosures in any specific area to increase the Indian take in any given river and, if so, would you state the specific areas and the specific fisheries that you would expect to be affected by such restrictions?
A I think you had better describe the word "advocate," because I am not an advocate, I hope.
Q Okay. Would you favor restrictions of non-Indian fisheries in any specific area of these areas that we are referring to and, if so, which area and what Indian fishery would you anticipate that restriction would increase their fishery?

A I believe that it would be advantangeous to the Indian fishermen on the Nisqually and Puyallup, and Muckleshoot, if the fisheries in areas, well, let's say definitely 2, 1, 4, 4-A and 6, and possibly 5 were reduced.

Q Do you have any idea what percentage of a reduction in the non-Indian fishery would be required to give the Indians their fair share of the fish?

A No, I don't.

Q Okay. Have you ever specifically studied the Department of Fisheries regulations of the non-Indian fishery with the purpose of determining the type of restrictions to be placed on those, that non-Indian fishery, for the purpose of increasing the take on Indian river fisheries?

A No, we have not made any analysis of the type, nor the degree.

Q Then what do you base your general opinion that the restriction of those fisheries will increase the Indian fisheries?

A I don't believe that anybody needs a technical back-ground to know that if somebody in upper Puget Sound is cathcing the fish that somebody in lower Puget Sound won't.

Q Would there be any other management implications of restrictions on the upper Puget Sound commercial fisheries other than the fact that people in lower Puget Sound might catch more fish?

A Management implications?

Q Right.

A I think you have just asked me to write a book.

Q Well, if you could just state briefly what other management considerations there are in closing an upper sound fishery to increase -- is it just simply a matter of closing an upper sound fishery and you increase the lower sound fishery or are there other considerations that a manager would take into consideration in making that decision?

A I am sure Mr. Lassiter would have to deal with the other fisheries, and have to be prepared to handle that situation that the Department of Fisheries might have to tell purse seiners and gill netters in Upper Sound --

Q Let me restrict the question to just biological implications, I am sorry, just biological, are there any other biological considerations the manager of a fishery would have to take into consideration when he restricts the upper sound fishery other than the fact that the lower sound fishery is likely to have more fish in it?

A Yes, he would have to consider that he would probably secure with greater frequency at least the optimum number of fish escaping into each of the streams to provide the escapement goals established by the Department.

Q Would you advocate restricting -- I won't say advocate-- do you think it's desirable to restrict American fishing on Fraser River sockeye runs in the Straits of Juan de Fuca, or the Straits of Georgia?

A I don't know of any American fisheries on Fraser, sockeye, in the Straits of Georgia.

Q Okay, in areas 1 and 2 --

MR. DYSART: Counsel, it seems to me that the way the question is phrased, would it be desirable, is such an open ended, desirable for what, you are talking management, we have got international politics.

MR. McGIMPSEY: I agree. I will withdraw the question and --

Q Do you think it is biologically necessary for the, to increase the Puget Sound Indian river fisheries of the fish that are going into the Puget Sound Indian river fisheries to restrict the American fishing on Fraser River sockeye runs in areas 1 and 2?

A We are speaking strictly biological?

Q Yes. In order to increase the fish that go into Indian river fisheries and Puget Sound, would it be necessary from a biological point of view to restrict the fishing on the Fraser River sockeye runs in areas 1 and 2?

A Yes, to the extent that that fishery incidentally takes fish destined for those Indian fishing areas in the southern Puget Sound.

Q So you do think it's biologically necessary to restrict the fishery?

A I am not sure what your definition of biologically is concerned, but I --

Q As a matter of biology, getting fish to a certain location.

A Getting fish to the spawning grounds to --

Q Or to the Indian river fishery, getting fish to the Indian river fishery would be biologically necessary to restrict the American fishing on the Fraser River sockeye runs?

A Now, when you first asked me you said biologically, and I was assuming you meant would this put more fish on the spawning grounds in the lower Puget Sound rivers, and yes, it would, and if you did that you would increase the production in those streams and indirectly a --

Q Would it --

A It would increase the numbers of fish in the Indian fishery.

Q Do you know whether the Department of Fisheries uses the

commercial fishery in areas 1, 2, 4 and 4-A for getting catch statistics to estimate the returning salmon runs to rivers in lower Puget Sound?
A I am quite sure they do.
Q And I believe that yesterday you indicated that you felt that function could be accomplished by test fishing and it would not be necessary to have a commercial fishery to get that kind of information?
A You can secure a degree of that information by either means.
Q Okay. Do you know what the purpose of test -- you also indicated, I believe yesterday or the day before, that the Department of Fisheries does do test fishing in Puget Sound?
A Yes.
Q And in the Columbia River?
A Yes.
Q Do you know for what purposes that the Department of Fisheries does conduct such test fishing?
A I believe they conduct the test fisheries in an attempt to analyze the runs where there are, where it has yet to be intercepted by other fisheries, so that if necessary, changes in the regulations of those other fisheris might be accomplished to either protect a run if it's failing or to increase the harvest if it's particularly large,

they will--there is a lot of other things, do you want all of them or is that enough?
Q Go ahead and name all of them.
A Well, they also are able to, by examination of the age composition of the stock, determine something about what might be expected in the following year. To some extent they might be able to determine what stocks are entering the fisheries by one means or another of recognizing them in their test fisheries.
Q This would be by markings or something?
A By markings, by other means of identifying the specific river stocks.
Q What types of information on any given run, do you know what types of information on any given run that the Department is gathering when it tests fish?
A Do I know the types of information that they are gathering?
Q Yes, you have named some. They can identify by markings, the type of the run, and I guess you have indicated in your view that they can determine run strength by test fishing, by their present test fishing?
A Yes.
Q Is there any other type of information?
A Oh, there is -- those are general categories. They might also gather some information about the impact of

other fisheries that have already been centered upon the stocks, and relate that information to their early run prediction information, such as spawning ground count and so forth, to evaluate their management program, and to evaluate their prediction methods. The values of their estimates. I mean, they can relate this information to the industry, to the fisheries.

Q How do you know that the test fisheries conducted in Puget Sound and the Straits of Juan de Fuca by the Department of Fisheries have a purpose determining run strength?

A Because I have been familiar with this particular field for a number of years, and --

Q And have they told you that?

A I have done some reading. I have worked with other agencies in other states.

Q And it's run strength primarily that they are trying to gather when they do test fisheries?

A You said primarily? I would say this is a very important consideration in their test fishery, to get an idea of run strength, current run strength.

Q Do you know or have any idea of the number of vessels that would be required to get reliable data on run strength if you were to conduct a test fishery in Puget Sound?

A How large a vessel?
Q What?
A How large a vessel?
Q Well, why don't you state the presumptions that you would --
A You are asking me how many vessels, what kind?

MR. DYSART: I think we are going to have to be more specific.

MR. McGIMPSEY: All right, I will try to be more specific, George.

MR. DYSART: There are all kinds of runs and they are headed in all directions and to say the number of vessels required to run strength generally is too open.

Q If you were in charge of setting up a test fishery to determine run strength in Puget Sound, could you tell us how you would go about setting up that fishery, the test fishery?

MR. DYSART: Now, can you limit this to some specific illustrative example?

Q Well, I would like to know just generally how you would go about it, and I would take it that you would have, that one of the factors that you are going to consider is that there are lots of stocks going lots of places, and my question is, how would you have to account for that information, how would you set up the test fishery?

A Well, in the first place, I don't believe that you could answer that question if you were just going to talk about all stocks of fish in Puget Sound. Now, if we talk about the Columbia River test fisheries, and it is there that is the only fishery in addition to the sport fishery that we use to analyze the condition of the stock and set the season. We are talking about the spring Chinook?

Q We are talking about Puget Sound, Jim, and you have indicated yesterday in your testimony and somewhat this morning that the run strength determinations made by the Department of Fisheries from commercial catches could be done by test fisheries, and now I am asking you if you were the manager of the fishery within the waters of the State of Washington, in Puget Sound, how would you set up a test fishery that could provide the run strength data that is currently being provided by the catch statistics of the commerical fisheries, non-Indian commercial fisheries in the sound?

A We are assuming that the troll fishery is in effect, and we have gathered information from the troll and we proceed from there.

Q The ocean troll fishery?

A Right, assuming we have information from that.
Q Yes, from the ocean troll fishery?
A And also assuming that I --
Q Oh, one question about the ocean troll fishery since this is an assumption that you are building into the model --
A I would have to --
Q Okay. In the ocean troll fishery how is it determined where the fish that are caught are from, whether they are Columbia River fish or whether they are Puget Sound fish?
A It has been determined to a degree over the years by a variety of mark and tag studies of the fish in this case from the Columbia River. And their recovery in that fishery.
Q Okay, from the Columbia River. Do you know whether or not it's feasible to determine whether fish caught in the troll fishery are from Puget Sound and if they are, whether they are from upper Puget Sound river basins or whether they are from lower Puget Sound river basins?
A Taken in what portion of Puget Sound?
Q Can you determine, one, whether the fish caught in the ocean troll fishery are taken from rivers that have, that feed into Puget Sound, and then further, can you determine whether those are from rivers that feed into upper Puget Sound or lower Puget Sound?

A You mean taken from or produced in-- I am not sure what you mean.
Q Okay, produced in.
A "Taken from" means produced in."
Q Taken in the ocean from stocks that originated in rivers and Puget Sound?
A If it were a marked fish from stocks that had been released into a particular drainage, I definitely could, or with a pretty good degree of assurance identify that fish.
Q Okay, could you do it on wild stock?
A If I had marked any part of the out migration of the wild stock, yes.
Q Is it customary to mark wild stock?
A It's been done.
Q Go on.
A Well --
Q It's been done?
A Do we still have information from a troll fishery?
Q You still have a troll fishery and information as we have discussed it from that fishery.
A Okay. Then I would probably, if I was pretty sure of the migration route of a particular species or run of fish that I was concerned about in my test fishery, I would locate test fisheries along the migration route.

Q Okay, now, can you give me a specific example of a Puget Sound run that you know the location of and could set up your test fisheries?

A Well, just take the Fraser River, there is a comparable amount of information.

Q Let's take a run that we are concerned with in this lawsuit.

A We are concerned with Fraser Friver runs.

Q Okay, but I take it that no Indians are claiming rights to fish on Fraser River runs in Indian river fisheries?

A I didn't know we were restricted to Indian river fisheries.

Q Well, that is what I would like you -- I would like you to restrict it to a run that is going to go into an Indian river fishery that is involved in this lawsuit.

A The amount of information on stocks destined for Indian river fisheries varies considerably and in its reliability. I believe I would search the available information and attempt to determine what the migration route is of any particular stock that I would be concerned about testing.

Q Do you know whether migration routes will vary from year to year on any given stock of fish?

A They probably do. I am sure they do.

Q Then this would have to be one of the factors in determining, you indicated you would determine migration routes and set up your fisheries on the routes, how would you know for sure that that was going to be the route taken if the route varies from year to year?

A Just like everything else that varies in this "science", we would have to assume that there would be a reasonable amount of error, but that after a number of years or with a considerable pile of information we could work those kind of wrinkles out of it.

Q Okay, but wouldn't it be a problem if you were to set up your test fishery on what you estimated was the migration route and that turned out not to be the migration route for that year, wouldn't the results of your test fishery be very inaccurate?

A No, I wouldn't say that they would be very inaccurate.

Q Would they be inaccurate?

A What is inaccurate?

Q Well, would they accurately reflect the run strength of that run of salmon?

A A degree of accuracy would be influenced by the results of your test fishery. Now, if the migration route changed in one particular area or not, then yes, the accurateness of your results would vary, but let's assume we know the migration route of the Nisqually fall Chinook run from the Strait all the way down, the variance in the migration route is going to become less as that run moves on down into the sound, because the channel for it to vary in becomes smaller, so if you set a test fishery in several locations along that migration route so maybe you miss it, or don't hit right in the middle of it at the Bonilla-Tatoosh line, as it moves on down you will pick it up, and the accuracy with which you can predict its route is going to improve as you come closer to the Indian river fishery that you speak of.

Q Okay, so under your system of test fisheries, accurate predictions could not be made until you actually got down close to the Indian fishery?

A I didn't say they couldn't.

Q How would you know in any given year whether your results were accurate if you didn't know what, whether you had, were always right on the migration route?

MR. DYSART: Counsel, he has already said that accuracy is a matter of degree here, that he isn't knowing precisely.

MR. McGIMPSEY: Well, he says accuracy gets more precise as you approach the Indian fishery.

MR. DYSART: Correct, but your question was, how would he know that it was accurate. Now, it seems to me he has already said that precise accuracy you probably never have.

Q Okay, let's take this run where this hypothetical run that we are talking about to the Nisqually River. How many locations would you think would be necessary to set up a test fishery on?

MR. DYSART: For what run or what destination?

MR. McGIMPSEY: It's a hypothetical run to the Nisqually River, we haven't designated the species.

MR. DYSART: You have designated now the river. All right.

A Assuming, you are speaking of the Nisqually River?

Q This is the hypothetical that you had just posed. All right, let's see,then,this Chinook salmon run in the Nisqually River, how many locations would you think would be necessary to set up a test fishery on --

A Here I would almost prefer your word desirable, but --

Q Okay, desirable.

A I would assume that we might want to start checking this run at the first opportunity we had, and that would be out close to the Bonilla-Tatoosh line, and then perhaps in, oh, say, three other locations on its route from there to the Nisqually River mouth.

Q And where would you locate your three other locations?

A I would be influenced probably by whether or not there were other fisheries. Are we assuming this, that there are no fisheries in Puget Sound until we reach the Indian fishery?
Q No.--let's assume that there are no other fisheries in Puget Sound at this time, and all that you have got on Puget Sound is a test fishery to determine runs strength.
A I am going to assume that I am conducting this test fishery year after year and that I am developing a record of information.
Q Right.
A You could probably get by with test fisheries in two or three locations.
Q Now, have you had any experience in managing or in conducting test fisheries on Puget Sound?
A I have had experience in the formulation of plans to conduct test fisheries, yes.
Q In Puget Sound?
A Yes.
Q And would you describe that experience?
A Well, directly, we have worked with the Muckleshoot Indians, and the State of Washington Department of Fisheries in establishing test fisheries on the Green River, and others.
Q Have you had any experience with establishing test

Fisheries in the sound itself or in the Strait of Juan de Fuca?
A I have not been directly involved. I don't really think it's --
Q Have you analyzed the data collected by the Washington Department of Fisheries, test fisheries in the Strait of Juan de Fuca or in Puget Sound?
A We have never had an opportunity to analyze the raw material of the Department of Fisheries on that.
Q Have you ever been requested to do that?
A No.
Q So that the basis of this, of your opinion as to the location and the numbers of test fisheries that would be required to properly analyze this hypothetical Chinook run to the Nisqually River is based on theoretical knowledge and not on any actual experiences or knowledge you have of test fisheries in Puget Sound or --
A I have actual knowledge of test fisheries in Puget Sound. I also have actual knowledge that those test fisheries are conducted simultaneously with commercial fisheries.
Q What is your actual knowledge of those test fisheries, do you know what information they have gathered?
A I know generally the types of information they have gathered, and in some cases where they have gathered it.
Q Do you know what runs they have gathered it on?

A No, and in some cases I am sure they don't know either.

Q Okay. Do you know the number of vessels employed in the test fisheries?

A It would depend upon the time of the year and whatnot, it probably varies from one to maybe half a dozen.

Q Do you know of any specific test fishery that you have actual knowledge of that was conducted in the Puget Sound or the Strait of Juan de Fuca?

A I am aware that the Canadians test fish, I believe in area 20.

Q Okay, let's take the Canadian test fishery in area 20. Now, what do you know about that test fishery?

A I know that it exists and if I wanted the records of the results of the test fishery, I could probably secure them.

Q But I want to know what your knowledge is today.

A I don't have the records with me.

Q You don't have any knowledge of how many boats they use?

A I couldn't say exactly how many.

Q Okay. You don't have any knowledge of the times that they have conducted that test fishery?

A Yes, it would have to be while the fish are enroute through that area.

Q But do you have actual knowledge of the times, years, months?

A I don't have the record with me, I can't answer that.

Q Do you have actual knowledge of the purpose of the information that they have gathered?

A It would be generally that that I have already covered on the subject.

Q Have you read their reports?

A I can't recall making any particular analysis of that situation.

Q Am I correct in understanding then that the basis of your testimony today on the feasibility of conducting test fisheries in Puget Sound and in the Strait of Juan de Fuca is based on some general broad knowledge that you have as a fishery biologist but not on any specific knowledge that you have of the conduct of test fisheries?

A I said I have specific knowledge and broad knowledge.

Q Well, I have tried to find out what specific knowledge you have of test fisheries and so far each time you have mentioned one you tell me that you have not reviewed the records or you don't know.

MR. DYSART: Well, counsel, you say his general knowledge today. I don't know by that if you mean April 26th. We have already indicated that he was not asked to bring any specific documents or data with him, the deposition is being taken in a city away from his office, there was no advance information as to the scope of the deposition or coverage, and much of this information according to the original stipulation regarding discovery in this case was to have been sought through interrogatories. Now, you bring him here and we have been going for three days, or we are in the third day now, trying to probe in detail things that require, it seems to me, a resort to records if he is going to give any meaningful answer. I just think you are asking more than can be expected. I also would suggest that we are an hour and a half into this, maybe we ought to take a break here.

THE WITNESS: Before we do, could I perhaps elaborate on my reply to you?

MR. McGIMPSEY: Sure.

THE WITNESS: Or modify my reply to that last general question of yours?

MR. McGIMPSEY: Surely.

A I recall, my memory now in the case of Canadian test fisheries that we very definitely have reviewed the results of test fisheries on sockeye, pink salmon and Coho salmon in presenting our advice to the Makah tribe, and I very definitely recall conferring with Mr. Lassiter I believe last year on the results and the activity concerning their test fisheries at Discovery Bay and one other point in Puget Sound, and relating this to the returns of fish to the Puyallup River fishery.

MR. McGIMPSEY: Okay. I have to just make one statement in response to George's statement, and that is that I don't believe that we are asking the witness to provide us with data on test fisheries, what we are asking is that the witness has indicated that test fisheries could accomplish the same thing presently being accomplished by non-Indian commercial fisheries with regard to estimating run size of runs of salmon coming into Puget Sound. I have tried to explore with the witness the extent of his knowledge of test fishing to determine the basis upon which he bases his opinion. I am not asking the witness to provide any specific details about particular test fisheries. I just want to explore with him his knowledge, and when he says that he has specific knowledge, I am assuming that he has with him some specific knowledge of a particular test fishery. I don't expect him to come up with the published results of that fishery and that is not what we are here asking for, but if he has formulated this opinion and says that it is based on specific knowledge of test fisheries, I think as he has just indicated for the record that he should indicate those test fisheries that he has analyzed at least, and what the basis of the knowledge is.

MR. DYSART: Well, I don't want to get into extended argument with you here, Earl, but it seems to me that you have been asking specifics, you asked him how many boats were used in the Canadian test fisheries, you asked him what run it was conducted on, you asked him what were the reports and results of it. I think as far as he gives you an answer that is perhaps the best he can recall under the conditions of this deposition, you will follow it by something in which you ask him specifics, and you say well, are you formulating this opinion without specific knowledge. Now, the specific knowledge he brings in his head with him to this deposition is, I would assume, far more limited than knowledge that might be available to him back in his office if he is being asked to formulate an overall recommendation, and the same is true of your staff or any other regulatory agency staff. They can't be expected to formulate a specific recommendation off of the top of their head or at least I hope they wouldn't, without carefully checking of records and data that this man does not have here, and was not asked to bring here.

MR. McGIMPSEY: Okay. Why don't we take a break?

(Recess.)

Q Let's shift our focus away from test fishing to the coastal rivers involved in this lawsuit. In your opinion, has the Department of Fisheries management of any of the Western Washington coastal rivers involved in this lawsuit been inconsistent with what has been unnecessary for conservation?

MR. DYSART: Are you asking him whether any of the regulations which --

MR. McGIMPSEY: Okay, let me rephrase the question.

Q In your opinion, has the Department of Fisheries management of any of the Western Washington coastal rivers involved in this lawsuit as it affects Indian tribal fishing been not necessary for conservation?

A You said management, and we are -- I am taking the broad --

Q The broad term management at this time.

A Of the word. Management of those streams I would say is necessary for conservation.

Q Have any of the regulations promulgated by the Department of Fisheries with regard to rivers in Western Washington, coastal rivers in Western Washington involved in this lawsuit been not, as it affected Indian fishing, been not necessary for the purposes of conservation?

A I don't have those in front of me and I don't believe

I can tell you, give you my detailed answer on that one. Unless you have a specific one in mind, I might recall.

Q Are you talking about rivers, you don't have the rivers in front of you or --

A You are talking about regulations in total?

Q Regulations, right. Have you reviewed the regulations at any time promulgated by the Washington Department of Fisheries for the coastal rivers of Western Washington involved in this lawsuit?

A Yes.

Q Okay. When did you review those regulations, or have you reviewed those regulations?

A As late as the time of their proposals for 1973.

Q Now, in reviewing those regulations, have you ever made, formed an opinion that those regulations as they affected Indian tribes were unnecessary for the purposes of conservation?

A It seems I have, but I don't have them with me, I don't believe I could pick out specific parts of the regulations that I thought were unnecessary.

Q Have you so advised the Indian tribes?

A I believe I may have.

Q Do you know for sure whether you may have or do you --

A I have advised the tribes.

Q That the regulations for the Western coastal rivers are unnecessary for conservation?
A There, again, I think you are talking of regulations in general on all-over regulations.
Q No regulations of the Department of Fisheries?
A Do you mean particular parts of the regulations?
Q Right, have you ever advised Indian tribes that have fisheries on the rivers in the Olympic Peninsula that are coastal rivers, have you ever advised them that the annual regulations promulgated by the Department of Fisheries setting seasons and restrictions on gear, etc., were unnecessary for conservation?
A May I consult my counsel?
Q Yes.

THE WITNESS: He is saying regulations, does that mean have I advised them that their regulations in total are unnecessary or part of their regulations?

MR. McGIMPSEY: Well, any part of their regulations.

MR. DYSART: Earl, can you give us, I mean they are your regulations. You must have them there. Can you give him a specific regulation and ask him a question in regard to a specific regulation?

MR. McGIMPSEY: Okay, I thought we could save a lot of time if you have just at any time ever advised Indian tribes on those rivers whether any part of our regulations were unnecessary for conservation.

MR. DYSART: All right, Jim, if on any occasion with respect to any regulations you have ever said that a particular provision was in your judgment unnecessary, then the answer to the question he is asking you is yes.

A The answer is yes.

Q Okay. And do you recall those occasions when you gave that advice?

A I don't recall the occasions. But I might recall the type of advice.

Q Okay. Do you recall it?

A The only part of those regulations that I, at the moment, could positively say I thought were unnecessary was the stopping of the fishing season on November 30th.

Q Okay.

A In other words, they close the season on November 30th and I didn't think that was always necessary,on some of those streams at least.

Q And what was the basis of your opinion that it was unnecessary for conservation to close on November 30th?

A Probably the basis was that I hadn't seen any proof that it was necessary.

Q Okay. Do you believe that the Indians exercising fishing rights under treaties are entitled to a fair and equitable share of the fish that are in the fishery that comes within the jurisdiction of the State of Washington?

A I believe that is the concept under which the Department of Interior treats the Indian fishery and I am an agent of the United States.

Q What is your definition of a fair and equitable share?

A I don't have one.

Q Okay. Have you at any time ever tried to develop a biological model on which a fair and equitable share could be administered?

A No.

Q Are you familiar with the model that is used in the so-called/So Happy case on the Columbia River?

A No, not to any extent. I don't, I am not exactly sure what you mean by model.

Q Okay.

A Is it something in writing?

Q Well, it's in writing in the decision, I think. The method by which Indians on the Columbia River are assured of their fair and equitable share of the fish.

A I don't understand your question.

Q Okay.

A Because I don't know what you mean by assured; assured by whom?

Q Well, I take it they are assured by the federal court in the So Happy Case?

A I would have to consult my counsel for that.

Q Do you have any ideas on how you might assure Indians in the Puget Sound and coastal rivers of Western Washington of a fair and equitable share of the fish, at least from a biological point of view, what would be a biologically feasible way or acceptable way of allowing Indians a fair and equitable share of the fish?

MR. DYSART: Well --

A I just don't understand what fair and equitable would be, and then I would have to understand what conditions you are speaking of.

Q Okay, I just asked you if you have ever considered that, I am not asking you if you have got one; have you ever considered --

A I have heard the word, I have spoken the word, the thought has banged around in my mind but have never devised any kind of a solution to finding an answer to that.

Q Do dams affect salmon abundance?

A Definitely.

Q And are there power dams and flood control dams on the

watersheds that feed Puget Sound?
A On some of them.
Q Are you familiar with those dams?
A Some of them.
Q As to the power dams, do you know who authorizes power dams, what governmental agency authorizes the placement of a power dam on a river?
A I am generally familiar with the United States licensing of power dams in recent years but I am not aware of the rights, responsibilities, jurisdiction or necessity of state approval, or others who might need to approve those.
Q In what manners do dams affect salmon abundance?
A The dam might block the migration route of salmon to spawning areas; in other words, making them inaccessible to the salmon that might change the conditions on the spawning grounds, eliminating or reducing the production or the use of that spawning area. In some areas where there are passage facilities in dams, the dams might cause delays in the migration of the fish which directly or indirectly could cause losses of the spawning population. There are many other things to consider.
Q Do dams, power dams or flood control dams, in your opinion, deteriorate the stream environment for salmon spawning purposes?

A In many cases they do.

Q How about drainage control projects, do they similarly --

MR. DYSART: Isn't all this covered in the Joint Biological Statement?

THE WITNESS: Boy --

MR. McGIMPSEY: Will you stipulate that dams, power dams, flood control dams, drainage control projects, irrigation projects all harm the stream environment and reduce the stream potential for production of salmon?

MR. DYSART: If you change that to "that they can harm it," I would say yes.

MR. McGIMPSEY: Will you stipulate that they do harm it?

MR. DYSART: In essence, yes.

MR. McGIMPSEY: Okay.

THE WITNESS: I agree with that.

MR. McGIMPSEY: You are not under oath, so I take it that the witness --

MR. DYSART: Oh, all right, I am representing the parties that are willing to stipulate.

MR. McGIMPSEY: Stipulate to that?

MR. DYSART: The party to the case, and we are willing to stipulate.

Q Will you also stipulate that the U. S. Government is the agency or agencies thereof are the ones who have to approve the placement of power dams and flood control dams on rivers and watersheds of this lawsuit?

A I would say there are dams --

MR. DYSART: Counsel, since that is legal, if you wouldn't mind my answering, I would say we will stipulate that that is true certainly on navigable waters or on streams affecting navigable waters. Now, there are some small projects that are not required to be licensed by the United States.

THE WITNESS: May I go off the record?

(Off the record.)

MR. DYSART: May we go back on the record? Counsel, with regard to the federal licensing there are some projects which were initially constructed prior to the licensing requirement times. Many of those are now up for possible relicensing. Licensing requirements are more stringent now than in the past, and we would certainly stipulate that for dams on most of the waters of this area, the navigable waters, and many waters affecting navigation do require today a federal license if they were to be constructed or altered or extended.

Q Have you ever testified on behalf of Indian fisheries before any hearings of the Federal Power Commission or the

Corps of Engineers regarding dam construction?
A When you say "testified," do you mean by appear and speak or did I --
Q Did you appear and speak?
A The only occasion that comes to my mind is about, approximately a year ago when I attended a Corps of Engineers' hearing concerning flood control proposed in the Puyallup system.
Q And at that time did you testify that, as to the effect that the dam would have on Indian fisheries?
A I made a statement to that effect, yes.
Q From a strictly biological point of view, what would be the most efficient way of harvesting anadromous fish?
A Efficient in what respect, to secure a what?
Q To secure the maximum harvest and provide for the optimum spawning escapement.
A Then in that sense I believe the most efficient manner would be some way in which you could be positive of the identity of the stocks upon which you are fishing.
Q Would any particular type of gear be the most efficient way, in your opinion?
A In determining the identity of the stocks, I don't believe that it would make any difference.
Q Do you think that fish traps should be an authorized

form of gear for catching fish, anadromous fish?

A May I ask under what conditions?

Q Do you think that fish traps set across the mouth of the river or in such a manner that they could capture the entire harvest, this is assuming that there would be no other harvest of the fish in the sound, that is to say, would be an efficient and -- would be a desirable way to harvest the salmon resources of the State?

A It might in some cases be desirable.

Q Would it be desirable in all cases?

A I haven't examined all cases, and I couldn't answer that.

Q Okay. In those, you say in some cases, in what cases would you think it would be desirable?

A Oh, probably in cases where it would be feasible to do so on the basis of the size of the river and the size of the run that would be intercepted by it.

Q You have indicated two factors that would contribute to the feasibility of traps. Perhaps we could take a specific river. Do you think it would be feasible to set fish traps on the Skagit River to harvest all the fish and allow for spawning escapement?

A I would have to know what you meant by all the fish; how many are you talking about?

Q Okay, assuming that there would be no commercial fishery in the sound, do you think that it would be feasible to establish a fish trap or traps on the Skagit River to harvest the entire stock of harvestable fish and provide for an optimum escapement?

MR. DYSART: Are you talking physically feasible, politically feasible?

MR. McGIMPSEY: No, I am talking about feasible as he described it, he said feasible was conditioned on certain size --

THE WITNESS: Size of the river and size of the run.

MR. McGIMPSEY: And size of run.

MR. DYSART: I still want to get the context of the question. Are we talking about politically feasible, socially feasible?

MR. McGIMPSEY: Let's say just biologically, not politically or socially, let's say biologically feasible.

THE WITNESS: I don't really get your relationship to traps and biology, but --

Q I take it that the considerations you have just mentioned are biological considerations and George has indicated some other considerations here and I want to restrict it to --

A Did I not specify they were only biological? I said it would depend upon the size of the river, and the size of the run.

Q Okay, well, let's just take from a biological and a mechanical or physical point of view.

A Mechanical or physical?

Q Would it be feasible to establish fish traps in the Skagit River so that you could completely harvest all of the harvestable fish for that river in the trap and provide for an escapement, optimum escapement of the salmon in the tributaries?

A I can't answer that because I would not be aware, since there is a troll fishery and other fisheries on the stock, that we would be able to guarantee with a trap that we would have a spawning escapement. If we didn't receive a spawning escapement, an optimum spawning escapement -- first of all, we have to receive it and I don't know that we have received it.

Q Okay. But I take it if there were no commercial, there were no non-Indian commercial fishery or no commercial fishery of any kind in the sound, would it be possible, do you know of any instance in the Skagit River where the spawning escapement has been so low that there has been no fishing at all allowed on the river?

A I don't have the records in front of me, but I would guess that we probably have experienced spawning escapement on that river below what is optimum for spawning, on various species.

Q Let's assume that all the fisheries are operative, right now as they are today, okay? Could a trap or traps be set in the Skagit River so as to allow a harvest of the fish that would go up the river and also an escapement of fish to go up the river.

Q This would be in place of any other type of river fishery?

A I interpret your question to assume that we will receive some unknown species since you haven't specified.

Q Okay.

A And --

Q No, I am just talking about the Skagit River.

A A run to the Skagit River, which has, which is large enough to include both a harvest and an escapement for spawning --

MR. DYSART: Do you assume, counsel, in this question, did you assume in this question the existence of a regulatory authority which has the right to determine the extent to which the trap will be open or closed; in other words, control over the operation of the trap?

MR. McGIMPSEY: I am assuming in this question that there will be a sufficient number of fish enter into the trap or to the area where the trap would be located that there would be fish to be harvested and there would be enough fish for a spawn escapement, that is my assumption. I am not assuming now -- and I am assuming that as a biologist you would have some management over the trap to assure there would be a spawning escapement, but I am not assuming as to any political or economic factors of that. All I am asking is from a strictly biologicical and physical considerations of putting a trap in.

Q Do you have an opinion as to whether or not a trap could be placed in the Skagit to harvest the fish?

A Yes, a trap could be placed in the Skagit to harvest the fish.

Q How many traps would it take?

A I don't know. Are we talking about only the Skagit River?

Q We are talking about only the Skagit River.

A I would have to make a thorough examination of that river.

Q How many mouths does the Skagit River have?

A How many miles?

Q Mouths?

A I am not sure, I would have to take a quick look at a map, I think.

Q Okay, you said that -- okay, let's assume that you could, no matter how many mouths there were, you could put a fish trap in each mouth so that you could control the total fish coming into the river.

A No, wait a minute, I didn't say that, I said you could harvest.

Q Okay, you could harvest fish in a trap; is that all you are saying?

A That is the way your question was phrased.

Q Could you make a trap so that you would take all of the fish and release from the trap the number required for a spawning escapement and keep the rest for harvest, could you design that kind, biologically, and economically, could that kind of a trap be placed in the Skagit River?

A I don't know.

Q Are you familiar with hatchery racks?

A Some.

Q What problems,have you ever experienced any problems in your management of hatchery racks caused by high water?

A I have never managed a hatchery rack.

Q Didn't you testify yesterday that you had under your supervision twelve hatcheries?

A No, I don't have them under my supervision.

Q Well, I didn't mean immediate supervision, but I meant --

A Even indirect.

Q Was it just the plantings from the hatcheries that you supervised?
A That we programed.
Q Programed?
A The fish to be released from those hatcheries.
Q Okay, then going back to just your general knowledge of hatchery operations and hatchery racks, are you familiar at all with any problems that high water creates at Hatchery racks?
A Please understand there are many different kinds of hatchery racks, and high water affects them just like low water affects them.
Q Okay, and what are the effects of high water on the different kinds of hatchery racks? Okay, have you ever known of difficulty in maintaining a hatchery rack because of high water, maintaining it in its location in its position because of high water?
A In some cases, yes.
Q And I take it -- do you have any idea of what it would cost to put a trap across the Skagit River?
A No.
Q Are you at all familiar with the Swinomish traps?
A I have seen them.
Q Where are the located?
A Oh, generally westward of the Indian reservation.

Q Are they at all designed to trap the entire fish run that will enter the Skagit River?
A I don't believe they are.
Q They are just traps to catch fish, basically?
A Like most fish traps.
Q I mean without any aspect of control in them, control of the fish run?
A Well, I don't know what you mean by control.
Q The Swinomish trap is not designed to --
A Controlled a certain part of it, that part that it catches.
Q It affects a certain part, it doesn't control it; is that correct?
A Once it has it in the trap, it's under control.
Q The fish are under control?
A That part of the run.
Q Is there any difference in food qualities between fish at the mouth of the river or in the river, and fish in the sound?
A It depends on who is eating the fish.
Q Is there any difference in their commercial sale value?
A Sometimes.
Q And what would the difference be?
A I don't know. I don't know what you are referring to. What species, what time, what fisheries?

Q In Chinook salmon, are Chinook salmon that are caught in Puget Sound commercially more salable per pound than Chinook salmon caught by the Nisqually Indians in the Nisqually River?

THE WITNESS: Do I assume commercially, he is eliminating the Indian who is eating it?

MR. DYSART: Better ask him.

Q That is right, commercially, that he sells in the commercial channels.

A At some times there may be no difference and other times there may be differences.

Q And what would the difference be at the time that there are differences?

A It would be in the numbers of cents or dollars per pound that exist at the time.

Q Would the fish caught in the sound bring a higher price than the fish caught in the Indian river fisheries?

A I say sometimes, and sometimes not.

Q That is the same times we are talking about, at the times there are a difference would the fish caught in the sound bring a higher price than the fish caught in the river fishery, per pound?

A This is assuming that both of them are catching the same stock of fish?

Q Right.

A When there is a difference, and I am not sure that I would cover all cases, the numbers per pound in the salt chuck might be higher than in the river. Salt chuck means marine area.
Q And what would the difference in price per pound be attributable to?
A It would probably be attributable to the standards established by the industry and the preference of the consumer as he has knowledge of the value of that fish.
Q So that from a market condition point of view, the fish caught in the sound, when there is a difference, is a more valuable fish than the fish caught in the river?
A From strictly --
Q Per pound?
A In strictly a dollar and cents standpoint under the standards that I have very clumsily defined, I would agree.
Q And is that based on the, at least perceived quality of the fish by those who are commercially buying the fish?
A The quality as they might define the word.
Q Do you know if there is any difference in the actual food value, calories, oil, contents, etc., of a fish caught in the sound and one caught in the river fishery?
A In what respect, do you mean value?

Q Well,does the fish caught in the sound have a higher calory content than the fish caught in the river?

A It might be because of the general difference,in some cases very minute and very subtle, in the energy stores of the two. It depends on whether you are having heart trouble or not. I think if you are having problems with your cardiac system you might avoid some of those very rich fish that are taken in the sound to avoid cholesterol.

Q Your answer is that it would have a higher calory content if it were caught in the sound than it would in the river? I am not asking you about any particular buyer's heart attack problems.

Q Depending upon where you caught him in the river, it may not even be measurable; or time of the year or species involved.

Q Would you have any idea if hypothetically we could establish a trap across a river that would take all of the fish coming into that river and then release the number of fish for spawning, do you have any idea as a biologist how you would segregate out the fish that are spawning to different spawning grounds on the tributaries of that river?

A I would have to make an analysis of the river to determine if there are different spawning grounds.

Q Let's assume that there are different spawning grounds, for the purpose of this question, on the river.
A For one species?
Q For one species of fish. How would you determine that your escapement, when you segregate out the fish for escapement, how would you determine that you were not overloading one spawning ground and underloading another?
A I would have to study it.
Q Do you think it's possible to make that kind of a determination from the examination of a fish in a trap?
A Yes, over a period of years, experience.
Q How would you do it?
A Would I study it?
Q Yes, but how would you go about making that kind of determination of the fish in the trap?
A I would count them.
Q How would you know, when you look at a fish, is there anything that would identify that fish as going to one spawning ground as opposed to another spawning ground?
A I would study it for a number of years.
Q Do you know of your knowledge today if there is any way to determine at that point whether a particular fish were going to go to one spawning ground or another spawning ground on the tributaries of that river?
A In some rivers it is possible to have a pretty fair

knowledge by examining, or by analyzing the time and all of the other considerations that a particular stock is entering a river that it is destined for a particular part of the system. And I refer to the Fraser River studies.

Q Is there any danger to the fish from handling them in a situation where you had a trap across a river and were catching all of the fish and releasing the number necessary for escapement, is there any danger to the fish mortality-wise or otherwise, that would be caused by handling the fish in the releasing of them?

A It would depend on how they are handled, as to what degree "danger" there might be.

Q As a biologist, would you say that handling of fish does not harm them?

A I don't understand what you mean by harm; do you mean harm to the point of killing them?

Q Is there harm --

A Causing pain?

Q Harm to the point of either causing mortality or in affecting spawning behavior?

A I would say it is possible that in any kind of situation where you intercept a fish by whatever means you might take a chance on "harming it".

Q As a biologist, would it be more desirable to you to

have fish pass through the river unhandled by men as opposed to having the fish caught in a trap and handled by men?
A What do you mean, undesirable?
Q Which would be more desirable to the fish, from your point of view, from whatever possible effects that -- I take it that you have just testified that it is possible in handling fish that harm can come to those fish either in increased mortality rates or in adversely affecting spawning behavior?
A To some degree down to minuteness.
Q Okay, to whatever degree that it would affect them would it be from a biological point of view, would it be more desirable to have the fish not be handled?
A I think if I were a fish that is the way I would look at it.
Q I am talking about you as a biologist.
A I think I would prefer to keep all hands off of the fish if all I wanted is for him to get to the spawning ground so that he can have a maximum degree of success there.
Q Do you know of any trap that has ever been designed or have you read any literature of traps that have been designed to catch every fish that would go into a river?
A I am aware of instances where it was the hope that that

might occur.

Q Okay. Do you know whether that actually did occur?

A I don't know of any occasion where it ever actually occurred that all of the fish were taken in a trap on a drainage that was not subject to freshets of flooding.

Q There is a description of reef netting in the Joint Biological Statement. But as I recall that description of it, there is not much mention about reefs.

A About reefs? Pardon me?

Q About reefs, and then reef netting fishing method. Could you describe to me what role the reef played in -- well, how did the term reef netting get its name, do you know?

A I believe the Indians originated this form of fishing, and they created through various materials,lines and kelp and other things, an artificial reef that they hoped would guide the fish into their trap.

Q It's your testimony then that the Indians created artificial reefs?

A Yes.

Q Do you know whether the Indians actually used natural reefs at any time?

A I believe they might have stumbled onto the idea by doing so. I would guess that might be possible.

Q The idea came from natural reefs and then they stumbled onto the idea of artificial reefs?

A Oh, I am not really positive, I haven't made that thorough a study of it.

Q Well, which did the Indians do first, natural reef fishing or artificial reef fishing?

A I don't know.

MR. McGIMPSEY: That is all the questions I have got.

CROSS EXAMINATION

BY MR. DYSART:

Q Jim, there was some discussion earlier in the deposition with regard to the Lake Quinault sockeye fishery, and the possible cause of declining or alleged declining sockeye runs. Has there been any effect in terms of the amount of spawning area open to those runs over the years, has the spawning area increased or decreased from what it was twenty, twenty-five years ago?

A I don't know specifically that it has, George. The possibility exists.

Q Have the conditions on the spawning area varied from year to year in terms of the environmental conditions of the stream; are some areas open to effective spawning in some years that because of stream changes might not be open in intervening or other years?

A Yes, I have witnessed an actual major reduction in the size of the spawning area because of the meandering nature of the river, and semi-permanent changes in the location of the main channel.

Q Now, you also mentioned that the Quinault Indians had established a deadline in the upper portion of Lake Quinault beyond which they did not allow the non-Indian fishery on Lake Quinault to take place. Was this restrictive deadline also made applicable to the Indian fishery?

A Yes. I might mention further, George, if I can on that point, the tribe did restrict the type of gear that might be used in Quinault Lake to avoid the catch of sockeye salmon.

Q This would be gear that is used for fishing for other species of fish in the lake; is that right?

A Yes, primarily trout.

Q Now, during the questioning with respect to the identity of federal hatcheries that produce an anadromous fish for areas affected by this lawsuit, you listed a large number of those hatcheris and then I believe you said you feel you might have missed some. You did not list

any hatcheries in California; are there any hatcheries
in California that produce fish that frequent any of the
waters involved in this lawsuit?
A There is one. Coleman National Fish Hatchery, located
on the Sacramento drainage.
Q And are there other federal activities or programs
that affect fish supply that would be available to
Indian tribes in Western Washington, in addition to
hatcheries? Hatcheries were mentioned as one.
A Oh, yes. Of the various managers of federal land or
those -- well, for example, Bureau of Land Management,
Forest Service, National Parks, they conduct work in
streams, expend funds to protect and enhance the stream
environment, the Corps of Engineers is active in --
and Bureau of Reclamation is active in enhancement in
mitigating measures that would affect these fish, and,
of course, I could go on.
Q You mentioned at least one hatchery, as I recall, that is
located on an Indian Reservation, the Quinault Hatchery,
I believe. Are there other propogation facilities on
other reservations that produce fish that add to the
availability of fish in the Western Washington and off-
shore area?
A Well, the tribe, the Quinault tribe itself, has a
program on Quinault Lake that produces anadromous fish.

The Lummi Hatchery program will produce fish. The Squaxims, in a cooperative program with Washington Fisheries Department, can be included in this category along with the Tullalips, the Warm Springs Indians in Oregon have an active propagation progam, including the present construction of a hatchery, national fish hatchery.

Q Do these facilities benefit the non-Indian fishery?

A Yes, they do.

Q Fish that are produced at these facilities go into some of the non-Indian fisheries in the Northwest; is that correct?

A This, I might make a point that it was with this full knowledge that the Quinaults went ahead with their efforts to secure a national fish hatchery on their reservation, they were fully advised that the production of this hatchery would benefit in many cases the non-Indian fishery to a greater extent than it would benefit the fisheries of the Indians on the reservations. The same is true in consideration of the Makah, and several Indian tribes in southern Puget Sound, that are now requesting federal participation in a hatchery program to benefit that area.

Q Now, there was discussion concerning your role in advising Indian tribes with respect to their regulations.

In the work that you have done with Indian tribes and in the associations you have had with them, do you have any feeling that the tribe has any stronger concern over their claim of autonomy or sovereignty in the managing of their affairs, and specifically in the promulgation of regulations that may affect their fisheries?

A I have a feeling that most of them feel they have a right and want to be a part of the management picture.

Q Well, do you have any feeling for their attitude, regardless of whether it's a -- I am not asking you whether it's correct or an incorrect legal interpretation of their powers, but of their feeling as to their autonomy or sovereignty in the making of tribal regulations that affect their fisheries, or that control their fisheries? Do they feel this is their responsibility or that it's the federal government's responsibility or the state's responsibility?

A I think they feel that it's their responsibility to regulate their people.

Q And in their contacts with you when they seek advice from you or when you offer advice to them, is this feeling at all, or does this feeling at all influence the nature of the relationship you have with them in rendering this advice?

A Yes, it does.
Q In what way?
A Just like I would with any cooperator, I would have to try to determine what uses they might want to make of the fish, and how they might want to fish for them.
Q Do you feel that you have the same latitude in making suggestions to them that you would have if you were making suggestions to -- well, let me phrase it this way, suppose that the regulations of the Indian fishery that you were being asked to advise on were being made by a federal agency, such as the Fish and Wildlife Service, and that you were being asked by the responsible head of that agency, we will say the regional director, to advise him with respect to the regulations, do you feel that the latitude you have in making recommendations to the tribe, on their recommendations, is the same as or different than the latitude you would have in making regulations, say, to the regional director of the Fish and Wildlife Service if he were the one making the regulation?
A May I explain, George, the regional director of the Fish and Wildlife Service is my boss?
MR. McGIMPSEY: Do you want to go off the record?
THE WITNESS: Could we go off the

record?

MR. DYSART: Let's keep on the record.
What I am getting at is, the tribe has feelings, do
they not, of what they are going to want to do, and
they haven't indicated to you that they are necessarily
going to adopt what you tell them?

A That's right.

Q Now, is it true then that in making recommendations to
them you are guided to some extent by what you feel
you can persuade them to accept and not just solely by
the ideal that you would like to see if you had full
control of the regulation?

A This is true. I attempt to interpret their interest and
need from what they tell me and I don't always know
what those are in total, and further, I try to
adjust the framing of my suggestion to allow them some
latitude in selecting the final regulations.

Q We have had a lot of talk throughout here about examining
things solely from a biological standpoint, or consider-
ing a particular aspect solely from a biological stand-
point. But is it correct that when it comes to making
recommendations for a tribe, to a tribe, with respect
to its regulations, that you have to consider things other
than just the biological aspect?

A That is correct.

Q And that even your biological recommendations are influenced by other factors that are present in determining this content of the regulation?
A That is correct.
Q Would it be correct to say that it is unrealistic in any regulatory scheme, whether it be federal, state or tribal, to think of it solely in terms of its biological aspect?
A I cannot imagine that any such condition ever exists.
Q You cannot imagine any condition existing where only the biological would be so?
A That's right.
Q Now, with respect to the Makah tribe, there was reference to advice on that tribe, is there an advisory body that that tribe has established consisting of state and/or federal biologists that that tribe looks to for suggestion?
A Yes, the body was established for the tribe at the, I believe the concurrence or advice of the State Department.
Q And do you serve on that body?
A Yes.
Q Is there a representative of the Washington Department of Fisheries on that body?
A Yes.
Q Are there any other biologists on the body?

A Biologists from the National Marine Fisheries Service.
Q And that body does express itself to the tribe with respect to their proposed regulations; is that correct?
A Yes.
Q And does the Washington Department of Fisheries biologist bring into the discussions of that group, prior to the time that the group makes its recommendations to the tribe information from his department concerning the condition of the fish runs, the status of the resource?
A Yes.
Q So that when that body does make its recommendation and when you as a member of that body make or join in making the recommendation, you have the data that the Washington Department of Fisheries has or feels is relevant to the content of the regulations of the tribe that you are being asked to advise them upon?
A Yes.
Q Now, on the discussion of the services you render or the studies you have made for the Quileute tribe, I believe the question was asked in the context by Mr. McGimpsey, in the context of salmon, and to what extent you had made recommendations to the tribe on their salmon regulations, and I believe your answer was "very little;" is that correct?
A I believe it probably was, and I was relating that to the

amount of assistance we provided to some others, such as Makahs.

Q Have you also made an analysis of the Quileute River and the fisheries on that river with respect to steelhead fishing?

A Yes.

Q Have you made any more extensive analysis of the steelhead situation than you have of the salmon?

A Yes, we in recent years have made a much more intense analysis of the steelhead situation there than we have on salmon.

Q Why is that?

A Oh, approximately a year, a little more than a year ago, I was requested by the Bureau of Indian Affairs, or the solicitor's office, I can't remember which came first, to prepare material concerning that steelhead run, in connection with the requested hearing to obtain a TRO against the State Game Department.

Q Do you have any opinion or information as to the relative importance to the Quileute tribe of their salmon fisheries as compared to their steelhead fisheries?

A I recall in the analysis of the steelhead for that purpose I mentioned that of the total anadromous fisheries that the tribe is operating on today steelhead quite easily could comprise a major part of that.

Q Has it been your observation that there is any greater problem between the tribe and the State over the regulations or exercise of the Indian fishery as between steelhead and salmon? Do they have, does the tribe have a greater problem with the state over state control of one of those two types of fish as compared to the other?
A Based upon the amount of attention and activities that have been focused there I would say that it appears that the major concern at the moment might be concentrated on the steelhead situation.
Q They are more concerned over difficulties they have had with the state in connection with steelhead than they are in connection with salmon; is that what you are telling me?
A I can't answer that, George.
Q Now, we had some extensive discussion the other day with respect to the desirability of unified management of the salmon resources in the State of Washington, and I believe the question was asked would it be desirable from a biological standpoint to have a unified management of the salmon resources of the state, and you replied yes, I believe. Do salmon or steelhead of the State of Washington stay strictly within the boundaries of the state during their life cycle?
A Mostly no.

Q Do they go into international waters?
A Yes.
Q Do salmon and steelhead that frequent some waters of the State of Washington also go into waters of other states?
A Yes.
Q And is some of the resource that is available for harvest in the State of Washington originally --

MR. McGIMPSEY: George, this is all in the stipulation.

MR. DYSART: All right, I will come directly to it.

Q In terms of a unified management concept is it more desirable that the unified management be an agency that has jurisdiction only over the portion of the area within the State of Washington or would it be desirable that it have a unified management over the entire run, and have jurisdiction over the entire run?
A It could exercise more precise and effective control if it had management jurisdiction over the entire area.
Q So when the question was asked whether it would be desirable to have the Washington Department of Fisheries be the unified manager, would you say that it would be more desirable again in the context of which the original question was asked, which is from a biological standpoint would it be more desirable to have an agency such as the

Washington Department of Fisheries which would have jurisdiction for the State of Washington, do that managing or would it be more desirable to have an agency from some political entity that has a wider geographical area of jurisdiction?

A I believe I would select the latter. Assuming that that agency would have control over all of the activities affecting the fish in that entire area.

Q In discussing whether it was desirable that uniform management within the state be in a state agency such as the Department of Fisheries, do you feel that giving some management authority such as presently exists to the International Pacific Salmon Fisheries Commission over some of the area within the State of Washington is desirable or undesirable?

A From the standpoint of managing the Fraser River stock it's desirable.

Q And within the State of Washington do you feel that it would be more desirable if a single agency had control of the area of state jurisdiction on a single river such as the Nisqually, rather than to divide that control between two agencies?

A From the standpoint of biology --

MR. McGIMPSEY: Now, are you speaking as to any specific species of fish?

THE WITNESS: He said salmon and steelhead.

MR. DYSART: I am speaking as to regulatory control over the river, over the taking of fish on the river.

MR. McGIMPSEY: But I mean if there are cutthroat trout in there are you talking about them, too?

THE WITNESS: He said salmon and steelhead.

MR. DYSART: Let me ask the question this way --

Q With respect to the taking of salmon and the use of gear for that purpose, even though the gear may have other consequences, do you feel it is desirable to concentrate the management authority on the Washington portions of the Nisqually River exclusively in a single management agency?

A I believe I would say it would be desirable, George, and I am thinking of the Chumm salmon run when I say that, specifically. If you care, I would elucidate.

Q Well, if you feel that that is necessary to give meaning to your answer, I am satisfied with the answer unless you feel you want to have some other --

A I am through.

Q I am not trying to cut you off, if you think it's necessary to explain your answer.

A No.

Q But would you say that that also applies to Washington coastal streams?

A Yes.

Q Now, there were some questions asked with respect to the order of priority which Indians might establish in terms of the use of fish or the purposes for which fish should be taken, and I think you indicated that it would vary from species to species as to which aspect they consider most important. Might this also vary from tribe to tribe?

A Oh, I believe so.

Q There was some indication as to whether fishing on a spawning ground was ever, whether there was ever a situation in which something other than the biological consideration should be given priority for fishing on the spawning ground. Let me pose a hypothetical to you and ask that if you had a condition where an Indian in a usual and accustomed place that was, that a particular tribe or group of Indians resorted to as a significant fishing area, were located on the spawning ground, can you conceive of any situation in which fishing might be recommended or allowed on that spawning ground to fulfill some economic or cultural need that might be given a priority over certain aspects of the biological need? Are you saying that there should never be fishing on a spawning ground because the biological situation is always such that it has to take priority to the point of prohibiting fishing on a spawning ground?

A It requires some explanation in my answer, George. I believe that you definitely could fish for one species on the spawning ground of another species if your activity were not detrimental to the success of the spawning of the other species, or even to the species that might be the target of your fishery. There are also other occasions where Indians take fish by simple means such as spears, and other things that don't interfere greatly with the use of that environment by fish where you could harvest in that area. I am referring specifically to the activities of Quinault Indians who harvest sockeye salmon on the spawning ground after they have spawned.

Q Well, suppose you had the hatchery capable of artificially re-stocking or supplementing the stocking of a stream, might not there be situations where economic and cultural considerations might be predominant consideration that a fish management authority would take into consideration in determining whether to allow an Indian fishing on a spawning ground, to allow any Indian fishing?

A I suppose that would, could occur, yes.

Q So that there might be situations where some regulated Indian fishing might be allowed on the spawning ground in order to fulfill an economic and cultural consideration even though if you were to view it solely from a biological consideration you would prefer not to have the fishing there; would that be a fair statement?
A I can conceive that this might occur, yes.
Q Now, this morning when we were talking about the Puyallup regulations and there was a question raised as to whether you had been requested by the Washington Department of Fisheries to provide them with certain catch data and whether you in fact provided the data that was requested and to the latter question I believe you said no. Did you provide all of the data that you had? That is, you indicated you were not able to get some of the data from the tribe?
A As far as I recall, we weren't able to get any.
Q All right. So it was neither you or your agency that refused the Department of Fisheries request, you gave all of the information to the fisheries that you had, which may have been zero, but did you give it all?
MR. McGIMPSEY: He just testified he didn't have any, George, how could he give it all to them?
Q Oh, all, maybe zero?

A I gave all of zero to them.
Q You did not withhold any information from the Department of Fisheries?
A Right.
MR. McGIMPSEY: He's a nice guy, George, we stipulate to that.
THE WITNESS: That's right. We attempted to get it and had we received it we would have provided it to the Department.
Q All right, that was going to be my next question as to whether you relayed the request on to the tribe and you said you did?
A We did, we met with them and requested it specifically and we wrote to them.
Q Now, there was some discussion about restriction in the various fishing areas that are established for the Puget Sound area and are shown on the chart in the Joint Biological Statement that was referred to, as to whether fishing in areas such as area 1 would affect all of the fisheries in-sound from there, and then what fishing would be affected by restrictions in areas 4 and 4-A, for a couple of examples that were given, I believe. Would it be correct to say that restrictions in inner-sound areas such as 4 or 4-A may also affect the amount of fishing that could be allowed in areas seaward of

that?

A Yes.

Q So that the restrictions that might be applicable to areas 4 and 4-A would be relevant to the amount of fishing that could be allowed to an Indian fishery in area 2? Area 2 is the one farthest out, I believe in the Straits?

A That is possible.

Q There was discussion about the market price of fish in terms of sound or river catch. Would it be correct to say that market price is affected by other factors than just the quality of the fish?

A Yes, the supply would be one important factor.

Q So that if a regulatory regime were applied that concentracted fishing in one particular area to the either exclusion or at least restriction of fishing in another type of area, this might affect the market price of the fish in the two areas, it might have an influence on the market price?

A It might, yes.

Q There was also discussion as to whether as a biologist you would consider it more desirable to have fish unhandled. Aren't there occasions when biologists do handle fish?

A Frequently.

Q In order to obtain information with respect to it; I am talking now of fish that they intend to return to the stream to go further on up or down the stream?

A Yes, practically all management and fisheries research agencies have at one time or another handled fish to make studies.

Q So if we are talking about what is desirable from a biology standpoint, would it be correct to say that there are times when it may be desirable to handle fish in order to enable you to get information that you could not otherwise get?

A Certainly.

MR. McGIMPSEY: We would stipulate to that, George.

MR. DYSART: I just didn't want the record to indicate that it would never be desirable to handle, which is what I think the first answer was.

MR. McGIMPSEY: I think -- go ahead.

MR. DYSART: I think that is all. I have no further questions.

MR. McGIMPSEY: I have a couple of questions.

REDIRECT EXAMINATION

BY MR. McGIMPSEY:

Q Jim, I take it that this lawsuit is concerned with claims by Indians that in their fisheries within the geographical bounds of this lawsuit they are not getting a sufficient number of fish that they feel that they are entitled to, is that your understanding basically, and that this is a lawsuit to try to determine what fair share that they are entitled to and to impose some kind of -- at least the Indians' intent is hopefully to impose some kind of control on the state departments that are regulating the fish to assure them of a fair share?

MR. DYSART: I would ask the witness to answer only to the extent that he knows what the intent of the tribes were when they asked the lawsuit --

Q To the extent that you know, is that your general understanding of basically what the lawsuit's about?

MR. DYSART: If he knows.

Q The Indians claim they don't have a fair share of the fish and that they should have more, and that the state's controlling the fisheries; you must have some understanding about what this lawsuit's about?

A Yes, I have some understanding what the lawsuit's about, but I don't have a full understanding of all of the factors that the Indians have considered when they requested a suit be filed.

Q Okay, fine, but I mean, is that a factor, do you think, in this whole problem of increasing the fish that the Indians are taking, that a concern of theirs was?

A I would say yes.

Q Okay. And it's also, you would agree or stipulate that these fish, anadromous fish that the Indians are fishing on, pass not only through waters over which the State of Washington exercises jurisdiction, but I think you indicated that national and international bodies also exercise jurisdiction over waters throughout which these fish pass; is that correct?

A That is correct.

Q Okay. Do you, in your opinion, think it's fair or a total answer to require only the State of Washington or one of these bodies that exercises jurisdiction over one area to be responsible to the Indians for assuring them of whatever is determined to be a fair share of the fish?

MR. DYSART: I don't think that is an appropriate question as to whether he thinks it's fair or not. That's for the court to determine.

Q Okay, as a biologist, do you think it's desirable that only one segment of the waters that are being controlled by the defendants should be the sole source out of which any increase to Indian fisheries should come from, only one?

A Could you --

Q Or do you think more properly from a biological point of view that any decision should consider the entire geographical area where these fish go?

A I think that is a pretty complicated question. I would only say that to my knowledge this court case is the U. S. vs. Washington, and I think whatever can be achieved in relationship to the State of Washington through this case should be the object of the case.

Q As a biologist, though, would it be desirable from your point of view that the fishery should really be, if it's to be adjusted to increase the Indian take, or catch, that it should be adjusted across the whole spectrum of the fishery and not in just one segment of it?

A I think that is fair.

Q And so when you say that, for example, in fish--let's see, fishing in the southern sound river basins could be increased by restricting it in areas 4 and 4-A, without restrictions, without there being any change in restrictions in areas 1 and 2, although that's agreeably possible, would you agree that that is the desirable way to go about doing it?

A I still think your word "desirable" has too many ramifications, and I would care not to answer that.

Q Okay, but as a biologist would you think -- you have already stated that you think it is desirable that the adjustments to the fishery be made across the whole spectrum of the fishery. Now, would it similarly be desirable that,we have indicated here, you have indicated that adjustments could be made, for example, in areas 4 and 4-A, that would increase the Indian catch very likely down in southern Puget Sound rivers, do you think it would be desirable in the same sense as we have just referred to it to instead of concentrating just on areas 4 or 4-A, to concentrate across the whole spectrum of the fishery being on -- this is as a biologist, not as a political scientist?
A Earl, I don't know whether or not it would be desirable, but I think there is a possibility that it might be necessary.
Q Necessary to do it across the whole spectrum?
A Yes.
Q Do you believe that your agency today has the capability to undertake the management responsibilites now exercised by the Department of Fisheries?
A Not in our present staffing and form.

MR. McGIMPSEY: Okay.

WITNESS.

ELMER F. GROSHONG & ASSOCIATES
612 RUST BUILDING
TACOMA, WASHINGTON

STATE OF WASHINGTON)
)SS
COUNTY OF PIERCE)

I, ELMER F. GROSHONG, a duly authorized Notary Public in and for the State of Washington, residing at Tacoma, do hereby certify that JAMES HECKMAN was called as a witness on behalf of defendants herein; was by me first duly sworn on oath to testify the truth, the whole truth, and nothing but the truth in said cause; that the oral examination of said witness was recorded in shorthand and later reduced to typewriting; that the above and foregoing is a true and correct transcript of the testimony given by said witness, with no additions or deletions; and that signature thereto was reserved.

I do further certify that said deposition, Volume III, was taken pursuant to notice of counsel for plaintiffs, by defendants, on Thursday, April 26, 1973, before me, at 612 Rust Building,Tacoma, Washington.

I do further certify that I am not a relative of, employee of, or counsel for either of said parties, or otherwise interested in the event of said proceeding.

WITNESS MY HAND AND OFFICIAL SEAL at Tacoma, this 3rd day of May, 1973.

Notary Public in and for the State of Washington, residing at Tacoma.

Hickman Deposition
Exhibit 2a

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
FISH AND WILDLIFE SERVICE
AND THE
OFFICE OF INDIAN AFFAIRS

It is the object of this memorandum to outline the basic policy to be pursued by the cooperating agencies in the preparation and application of plans of fish and wildlife management on lands and waters under the jurisdiction of the Office of Indian Affairs. This memorandum proceeds from the desire of the cooperating agencies to coordinate more closely their respective programs of the aforementioned subject.

Wildlife is considered an intergral factor in the social and economic life of the Indians, and is at all times to be so managed as to furnish a maximum contribution to their welfare consistent with a continuance of much contribution to future generations. The conservation of wildlife must at all time be treated as an inseparable factor in the broad unified conservation of soil, moisture, forests, and other vegetation, and must be so adjusted as to attain a proper relation between wildlife values and agricultural and stock-raising values.

No management measure or any interference with biotic relationships shall be undertaken prior to a properly conducted investigation.

It is recognized that rodent and predator control may be necessary under certain conditions. Where there is apparent need for control, an impartial investigation will be made and any control action will be taken only after approval by the Commissioner of Indian Affairs.

It is agreed between the Fish and Wildlife Service and the Office of Indian Affairs that:

1. The Fish and Wildlife Service is recognized as the scientific authority within the Department of the Interior on fisheries and wildlife matters on Indian lands and fish and wildlife refuges. It will advise the Office of Indian Affairs on such matters and prepare in cooperation with the Office of Indian Affairs, as requested, management plans for wildlife and fish on lands and in waters under the jurisdiction of that Office. The primary responsibility for execution of wildlife management programs in the field will rest with the Indian Service field office in charge, with much aid and inspection by the Fish and Wildlife Service as may be desirable or necessary

F 1

2. The Office of Indian Affairs is recognized as the agency primarily responsible for the administration of Indian property, including lands within Indian reservations, and for the enforcement of treaties, laws and regulations pertaining to the affairs and welfare of the American Indians.

3. Both agencies will make a real effort to have personnel available for solving mutual problems. In the field, Fish and Wildlife Service personnel will assist the various Indian offices in fish and game matters, including wildlife census procedures, necessary protective measures, law enforcement and fish stocking, and will collaborate with the Office of Indian Affairs in such educational work with the Indians as is necessary or possible to give them a better appreciation of the need for wildlife conservation and management. The Office of Indian Affairs will encourage the organization of conservation units among the Indians through the medium of established Indian tribal organizations, wherever such exist, and urge the adoption of such plans for wildlife management on Indian lands and waters as are mutually agreed upon, and collaborate with the Fish and Wildlife Service on general programs for national wildlife conservation.

4. The Fish and Wildlife Service will report to the superintendents of Indian reservations any infractions by Indians of local laws relating to wildlife on Indian reservations and the Indian reservation superintendents, through the law enforcement personnel, will make a conscientious effort to insure that all such local laws are obeyed. Infractions of the Migratory Bird Treaty Act, as amended, will continue to be handled by the Fish and Wildlife Service.

5. Memoranda of procedure covering broad cooperative action will be drawn up as needed by the two agencies and approved by the Director of the Fish and Wildlife Service and the Commissioner of Indian Affairs. Under such memoranda the details of specific field projects will be covered by field agreements, executed and signed by field representatives of both agencies who have been authorized by their respective superiors to take such actions. Field Agreements will outline

in detail the nature, location and extent of the cooperative project, its purpose or purposes, its cost and the source and amount of funds, contributions, etc., to be utilized, and receive the approval of the appropriate governing body of the Indian tribe concerned, wherever such approval is required by regulation or policy.

6. On Fish and Wildlife refuges and fish hatcheries located on Indian lands, it is desirable to utilize Indian CCC and other Indian labor, as far as possible, on development projects. Both agencies will cooperate fully to further this end.

7. Where irrigation projects, including storage reservoirs, on lands under the jurisdiction of the Indian Service have value as wildlife refuges of national importance, both agencies will cooperate to the fullest extent in securing designation of these areas as national wildlife refuges, and effect their proper development consistent with the primary purpose of the irrigation projects. Where fish life, migratory or otherwise, may be adversely affected by such projects, the Office of Indian Affairs will endeavor to establish, with the technical cooperation of the Fish and Wildlife Service, such fish protective devices and facilities as may be practicable and suitable.

8. Where Federal Wildlife refuges adjoin or include Indian tribal and allotted lands, field personnel are authorized to prepare such Field Agreements as are necessary to coordinate effectively the programs of the cooperating agencies in the interest of sound land use and development.

9. The Fish and Wildlife Service will endeavor to provied fish of suitable species for stocking the waters in Indian reservations where need for such stocking is evident and where adequate protection is afforded, The Office of Indian Affairs will endeavor, through procedure outlined in Article 3 to supply protective management and conservation measures for migratory fish of both game and commercial species which may be resident upon Indian reservations at seasonable intervals.

/s/ W. C. Henderson
Acting Director, Fish and Wild-life Service

Approved: Aug - 7, 1941

/s/ E. E. Burlew
First Asst. Secretary of Interior

/s/ John Collier
Commissioner of Indian Affairs

.1 Objective. The arrangements provided for by this chapter are designed to promote the maximum conservation, development, and utilization of the fish and wildlife resources of land and waters under the administration and jurisdiction of the Bureau of Indian Affairs. In carrying out this objective, full consideration and recognition will be given to the fact that the vast majority of the lands subject to BIA management control are not public lands, but represent the principal resource available for economic and social advancement of the Indian people as beneficial owners. However, in its capacity as trustee, the Bureau of Indian Affairs will strive to establish and maintain policies and practices comparable to those carried out by the United States Fish and Wildlife Service, or by well-informed private conservationists in protecting fish and wildlife resources.

.2 Respective Roles of the Bureaus. The Bureau of Indian Affairs is the agency primarily responsible for the administration of Indian property, including lands within Indian reservations, and for the enforcement of treaties, laws, and regulations pertaining to the affairs and welfare of the American Indians. Wildlife (including fisheries) is an integral factor in the social and economic life of the Indians, and must always be so managed as to furnish a maximum contribution to their welfare consistent with a continuance of such benefits to future generations. The conservation of wildlife must always be treated as an inseparable part of the broad, unified conservation of soil, moisture, forests, and other vegetation, and must insure a proper relation between agriculture, stockraising, and wildlife values. The responsibility and authority for coordination and integration of management programs pertaining to Indian resources and Indian off reservation treaty fishing rights rests at all times with the Bureau of Indian Affairs.

The Bureau of Sport Fisheries and Wildlife is recognized as the fact-finding arm and scientific authoriy within the Department of the Interior on sport fishery and wildlife matters. This Bureau advises the Bureau of Indian Affairs on such matters and prepares fish and wildlife management plans data as requested, after appropriate field investigations. The primary responsibility for execution of fish and wildlife management programs in the field rests with the local field offices of the Bureau of Indian Affairs and the tribes, with such aid and assistance by the Bureau of Sport Fisheries and Wildlife as may be necessary.

.3 Fish and Wildlife Resource Management on B.I.A. Lands. All Indian lands administered by the BIA, which contain fish and wildlife values suitable for management and development shall have, with the consent and participation of the tribes, an active, progressive program for management and conservation of fish and wildlife consistent with other land uses.

This shall be accomplished through:

A. Memoranda and Agreements. Memoranda of procedure covering broad cooperative action will be drawn up as ne ded by the two agencies and the Indian tribes. The details of specific field projects will be covered by field agreements, executed and signed by field representatives of both agencies who have been authorized by their respective superiors to take such action. Field agreements will outline in detail the nature, location, and extent of the cooperative project, its purpose or purposes, its cost, and the source and amount of funds, contributions, etc., to be utilized. Such agreements shall receive the approval of the appropriate governing body of the tribe concerned, whenever such approval is required by regulation, or policy, or when the tribe is an active participant under the terms of such agreements.

B. Cooperative Activities in the Field. The Bureau of Sport Fisheries and Wildlife will assist the Bureau of Indian Affairs in dealing with problems and devising management plans in its special fields of operations when so requested by the BIA. In the field, personnel from the Bureau of Sport Fisheries, in addition to conducting fish and wildlife surveys and research, will assist the various BIA offices in fish and game matters, including fishery management, wildlife census procedures, necessary protective measures, and law enforcement, and will collaborate with the BIA in such educational work with the Indians as is necessary to give them a better appreciation of the need for wildlife conservation and management.

The adoption of fish and wildlife management plans on Indian lands and waters as are mutually agreed upon shall be furthered. The Bureau of Indian Affairs will collaborate with the Bureau of Sport Fisheries and Wildlife on general programs of fish and wildlife conservation of national significance.

The Bureau of Sport Fisheries and Wildlife will endeavor to provide suitable species of fish for stocking the waters on Indian reservations in accordance with approved fishery management plans or where the need for stocking has been determined by fishery biologists and where adequate protection is afforded.

Where there is need for animal damage control, the Bureau of Sport Fisheries and Wildlife will assist the BIA and Indian tribes to the extent agreed upon at the appropriate field level, within both Bureaus. The Bureau of Sport Fisheries and Wildlife will cooperate with tribal authorities and officials of the BIA in protection of fish and wildlife, including the enforcement of the Migratory Bird Treaty Act and other Federal laws.

Where irrigation projects, including storage reservoirs, on lands under the jurisdiction of the BIA have value as wildlife refuges of national importance, both agencies will cooperate to the fullest extent in securing designation of these areas as National Wildlife Refuges, and in effecting their proper development consistent with the primary purpose of the irrigation projects and Indian rights on the lands and waters concerned. The Bureau of Sport Fisheries and Wildlife will advise the Bureau of Indian Affairs of fishery, of wildlife values that may arise from development of multipurpose water projects on Indian lands. Whenever possible, this advice will be given during the early stage of project planning.

Where National Wildlife Refuges adjoin or include tribal or Indian-allotted lands, field personnel are authorized and encouraged to prepare such Field Agreements as are necessary to coordinate effectively the programs of the cooperating agencies in the interest of sound land use and development. On National Wildlife Refuges and National Fish Hatcheries located on Indian lands, Indian labor, as far as possible, will be utilized on development projects. Both agencies will cooperate fully to this end.

.4 State Cooperation with the BIA in Fish and Game Activities. State fish and game departments participate to some extent in fish and game management on a number of Indian reservations. The Bureau of Sport Fisheries is the principal technical advisor to the Bureau of Indian Affairs. Local agreements among the tribes, Bureau of Indian Affairs and State fish and game agencies do not relieve this Bureau of its responsibilities to the Bureau of Indian Affairs as designated in 501 DM 1, 2, and 3.

.5 Financing. The extent to which the Bureau of Sport Fisheries and Wildlife and the Bureau of Indian Affairs will undertake cooperative projects will depend upon budgetary considerations and available personnel. Funds may be increased, by mutual agreement, through transfer from one agency to the other. Each agency is authorized to assist the other in performing surveys, research, and management activities by providing such manpower, equipment, and facilities as may be available for the purpose.

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Heckman Deposition
Exhibit 3

Memorandum

TO : Off-Reservation Indian Fishing File

DATE: January 17, 1973

FROM : Fishery Management Biologist
Tumwater, Washington

SUBJECT: File Report - Stream Surveys, Western Washington

Attached is the subject report concerning the initiation of a program to systematically obtain data on the salmon and steelhead resources of certain drainages in Western Washington which support an Indian river fishery.

While an attempt was made to cover all major tributaries of the drainages studied, more extensive coverage was given to the coastal areas, since it was felt that less information was available for these areas.

In the Puget Sound region, work was limited to four major drainages and one small independent drainage in Southern Puget Sound. Surveys were conducted mainly on the mainstem rivers and their tributaries which are listed in the Puget Sound and Adjacent Waters Comprehensive Study as being utilized by anadromous fish. The coastal area presented more of a problem, since we did not have the advantage of a comprehensive plan; consequently, considerable time was spent surveying tributaries to determine those which appeared to have significant value to anadromous fish resources.

One of the purposes of this study was to identify, where possible, tentative index areas for the various species of salmon and steelhead utilizing a given drainage. In most drainages, potential index areas were established; however, in a few drainages, insufficient data precluded this. The index areas established will have to be further evaluated and refined, eliminated, or relocated, as conditions warrant.

Although a species of fish may be known to occur in a drainage, it is not listed in this report if it was not actually observed during the survey period.

Curtis L. Burley
Curtis L. Burley

CLB:de

Attachment

INTRODUCTION

During the latter part of September 1971, six temporary employees were hired and assigned to the Tumwater Office to collect data on certain runs of returning adult salmon and steelhead trout in Western Washington. In addition to observing actual runs, considerable data was collected concerning habitat characteristics and conditions.

Effort expended on these surveys was limited to the Skokomish, Nisqually, Puyallup, and Green River drainages, and McAllister Creek, all of which enter Southern Puget Sound; the Hoko and Sekiu River drainages which enter the Straits of Juan de Fuca; and the Quillayute and Hoh River drainages which enter the Pacific Ocean along the Northern Washington Coast line.

Full scale operation of the survey did not commence until October, and it continued until approximately the first week of February. During the survey period, several changes in personnel occurred, resulting in some loss of time in data collection. Where possible, tentative index areas for the various species of salmon and steelhead encountered in the drainages were established. Not all index areas were established in time to provide repetitive counts. This was especially true in the case of chinook salmon. In some cases, potential index areas were established on the basis of previous counts and general knowledge of the area. The surveys were terminated prior to the end of the steelhead season.

SUMMARY OF RIVER DRAINAGES SURVEYED

The following summarizes, by drainage, the information collected during the survey period.

SKOKOMISH RIVER DRAINAGE

Approximately 10 stream survey miles were walked on the North and South Forks of the Skokomish River, and Vance Creek, a major tributary. In addition, one float trip was conducted covering the mainstem river. Chinook, coho, and chum salmon, and steelhead trout were found utilizing the drainage (Table 1).

Chinook were found spawning in the mainstem, South Fork, and Vance Creek. Numerous chinook were present in the latter part of September and were observed in declining numbers until early November, when the last live chinook observation was made.

Schools of coho were observed in the mainstem during the latter part of September; however, the first observation of coho spawning was made in early November. Coho were found utilizing the North Fork and Vance Creek. Due to heavy snow and poor road conditions, surveys during the coho run were intermittent. Large numbers of coho carcasses were observed in late December and early January, indicating the main portion of the run occurred sometime between late November and early December. The last live coho was seen in mid-January.

Chum salmon were seen in the mainstem during late September. They were also observed in the South Fork and were found spawning in the North Fork and Vance Creek. Again, due to intermittent surveys, the main chum run could not be observed; however, large numbers of carcasses were seen in mid-January, indicating the main run occurred sometime during early January. The last live chum observation was made mid-January. Steelhead were observed in the drainage as stream surveys were being terminated.

A tentative index area for coho and chum was established on the North Fork.

Table 1. Observed area of use, by species, in the Skokomish River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem	x	x		x	x
North Fork		x		x	
South Fork	x			x	
Vance Creek	x	x		x	

NISQUALLY RIVER DRAINAGE

About 34 stream survey miles were walked on 12 tributaries of the Nisqually River. The mainstem was not surveyed because of its extremely turbid condition throughout the survey period. Pink, coho, and chum salmon and steelhead trout were found utilizing the drainage (Table 2). Although McAllister Creek is an independent drainage, it is included in the discussion of the Nisqually River drainage.

Pink salmon were found in three tributaries, Yelm Creek, Ohop Creek and the Mashel River. They were observed from the first survey in early October until early November.

Coho salmon were found in the following seven tributaries: Muck, Yelm, Horn, Tanwax, Ohop, and 25-Mile creeks, and the Mashel River; as well as in McAllister Creek. Coho were observed from early November to early February.

Chum salmon were found to be spawning in three tributaries: Muck, Yelm, and Tanwax creeks; also in McAllister Creek. Chum observations were made from late December until mid-February.

Steelhead trout were found in two tributaries: Muck Creek and Yelm Creek. They were also observed in McAllister Creek. Steelhead were first observed in late December, and observations became more frequent through mid-February, when surveys were terminated.

Index areas for coho were established on Muck, Yelm, Tanwax, Ohop, and 25-Mile creeks. Chum index areas were established on Muck, Yelm, and Tanwax creeks.

Table 2. Observed areas of use, by species, in the Nisqually River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
McAllister Creek		x		x	x
Muck Creek		x		x	x
Lacamas Creek					
Yelm Creek		x	x	x	x
Horn Creek		x			
Tanwax Creek		x		x	
Ohop Creek		x	x		
25-Mile Creek		x			
Mashel River		x	x		

PUYALLUP RIVER DRAINAGE

A total of approximately 33 stream survey miles, including 5 float trip miles, were covered on the Puyallup drainage. Areas covered were the White River, 15 lesser tributaries, and portions of the mainstem Puyallup River. The drainage was found to be utilized by chinook, pink, coho, and chum salmon and steelhead trout (Table 3).

Chinook salmon were seen spawning in South Prairie Creek (a tributary of the Carbon River), and in the mainstem of the White River. Chinook were present from late September through mid-November.

Pink salmon were observed in two tributaries, South Prairie Creek and Kapowsin Creek. They were first observed in late September and were last seen in early November.

Coho salmon were found in nine tributaries: Clark, Clear, Kelly, South Prairie, Kapowsin, and Fox creeks; the White River mainstem, and two of its unnamed tributaries. Coho were first observed between early November and mid-December. Coho were again seen in Clark, Clear, and Kelly creeks between early January and late February.

Chum salmon were found in two tributaries, Kelly Creek and Clear Creek, and were observed from late December through early February.

Steelhead trout were found in Kelly Creek, Clear Creek, and Clark Creek. The first observation was made in early February and numbers of spawning steelhead were observed increasing through early March when survey operations were terminated.

Index areas were established for coho on Clark Creek and Fox Creek; and for coho, chum, and steelhead on Kelly Creek.

Table 3. Observed areas of use, by species, in the Puyallup River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem					
Clark Creek		x			x
White River	x	x			
Clear Creek		x		x	x
Kelly Creek		x		x	x
Carbon River					
South Prairie Creek	x	x	x		
Kapowsin Creek		x	x		
Fox Creek		x			
Kings Creek					

GREEN RIVER DRAINAGE

Stream survey crews walked about 23 stream survey miles on the Green River drainage, which included 8 tributaries and portions of the mainstem. The drainage was found to be utilized for spawning by chinook and coho salmon (Table 4).

Chinook salmon were observed spawning in the Green itself, and in two major tributaries, Big Soos and Newaukum Creeks. Chinook were present in the latter part of September and were observed in declining numbers throughout early November.

Coho salmon were found in four of the tributaries surveyed: Big Soos, Burns, Spade, and Newaukum creeks, as well as in small side channels of the mainstem near Burns Creek. Coho were first observed in late October, and the last observation was made in late February.

Three tentative index areas were established on the Green River drainage. A chinook area was established on a portion of the mainstem. Portions of Spade and Newaukum Creeks were established as coho index areas.

Table 4. Observed areas of use, by species, in the Green River Drainage.

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem	x	x			
Springbrook Creek					
Big Soos Creek	x	x			
Burns Creek		x			
Spade Creek		x			
Newaukum Creek	x	x			

HOKO RIVER DRAINAGE

About 18.5 stream survey miles, including 9 float trip miles, were covered on the Hoko River drainage. The areas covered included five tributaries and the mainstem itself. Chinook and coho salmon were found to utilize the drainage. (Table 5).

Chinook were observed in the mainstem, and the Little Hoko River between mid-October and early December.

Coho salmon were observed in all five tributaries: Little Hoko River, Cub Creek, Brownes Creek, Bear Creek, and an unnamed tributary; they were also seen in the upper mainstem. Coho were first observed during the latter part of November, and last seen in early January.

Two index areas were established for coho, one on the upper mainstem and one on Cub Creek, an upstream tributary.

This drainage is heavily utilized for logging, and consequently anadromous fish spawning and rearing habitat has been reduced.

Table 5. Observed areas of use, by species, in the Hoko River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem	x	x			
Little Hoko River	x	x			
Brownes Creek		x			
Cub Creek		x			
Bear Creek		x			
Unnamed Tributary		x			

SEKIU RIVER DRAINAGE

The survey crews covered about five stream survey miles on the Sekiu River drainage, including portions of the mainstem and four tributaries. This drainage was found to be utilized by coho salmon, as evidenced by a single observation of two carcasses. This observation was made in the Little Sekiu on January 14. No index areas were established in the drainage.

The drainage has suffered from past and present logging operations which have considerably reduced anadromous fish spawning and rearing habitat.

QUILLAYUTE RIVER DRAINAGE

The Quillayute drainage is comprised of four major river systems. Because of their size and complexity, each river system is reported separately.

Dickey River Drainage

Approximately 19 stream survey miles, including 14 float trip miles, were covered on the Dickey River drainage. Areas covered included six tributaries, and the West Fork, the East Fork, and portions of the mainstem. The drainage was found to be utilized by chinook and coho salmon (Table 6).

Chinook were found only on the East Fork of the Dickey. Coho Salmon were found on the West Fork, the East Fork, and three tributaries: Colby, Coal, and Gunderson creeks. No indexes were established in the drainage.

The upper portions of this drainage support a great deal of logging activity and consequently anadromous fish habitat has been reduced.

Table 6. Observed areas of use, by species, in the Dickey River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem					
Middle Fork					
West Fork		x			
East Fork	x	x			
Coal Creek		x			
Colby Creek		x			
Gunderson Creek		x			

Soleduck River Drainage

Approximately 22.5 stream survey miles were covered on the Soleduck River drainage including 13 tributaries and portions of the mainstem. The drainage was found to be utilized for spawning by chinook, coho, and sockeye salmon and steelhead trout (Table 7).

Chinook salmon were seen spawning in the mainstem Soleduck, and in three tributaries: Shuwah, Lake, and Bear creeks. Chinook were present from latter September through early January.

Coho salmon were found in the following five tributaries: Tassel, Lake, Beaver, Bear, and Bockman creeks. Coho were first observed in mid-October and last seen in mid-February.

Sockeye salmon were found in Lake Creek, which flows out of Lake Pleasant. They were seen during the first survey in mid-October and last observed in early January.

Steelhead trout were found in two tributaries, Swanson Creek and the Soleduck State Salmon Hatchery outlet stream. The first steelhead observations were made in mid-February after which survey operations were terminated.

Two index areas, one for chinook and one for coho, were established on the Soleduck drainage, both on Lake Creek.

Table 7. Observed areas of use, by species, in the Soleduck River Drainage

	Chinook	Coho	Pink	Chum	Sockeye	Steelhead
Mainstem	x					
Tassel Creek		x				
Shuwah Creek	x					
Swanson Creek						x
Lake Creek	x	x			x	
Bockman Creek		x				
Soleduck Hatchery Outlet						x
Bear Creek	x	x				
Beaver Creek		x				

Calawah River Drainage

About 41 stream survey miles, including 19 float trip miles, were covered on the Calawah River which included 15 tributaries and portions of the mainstem. There are two Cool Creeks on the North Fork of the Calawah. Both are right bank tributaries and are approximately five miles apart. In order to avoid confusion, the Cool Creek that enters near the mouth of the North Fork will be referred to as Cool Creek No. 1; the other, entering the river five miles upstream, will be referred to as Cool Creek No. 2. The Calawah drainage was found to be utilized for spawning by chinook and coho salmon, and steelhead trout (Table 8).

Chinook were seen in the mainstem, the North Fork, the South Fork, and Cool Creek No. 1. Chinook were present during November and were observed in declining numbers until mid-January.

Coho were found in three tributaries: The North Fork, Cool Creek No. 1 and Elk Creek. Coho were first observed in early December and last seen in mid-January.

Steelhead trout were found in three tributaries of the North Fork: Cool Creek No. 1, Cool Creek No. 2, and an unnamed tributary. The first steelhead observations were made in mid-February after which survey operations were terminated.

One index area for chinook and steelhead was established on Cool Creek No. 1.

Table 8. Observed areas of use, by species, in the Calawah River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem and Lower South Fork	x				
Elk Creek		x			
North Fork	x	x			
Cool Creek No. 1	x	x			x
Cool Creek No. 2					x
Unnamed Trib. to No. Fork					x

Bogachiel River Drainage

About 31 stream survey miles, including 17 float trip miles, were covered on the Bogachiel River drainage. Areas surveyed included seven tributaries and portions of the mainstem. The drainage was found to be utilized by chinook and coho salmon (Table 9).

Chinook salmon were observed spawning in the mainstem and one tributary, Mill Creek. Chinook were present in declining numbers from the first survey in mid-November to late November when the last observation was made.

Coho were observed on mainstem side-channels and five tributaries: Maxfield, Mill, Eaton, Morganroth, and Dowans creeks. Coho were first observed in late November and the last observation was in early January.

Table 9. Observed areas of use, by species, in the Bogachiel River Drainage

	Chinook	Coho	Pink	Chum	Steelhead
Mainstem	x	x			
Maxfield Creek		x			
Mill Creek	x	x			
Dowans Creek		x			
Morganroth Creek		x			
Eaton Creek		x			

HOH RIVER DRAINAGE

Approximately 49 stream survey miles, including 13 float trip miles, were covered on the Hoh drainage, which included 21 tributaries and portions of the mainstem. The drainage was found to be utilized for spawning by chinook and coho salmon and steelhead trout (Table 10).

Chinook salmon were found in the mainstem above the confluence of the South Fork and in four tributaries: Anderson, Nolan, Winfield, and Owl creeks. Chinook were present in late October and were observed in declining numbers through mid-December when the last observation was made.

Coho Salmon were found in mainstem side channels of the upper Hoh and in seven tributaries: Anderson, Nolan, Winfield, Alder, Pole, Snider, and Taft creeks. The first coho observation was in early January.

Steelhead were seen during mid-February in one tributary, Pole Creek, as survey operations were terminated.

Two index areas were established in the drainage, one on Winfield Creek for chinook and another on Nolan Creek for both chinook and coho.

Table 10. Observed areas of use, by species, in the Hoh River Drainage

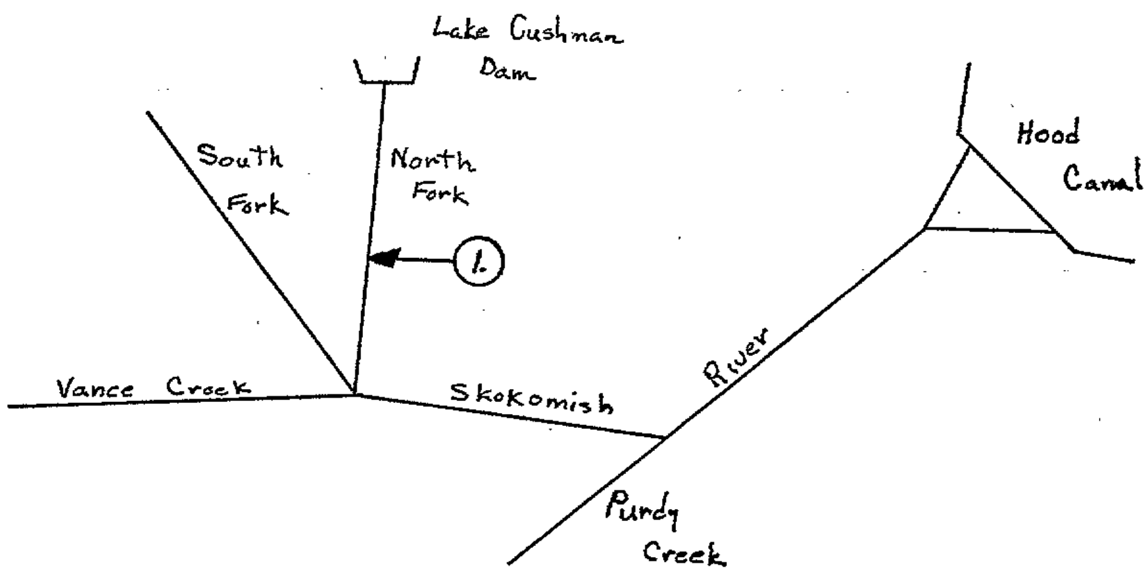
	Chinook	Coho	Pink	Chum	Steelhead
Mainstem	x	x			
Braden Creek					
Nolan Creek	x	x			
Winfield Creek	x	x			
Anderson Creek	x	x			
Owl Creek	x				
Alder Creek		x			
Taft Creek		x			
Snider Creek		x			
Pole Creek		x			x

INDEX AREAS

The following section locates and describes by drainage the tentative index areas established during the study. It should be kept in mind that several of these areas were established after surveys indicated usage by anadromous fish. In many instances, additional data on the stream is available, but because it is not limited to the confines of the index area, it is not included in this section.

Skokomish River Drainage

One index area for both coho and chum salmon was established in the drainage. The following schematic map locates the index area in relation to the entire drainage.



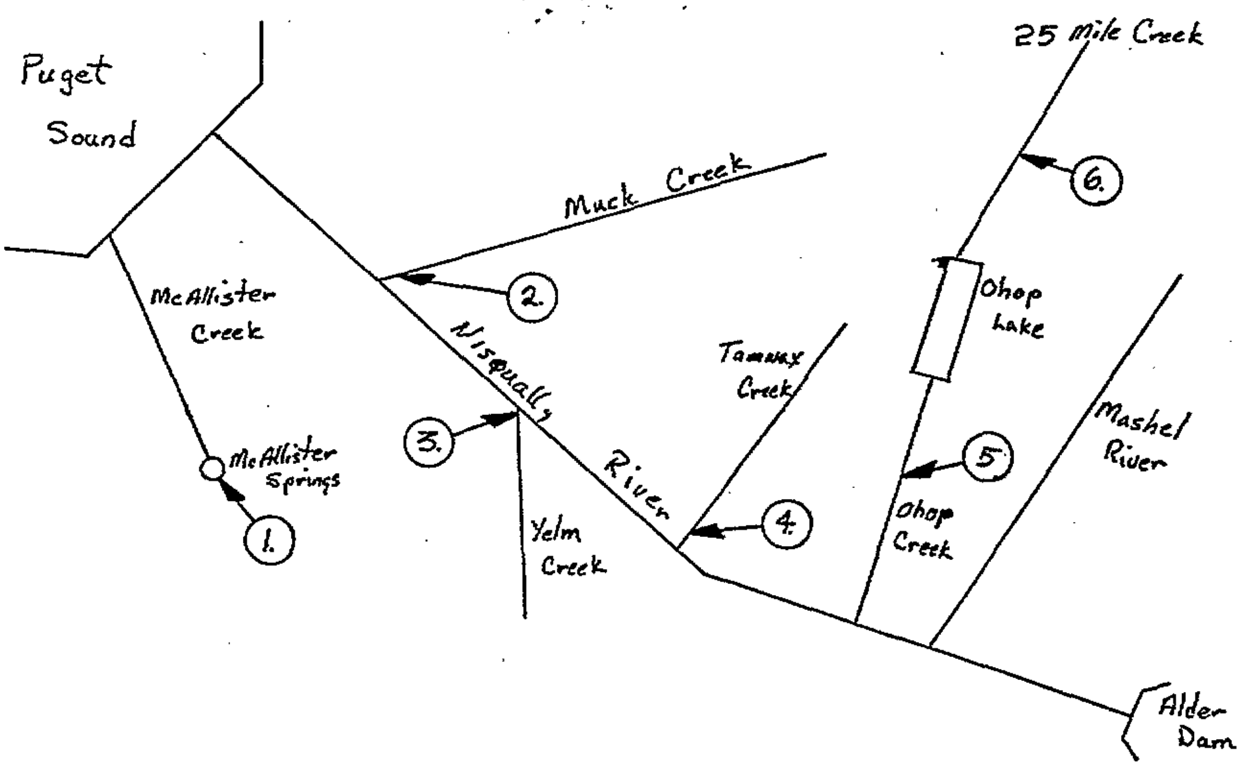
Index area number 1, for both coho and chum salmon, is located on the North Fork of the Skokomish River. The area starts at the point where the Potlatch Park Road crosses the river, and continues downstream .25 miles. The area is approximately 20 feet wide and has a pool-riffle ratio of 20:80. Gravel composition is 5% 6"-3", 80% 3"-1", 10% 1"-0" and 5% sand. The area was surveyed a total of nine times between November 8, 1971 and February 2, 1972.

Coho were already present in early November when surveys were initiated. Live chum salmon were seen in early December. Due to heavy snow the main chum run was missed; however, numerous carcasses were counted in early February.

Nisqually River Drainage

A total of five index areas were established in the drainage; five for coho, two for pink, and three for chum. In some cases the same area is an index for more than one species. Also shown (Number 1) is the index area on McAllister Creek.

The following schematic map locates the index areas in the Nisqually drainage, and on McAllister Creek.



Index area number 1, for coho and chum salmon, is located on McAllister Creek and includes the city of Olympia water supply reservoir and the springs immediately below it. This area has no riffles, but rather upwellings, which fish use for spawning. The gravel composition of the springs is as follows: 10% 6+", 25% 6"-3", 50% 3"-1", 10% 1"-0", and 5% sand and silt.

The area was surveyed eight times between January 5, 1972 and March 2, 1972. Coho were observed on the first survey, after which numbers declined rapidly, so that by the second survey, no live coho were present. Chum salmon were observed between late December and late February.

Index area number 2, for coho and chum salmon, is located on the lower .5 mile of Muck Creek, from the mouth upstream. The flow in the creek was very low until December, after which flows increased considerably. This made observations difficult during the latter part of the survey. In the index area, the creek is 15 to 30 feet wide, with a gravel composition of 5% 6"-3", 65% 3"-1", and 30% 1"-0". The area has a pool-riffle ratio of 10:90.

The area was first checked on October 5, 1971, and was surveyed a total of 12 times; the last survey being on February 10, 1972. Coho were first seen in this area in early December and were present until late December. Chum salmon were first seen in early January and were present until the last survey.

Index area number 3, established for pink, coho, and chum salmon, begins at the mouth of Yelm Creek and extends upstream for .5 miles. The index area has a pool-riffle ratio of 60:40, a width of 10 to 20 feet, and a gravel composition of 5% 6", 30% 6"-3", 50% 3"-1", 10% 1"-0", and 5% sand and silt.

The area was checked 13 times between October 8, 1971 and February 25, 1972. Pink salmon were observed during November. Coho were observed from mid-November to early January. Chum salmon were observed between mid-January and late February.

Index area number 4, for coho and chum salmon, is located on Tanwax Creek, and covers a .06 mile stretch from its mouth upstream. The stream in this area is 10 to 30 feet wide, with a pool-riffle ratio of 60:40, and a gravel composition of 30% 6+", 10% 6"-3", 30% 3"-1", 10% 1"-0", and 20% sand and silt.

The area was checked 16 times between October 15, 1971 and February 23, 1972. Coho began to appear in mid-November and remained until early December. Chum salmon first appeared in mid-January and remained until early February.

Index area number 5, established for pink and coho, is located on Ohop Creek. The area extends from the Highway 161 bridge near Eatonville downstream .5 mile. In the index area, the creek is 15 to 30 feet wide, with a pool-riffle ratio of 10:90, and a gravel composition of 5% 6", 50% 6"-3", 30% 3"-1", 10% 1"-0", and 5% sand and silt.

The area was checked nine times between November 5, 1971 and February 25, 1972. Pink salmon were already present when the first survey was made in early November, and were not observed again. The first coho observation was made in early November and they were last seen in early January.

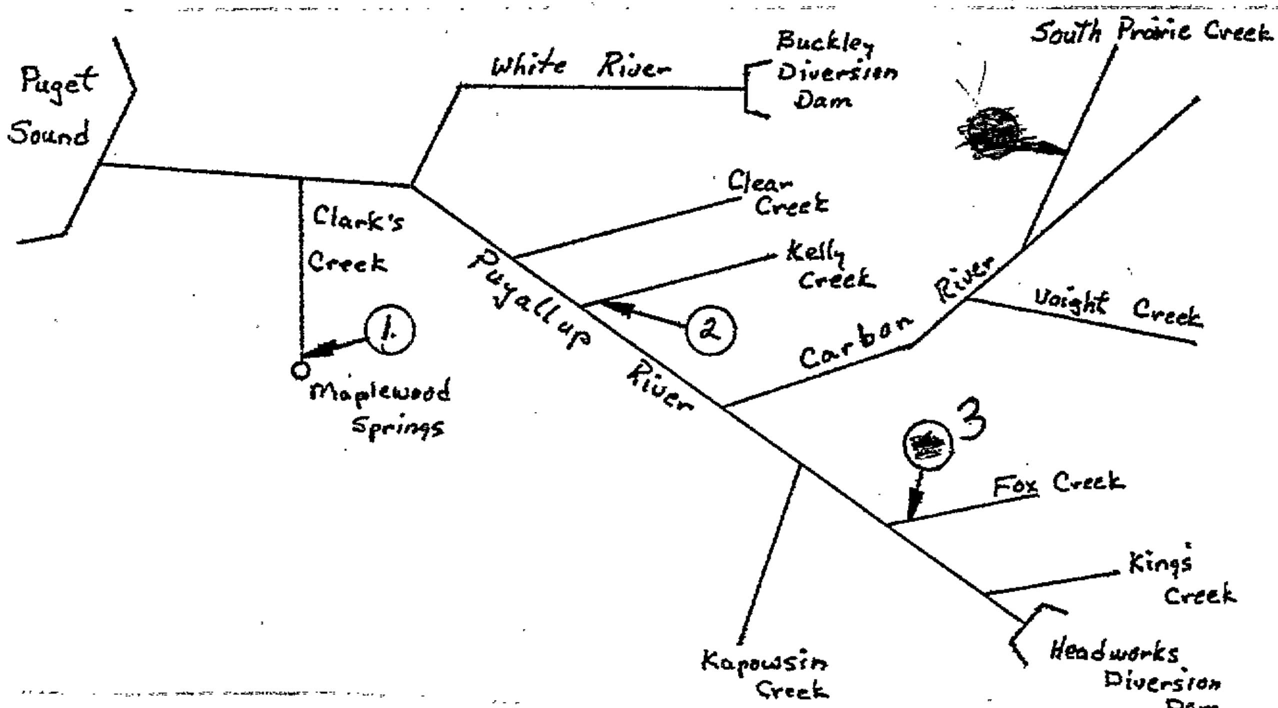
Index area number 6, for coho is located on 25-Mile Creek from the railroad bridge crossing near Clay C ity downstream .25 miles. This area is 4 to 8 feet wide, with a pool-riffle ratio of 40:60 and a gravel composition of 5% 6", 20% 6"-3", 30% 3"-1", 25% 1"-0", and 20% sand and silt.

The area was first checked on October 7, 1971, and was surveyed 15 times; the last survey being on February 24, 1972. Coho were observed from early November until mid-January.

Puyallup River Drainage

A total of three index areas were established in the drainage. These include: three for coho, one for chum salmon, and one for steelhead trout. In some cases an area is an index for more than one species.

The following schematic map locates the index areas in the Puyallup drainage.



Index area number 1, for coho, is located on Clark Creek and includes the first .25 miles downstream from its source. The stream in this area is approximately 10 feet in width, with a pool-riffle ratio of 60:40. Gravel composition is 35% 3"-1", 55% 1"-0", and 10% sand.

The area was checked a total of 12 times between October 13, 1971, and February 24, 1972. Coho were observed from early November to late January.

Index area number 2, for coho, chum salmon, and steelhead is located on Kelly Creek, from the first road crossing downstream .25 miles. The stream in this area is approximately 6 to 12 feet in width, with a pool-riffle ratio of 15:85. Gravel size is 10% 3"-6", 80% 3"-1", and 10% 1"-0".

The area was checked 16 times between November 11, 1971, and March 2, 1972. Coho were present in the index area from early November to early February. Chum salmon were observed from mid-December through early February, and steelhead were first seen in early February and were still increasing in numbers during the first part of March.

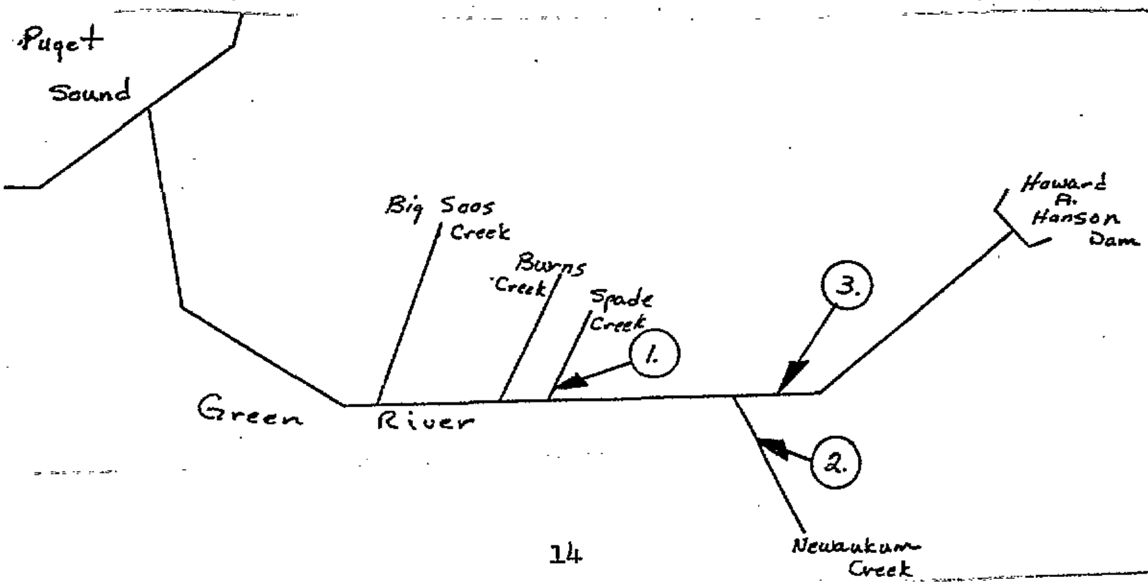
Index area number 3, for coho, is located on Fox Creek, and extends from the mouth .25 miles upstream. The stream in this area is approximately 3 to 10 feet in width, with a pool-riffle ratio of 70:30, and a gravel composition of 90% 3"-1", and 10% 1"-0".

The area was first checked on November 3, 1971, and was surveyed twelve times, ending on February 24, 1972. Live coho were observed in the area during the first part of November.

Green River Drainage

Three index areas were established in the drainage, one for chinook and two for coho salmon.

The following schematic map locates the index areas in the Green River drainage.



Index area number 1, for coho salmon, is located on Spade Creek. The area extends from the Green Valley Pool crossing downstream .25 miles. It has a 70:30 pool-riffle ratio, and is characterized by small riffle areas 5 to 10 feet wide, with a gravel composition of 70% 3"-1" and 30% 1"-0". The area was checked 11 times between November 19, 1971, and February 23, 1972.

Coho were observed in Spade Creek from early November until mid-February.

Index area number 2, for coho salmon, is located on Newaukum Creek, and extends downstream from the first paved road crossing .25 miles. The index area has a pool-riffle ratio of 50:50, and a width of 15 to 20 feet, with a gravel composition of 10% 6+", 60% 6"-3", and 30% 3"-1".

Coho were first observed in the area in early November and last seen in early January. It was surveyed a total of 9 times between December 8, 1971, and February 7, 1972.

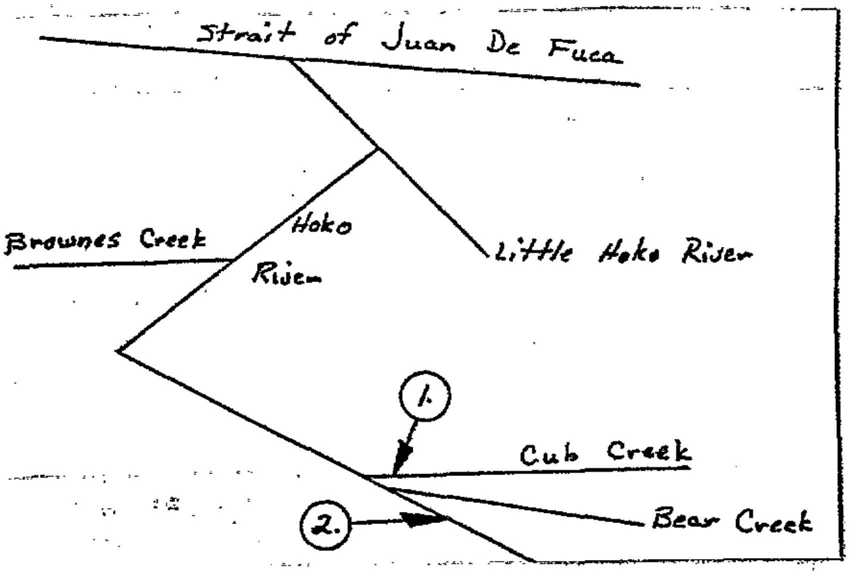
Index area number 3, for chinook is located on the mainstem Green River about 30 miles from the mouth. The area, approximately one mile in length, is from Flaming Geyser Park downstream one mile. In this area, the river is approximately 50 to 75 feet wide, with a pool-riffle ratio of 25:75, and a gravel composition of 40% 6+", 30% 3"-6", 25% 3"-1", and 5% 1"-0".

Chinook were observed in the area in mid-October; however, the area was not established as a potential index until after the run was over. The area was checked again in early February during the steelhead surveys.

Hoko River Drainage

Two index areas were established in the drainage, both for coho salmon.

The following schematic map locates the index areas in the Hoko drainage:



Index area number 1, for coho, is located on Cub Creek from the 6000 Road crossing upstream .25 miles. This area is 6 to 10 feet wide, with a pool-riffle ratio of 20:80 and a gravel composition of 10% 6+", 20% 3"-6", and 10% sand and silt.

The area was surveyed six times between December 15, 1971 and February 17, 1972. Coho were observed between mid-December and early January.

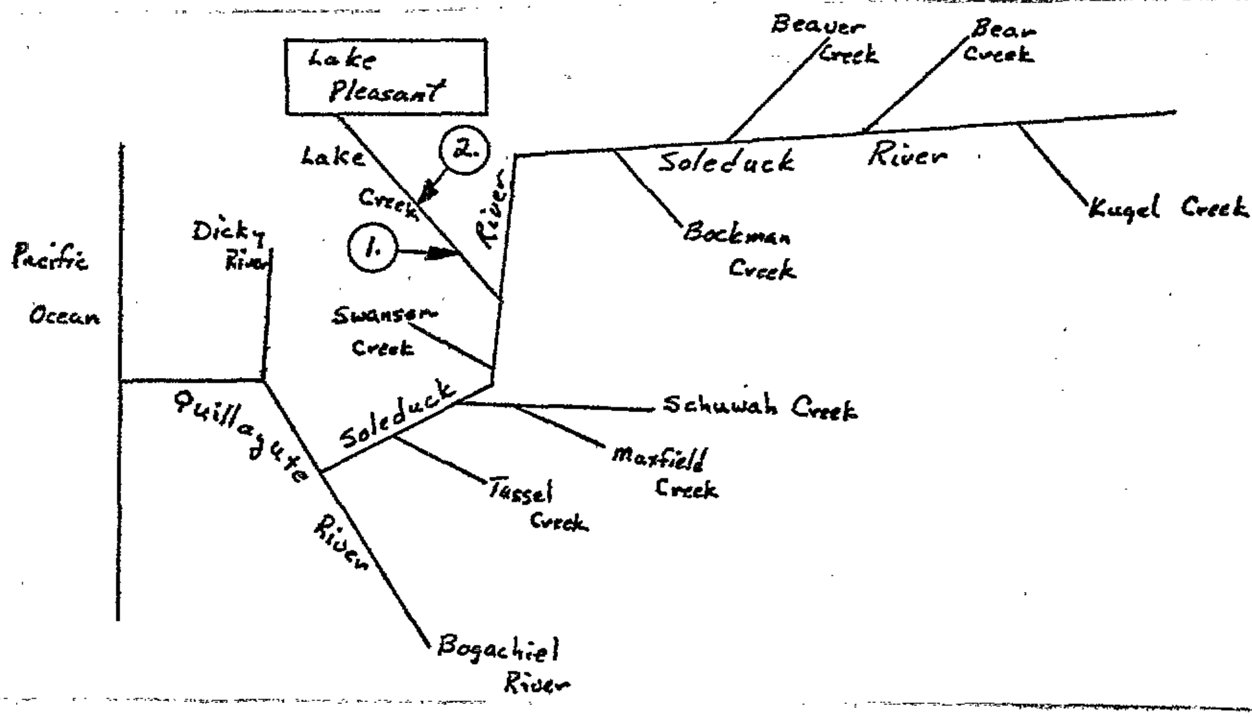
Index area number 2, for coho, was established on the Hoko mainstem, about 19 miles from its mouth and extends from the 9000 Road crossing upstream .25 miles. This area is 15 to 20 feet wide, with a pool-riffle ratio of 20:80, and a gravel composition of 10% 6+", 30% 3"-6", 30% 3"-1", and 30% 1"-0".

The area was surveyed six times between December 15, 1971 and February 17, 1972. Coho were observed in the area during mid-December surveys.

Soleduck River Drainage

Two index areas were established in the drainage, one for chinook and one for coho.

The following is a schematic map locating the index areas in the Soleduck drainage:



Index area number 1, for chinook salmon, is located on Lake Creek, and extends from the old railroad trestle above Highway 101 upstream .5 miles. The index area has a pool-riffle ratio of 20:80; a width of 15 to 30 feet; and a gravel composition of 20% 6+", 30% 6"-3", 30% 3"-1", and 20% 1"-0".

The area was surveyed six times between November 30, 1971 and February 2, 1972. Chinook were observed during November and December surveys.

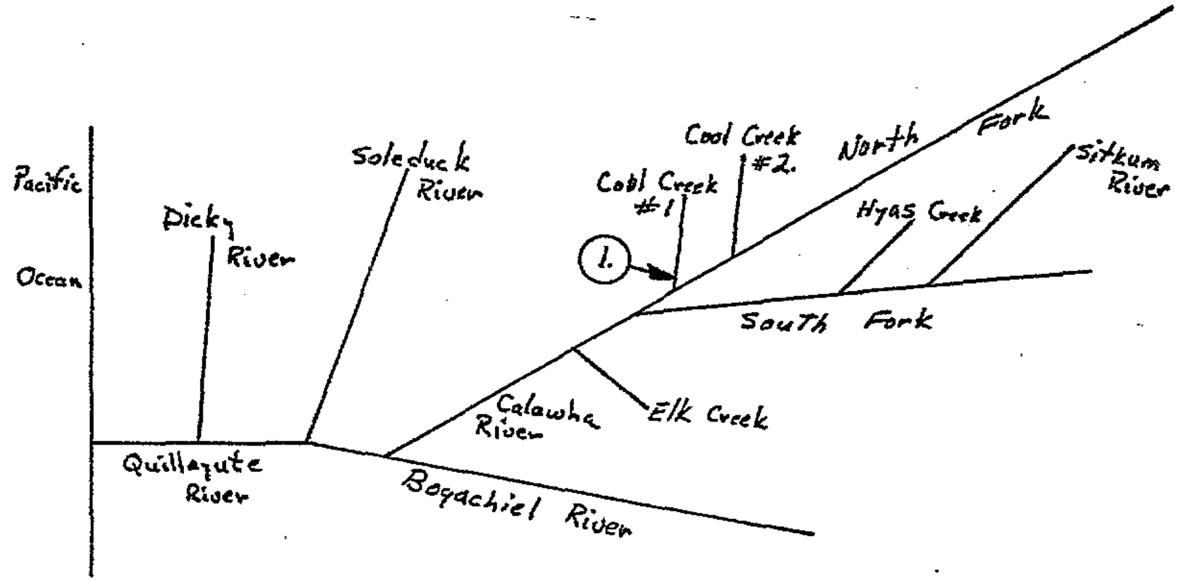
Index area number 2, for coho salmon, is located on Lake Creek. The area is located about one mile downstream from Lake Pleasant and extends from the wier downstream .5 miles. The index area has a pool-riffle ratio of 20:80, a width of 15 to 30 feet, and a gravel composition of 20% 6+", 30% 6"-3", 30% 3"-1", and 20% 1"-0".

The area was surveyed seven times between November 30, 1971 and February 2, 1972. Coho were observed late November through early January.

Calawah River Drainage

One index area was established in the drainage for both chinook salmon and steelhead trout.

The following is a schematic map locating the index area in the Calawah drainage.



Index area number 1, for chinook salmon and steelhead, is located on Cool Creek No. 1 and extends from the mouth upstream .75 miles. The index area is 6 to 15 feet wide, with a pool-riffle ratio of 10:90, and a gravel composition of 5% 6+", 25% 6"-3", 50% 3"-1", 20% 1"-0". The area was surveyed seven times between December 13, 1971 and February 17, 1972.

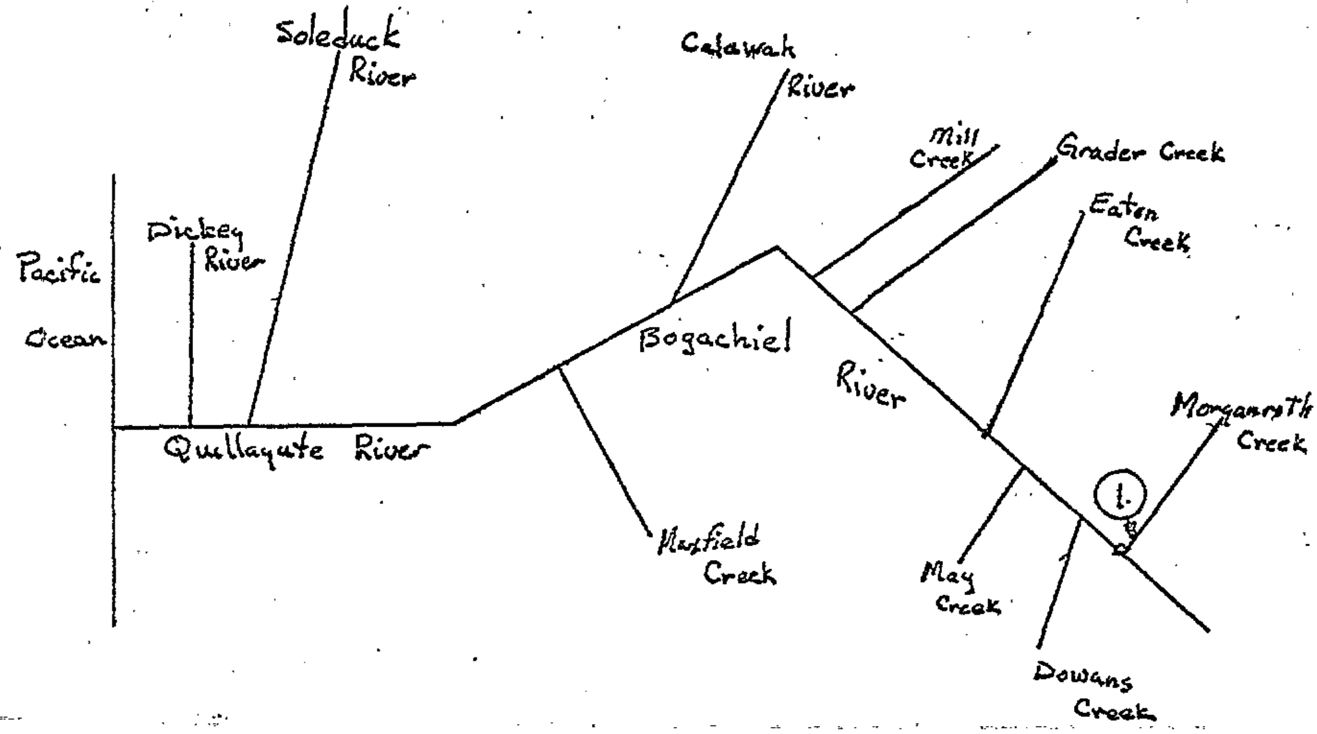
Chinook were observed from late November (before the area was defined as a tentative index) until mid-December.

Steelhead were observed spawning in the area during mid-February.

Bogachiel River Drainage

One index area was established in the drainage for coho salmon.

The following is a schematic map locating the index area on the Bogachiel drainage:

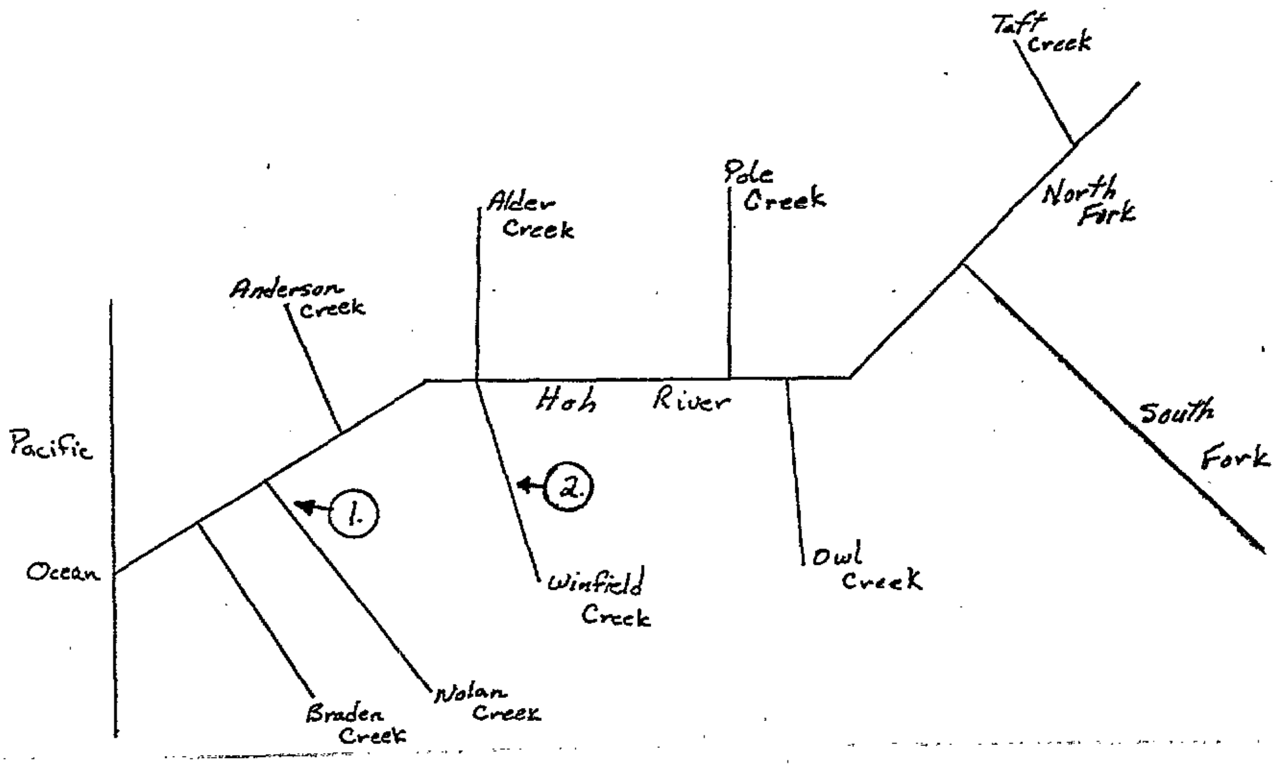


Index area number 1, for coho salmon, is located on Morganroth Creek and extends from the mouth .5 miles upstream. The creek is 4 to 10 feet wide, with a pool-riffle ratio of 10:90 and a gravel composition of 30% 3"-1" and 70% 1"-0". The area was first checked on November 30, 1971 and was surveyed 10 times, until the last survey on February 17, 1972. Coho salmon were already present at the time of the first survey, and were last observed in early January.

Hoh River Drainage

Two index areas were established in the drainage. One for chinook only, and one for both chinook and coho.

The following is a schematic map locating the index areas on the Hoh drainage:



Index area number 1, for chinook and coho salmon, is located on Nolan Creek and extends from the mouth upstream one mile. The stream in this area is 20 to 40 feet wide, with a pool-riffle ratio of 40:60, and a gravel composition of 60% 6"-3", 30% 3"-1", and 10% 1"-0".

The area was surveyed 11 times between October 27, 1971 and February 17, 1972. Chinook were observed between late October and mid-November. Coho were seen between late November and early January.

Index area number 2, for chinook, is located on Winfield Creek. The area is approximately one mile long and extends from the first bridge on 9000 Road downstream to an old bridge crossing on a spur road. The stream in this area is 25 to 35 feet wide with a pool-riffle ratio of 10:90 and a gravel composition of 5% 6+", 45% 6"-3", 45% 3"-1", and 5% 1"-0".

The area was first checked on October 26, 1971 and was surveyed 11 times, until the last survey on January 4, 1972. Chinook were already present on the first survey, and were last observed in mid-December.

Prepared by

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QUILLAUTE RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/27/70	Mainstem - from mouth to Hova Fall	1.50	overcast	clear	None														
			Total miles walked 1.50																	

DICKEY RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/28/70	Mainstem near Larger Cr.	1.0	clear	slightly turbid	None														
2	10/28/70	E. Fork - upstream from mouth	1.0	clear	clear	None														
3	10/29/70	W. Fork	Spotchecks - 4 points	clear	slightly turbid															
4	12/4/70	Skunk Cr. - Road to mouth	.75	overcast	clear				9	0	11									
			Total miles walked 2.75																	

SOLEDUCK RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/30/70	Mainstem - between bridges above Sappho, near Klahowya camp	1.50	clear	clear	10	0	0												
2	10/30/70	Mainstem - up [illegible] 1/4 mi. below fork boundary	.19	clear	clear	1	0	0												
3	10/30/70	South Fork - from mouth upstream	.19	clear	clear	6	1	2												
4	10/30/70	North Fork - from mouth upstream	.19	clear	clear	3	0	3												
			Total miles walked 2.07																	

CALAWAH RIVER DRAINAGE

Salmon Spawning Surveys
Run Ye ar 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/20/70	N. Fork near mouth	.50	clear	clear	6	0	1												
2	10/22/70	S. Fork- lower section vicinity of confluence with N. Fork	1.00	clear	clear	32	3	3												
3	10/27/70	N. Fork (no other reference)	Spot checks along 3 mi. of rd.	clear	clear	62	0	0	(estimate)											
4	12/3/70	N. Fork (no other reference)	.65	overcast	clear	0	3	0	7	10	1									
5	12/3/70	S. Fork- between Bridge + Hayes Cr.	.50	overcast	clear				2	1	18									
			Total miles walked 2.65																	

BOGOCHIEL RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook: Live	Chinook: Dead	Chinook: Redds	Coho: Live	Coho: Dead	Coho: Redds	Chum: Live	Chum: Dead	Chum: Redds	Pink: Live	Pink: Dead	Pink: Redds	Steelhead: Live	Steelhead: Dead	Steelhead: Redds
1	10/29/70	Mainstem - .08mi. below Bear Cr. to .25 mi. above it	.25	clear	turbid	None														
2	10/29/70	Mainstem from 3.7 mi. above Hwy 101 Br. upstream .38mi. on N. side	.38	clear	clear	None														
3	10/29/70	Mainstem - from mouth of Morganroth Cr. upstream	.33	clear	clear	7	0	0												
4	10/29/70	Morganroth Cr. - from mouth upstream	.25	clear	clear	0	2	2												
5	10/29/70	Mainstem - vicinity of Grader Cr.	.06	clear	clear	None														
6	10/29/70	Mainstem from [illegible] mi. above mouth of Grader Cr.	.28	clear	clear	0	1	0												
7	12/2/70	Unnamed Trib. near Bogachiel State Park	.50	clear	clear				11	6	4									
			Total miles walked 2.05																	

HOH RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/7/70	Nolan Cr. from Hyw. [illegible] Br. to mouth	1.00	overcast	clear	None														
2	10/17/70	Mainstem mouth to Nolan Cr. by boat	5.00 (boat)	overcast	clear	0	0	2												
3	10/17/70	Mainstem ½ mi. below Hyw 101 Br. to ¼ mi. above	.75	rainy	clear	None														
4	10/27/70	Nolan Cr. from Hyw. 101 Br. to mouth + 1 mi up from Br.	2.00	overcast	slightly turbid	13	2	2												
6	10/28/70	Mainstem - side channel from mouth of Anderson Cr. upstream	.33	clear	slightly turbid	0	2	0												
7	10/28/70	Mainstem - from mouth of [illegible] Cr. upstream	.06	clear	slightly turbid	0	1	1												
8	10/28/70	Mainstem - side channel above + below mouth of Tower Cr.	.38	clear	slightly turbid	13	1	4												
9	10/28/70	Mainstem - from mouth of Willoughby Cr. upstream	.12	clear	slightly turbid	6	0	4												
10	10/28/70	Anderson Cr. - from Oil City Rd. Br. to mouth	.33	clear	slightly turbid	2	0	7												
11	12/1/70	Nolan Cr. Hyw 101 to mouth + segment between 2nd + 3rd fork above Hyw 101	2.50	overcast	slightly turbid	0	1	0												
12	12/2/70	Owl Cr. 2 segments - 1 near mouth - other where Cr. turns N. after flowing W.	1.00	overcast	clear													2	0	0
13	12/2/70	Winfield Cr. - [illegible] lower half	1.00	clear	slightly turbid	0	23	*												
14	12/3/70	Winfield Cr. - vicinity gravel pit	1.75	rainy	slightly turbid				3	0	5									
			Total miles walked 11.35																	
			Total boat miles 5.00																	
			Total 16.35																	

* redds [illegible] not [illegible]

SKOKOMISH RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Fish Data: Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	10/19/70	Mainstem from mouth upstream - 1st boat	5.5 (boat)	rainy	clear	0	2	0	44	3	0									
2	10/21/70	Purdy Cr. & unnamed trib vicinity of [illegible]	N/A	rainy	slightly turbid	1	3	1	25	3	0 (All fish seen in Purdy Cr.)									
3	10/21/70	N. Fork from [illegible] downstream	1.5	rainy	slightly turbid	None														
			Total miles walked 1.5																	
			Total boat miles 5.5																	
			Total mileage 7.0																	

NISQUALLY RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/15/70	Maschel R. - Hyw. 7 to mouth	2.0	clear	slightly turbid	7	7	18												
2	10/15/70	Ohop Cr. [illegible] downstream from Hyw 7	2.0	clear	slightly turbid	None														
3	10/15/70	Muck Cr. from mouth upstream	.70	clear	clear	0	0	7												
4	10/15/70	Ohop Cr. from Hyw 161 bridge downstream	.50	clear	clear	None														
5	10/19/70	Machel R. from Hyw. 7 Br. upstream	([illegible] Machel R. [illegible] Maschel R.) 1.50	overcast	clear	2	0	2												
6	11/16/70	Muck Cr. from mouth up	.60	overcast	clear	None														
7	11/16/70	Yelm Cr. - vicinity of Yelm	1.06	overcast	clear	None														
8	11/16/70	Horn Cr. - from mouth upstream	1.80	overcast	slightly turbid	None														
9	11/16/70	Tanwax Cr. - from mouth upstream	3.00	overcast	clear	None														
10	11/17/70	Ohop Cr. from bridge on Hyw 161 downstream	1.60	overcast	slightly turbid				47	8	17									
11	11/17/70	Maschel R. - Eatonville to R.R. Bridge - upstream from town	1.30	overcast	slightly turbid	None														
12	11/17/70	25 mi. Cr. - vicinity of Clay factory	1.00	overcast	slightly turbid				34	0	15									
			Total miles walked 16.06																	

PUYALLUP RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Etc.
1	10/13/70	Kapowsin Cr. [illegible]	.39	clear	clear	10	2	4	2	0	1									
2	10/13/70	[illegible] Mouth to vicinity of [illegible] (boat)	13.00 (boat)	clear	turbid	None														
3	10/12/70	Voight's Cr. to hatchery water intake	.63	clear	clear	10	0	0	600	2	200	(estimate)								
4	10/13/70	White R. from mouth to [illegible] Cr. (boat)	4.00 ([illegible])	clear	slightly turbid	1	0	0												
5	10/13/70	Prairie Cr I [illegible]	1.00	clear	slightly turbid	54	43	39												
6	10/14/70	White R. from [illegible] North	1.20	clear	slightly turbid	12	0	5												
7	10/14/70	[illegible] Cr II (no other reference)	(not [illegible])	clear	[illegible] turbid	15	21	15												
8	10/14/70	Lower Carbon R., Sect. 26 [illegible]	.50	clear	turbid	None														
9	10/14/70	S. Prairie Cr III [illegible]	(not [illegible])	clear	slightly turbid	[illegible]	1	0												
10	10/14/70	S. Prairie Cr. [illegible]	.75	clear	clear	7	2	0												
11	10/14/70	White [illegible] from [illegible] Sec. [illegible] T[illegible], to 100' past power transmission line	2.60	clear	slightly turbid	19	2	7	3	0	3									
12	10/18/70	Kelly Cr. - Road to mouth	.25	clear	slightly turbid	None														
13	10/18/70	Clear Cr. - Road to mouth	.25	overcast	clear				1	0	8									
14	10/19/70	King Cr. [illegible] side of road with [illegible] gate	.50	overcast	slightly turbid	None														
15	10/19/70	White R. at [illegible]	.13	overcast	[illegible]				15	0	3									
			Total [illegible] (Kanaskat) 8.20																	
			Total [illegible] 17.00																	

Total 25.20

GREEN RIVER DRAINAGE

Salmon Spawning Surveys
Run Year 1970-1971

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	10/16/70	Big Soos Cr. - S.E. 25 [illegible] Hwy 18	.25	clear	slightly turbid	None														
2	10/16/70	[illegible] Soos Cr. [illegible] Ram to Covington [illegible]	1.50	clear	clear	2-unidentified														
3	10/16/70	Green R. mainstem (no other reference)	2.20	clear	clear	253	79	180	290	0	0									
4	10/16/70	Big Soos Cr. vicinity of hatchery	.50	clear	slightly turbid	479	200	+50												
5	10/16/70	Newaukum Cr. from Hwy 161 down to 424th St.	.50	clear	slightly turbid	None														
6	10/16/70	Newaukum Cr. - from Whitney Hill Rd. Br. down	.50	clear	slightly turbid	24	8	10												
7	11/16/70	Covington Cr. from Br. on 168th Ave to Big Soos Cr.	.50	overcast	clear				13	12	10									
8	11/16/70	Big Soos Cr. from S.E. Br. of Covington Cr. down	.25	overcast	slightly turbid	0	8	0	21	11	11									
9	11/16/70	[illegible] Cr. from Br. on Green Valley Rd. down	.25	overcast	clear	4	1	2												
10	11/17/70	Newaukum Cr. [illegible] Ave. bridge to mouth	1.00	overcast	slightly turbid	0	42	10	1	0	15									
11	11/17/70	Burns Cr. - near mouth	.25	overcast	slightly turbid	None														
12	11/17/70	Mainstem from Newaukum Cr. to S.E. 212th St. Br.	.75	overcast	clear	0	52	0	2	0	1									
13	11/17/70	Newaukum Cr. - New Enumclaw [illegible] Hwy [illegible] + S.E. [illegible]	.50	overcast	slightly turbid				16	0	11									
			Total miles walked 8.95																	
			Total miles [illegible]																	

HOKO RIVER DRAINAGE

Cub Creek

(Run year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
18	12/15/71		✓	RAIN	clear				10	2	6									
18A	12/15	IMM. ABOVE INDEX	1/4	RAIN	clear				13	3	12									
20	12/[illegible]		✓	SNOW	Slightly Turbid				23	5	18									
22	1/5/72		✓	RAIN	CLEAR				3	9	NUMEROUS									
28	1/13	-	✓	Overcast	Slightly Turbid				0	0	0									
29	2/3		✓	Clear	Clear				0	0	0									
31	2/17		✓	Rain	Slightly Turbid				0	0	0									
			Total miles walked on Index 1.50																	
			Total miles walked other than Index .25																	
			Total 1.75																	

1/ From 6000 Road Crossing upstream for .25 miles.

11

SEKIU RIVER DRAINAGE

Streams Surveyed

(Run year 71-72)

Survey No.	Date	Area Description	Index Area (·) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
7	10-8-71	Mainstream 1/2 above mouth of Carpenter Creek to 1 mile above	1	Clear	Clear															
1	10-8-71	Mainstream - 1/2 mi above mouth at Sekiu to mouth Carpenter Cr.	1/2	Clear	Clear															
3	10-19-71	No Name Cr. near mouth to trib	1/8	Rainy	Clear															
4	10-19-71	Carpenter Cr. near mouth	1/2	Rainy	Clear															
6	10-29-71	Carpenter Creek upstream from mouth	1/8	Rainy overcast	Clear															
5	10-29-71	Mainstream downstream from mouth of Carpenter Cr.	1/4	Foggy overcast	Clear															
7	12-22-71	Small creek near Crown Z gate	1/8	Rainy	Slightly turbid															
8	12-22-71	No name near mouth to trib.	1/8	Rainy	Slightly turbid															
9	12-22-71	Carpenter Creek from mouth upstream	1/8	Rain snow	Slightly turbid															
10	2-3-72	Mainstream above 7000 bridge	1/4	Overcast	Turbid															
11	1-13-72	Little Sekiu above 8000 Rd	1/2	Snow	Clear				0	2	0									
12	1-13-72	Trib. on South Fork on 5000 Rd	1/2	Snowing	Clear															
13	2-3-72	Little Sekiu - on stream from 7000 bridge	1/4	Clear	Clear															
14	2-2-72	Carpenter Cr. upstream from end of spur at washed out bridge	1/4	Overcast	Clear															
			Total miles walked 4.60																	

HOKO RIVER DRAINAGE

Mainstem

(Run year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	10-8-71	MAINSTEM - 1 MI ABOVE HOKO CAMP - 1 MI. BELOW CAMP	2	CLEAR	CLEAR															
4	10-21-71	MAINSTEM - BELOW MOUTH OF BROWNS CREEK	1/16	OVERCAST	CLEAR	1	0	2												
7	11-23-71	FROM BRIDGE BELOW WHERE FALLS USED TO BE, TO MOUTH (RAFT)	9	RAIN + FOG	SLT TURBID TO TURBID															
19	12-15-71	HEADWATERS INDEX	✓	RAIN	CLEAR				10	4	14									
21	12-20-71	UPPER MAINSTREAM INDEX	✓	SNOW	SLIGHTLY TURBID				5	4	6									
23	1-5-72	UPPER HOKO MAINSTEM	✓	RAINY	SLIGHTLY TURBID				0	10	0									
24	1-5-72	HOKO MAINSTEM, NEAR BROWNS CR - WALK DOWNSTREAM	1/4	RAINY	CLEAR				0	1	0									
25	1-11-72	UPPER STREAM	✓	OVERCAST	SLIGHTLY TURBID															
30	2-3-72	UPPER HOKO INDEX	✓	CLEAR	CLEAR															
32	2-17-72	HOKO INDEX	✓	RAINY	TURBID				0	0	0									
			Total miles walked on Index 1.50																	
			Total miles walked other than Index 2.31																	
			Total 3.81																	
			Total Raft miles 9.00																	

1/ From 9000 Road Crossing upstream .25 Miles.

HOKO RIVER DRAINAGE

Miscellaneous Streams

(Run year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
16	12/15/71	BEAR CR. FROM BRIDGE [illegible] UP	1/4	RAIN	Slightly Turbid				1	2	2									
3	10/21/71	LITTLE HOKO NEAR MOUTH	1/10	Overcast	Clear															
2	10/21/71	LITTLE HOKO UP. TR. BELOW SURVEY. CR. BREAK RD	1/4	Overcast	Clear															
6	10/29/71	LITTLE HOKO UP RD FROM CONFLUANCE WITH HOKO	1/2	Clear	Clear															
5	10/29/71	BROWNS CR. MOUTH UP	1/4	Clear	Clear															
18	11/2?/71	LITTLE HOKO CONFLUANCE W/HOKO	> 1/4	RAIN	Turbid															
8	11/23/71	BROWNS MOUTH UP	3/4	RAIN	Slightly Turbid				2											
12	12/8/71	LITTLE HOKO .2 MI. MOUTH UP	3/4	CLEAR	Slightly Turbid	1	0	0												
15	12/13/71	BROWNES MOUTH UP	1/4	Rain	Slightly Turbid						1									
17	12/15/71	TRIB. AT BRIDGE NEAR BEAR[illegible] CR.	1/4	Rain	Slightly Turbid				2	0	3									
26	1/13/72	BROWNS MOUTH UP	1/4	Overcast	Slightly Turbid															
27	1/13/72	LITTLE HOKO CON. OF HOKO	1/4	Overcast	Slightly Turbid				0	1	0									
			Total miles walked 4.10																	

11

DICKY RIVER DRAINAGE

Streams Surveyed
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
12	1/5/72	SQUAW CR. BR ON K-Line Rd. DOWNSTREAM	2/10	RAIN	Slightly Turbid															
13	1/5	1ST CR. W of Squaw Cr ON K-LINE Rd	1/4	RAIN	Slightly Turbid															
11	1/5	SKUNK CR, BR DOWNSTREAM	1/8	RAIN	Slightly Turbid															
9	12/22/71	COLBY CR BR. ON 5000 RD TO FALLS	3/4	RAIN	Slightly Turbid				1		1									
10	1/5	COAL CR. BR. ON 5000 RD, DOWN	1/4	RAIN	CLEAR				1		1									
1	10/15	COAL CR 3/4 MI ABOVE MOUTH	1	CLEAR	CLEAR															
2	10/28	Colby Cr. UP FROM LOWER BR	1/4	CLEAR	CLEAR															
3	10/28	COLBY CR. UP FROM MOUTH	1/8	CLEAR	CLEAR															
4	10/28	E. FORK Dickey R. up from mouth	1/4	CLEAR	CLEAR															
5	12/5	E. DICKEY FROM FALLS UP	7 (Raft)	RAIN	Slightly Turbid		3			1										
6	12/15	E. Fork Dickey R. from forks to mouth	7 (Raft)	RAIN	Slightly Turbid															
7	12/15	COAL CR. MOUTH UP	1/4	RAIN	Slightly Turbid															
17	1/6/72	UPPER W. DICKEY R. UPSTREAM 21 1/2 BR	1/2	Overcast	Slightly Turbid				0	1	0									
15	1/6	GUNDERSON Cr.-Mouth UP	1/4	CLEAR	Slightly Turbid				0	1	0									
16	1/4	SKUNK CR BR "B" RD	1/4	CLEAR	Clear															
18	1/6	PONDS CR 10 1/2 BR. DOWN	1/8	Overcast	Turbid					(Total miles walked					4.93					
19	1/6	STAMPEDE CR 21 1/2 BR UP	1/4	Overcast	Clear					Total miles by raft					14.00)					
14	1/6	COLBY CR FROM LOWER BR	1/8	Clear	Slightly Turbid															

SOLEDUCK RIVER DRAINAGE

Lake Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds	Sockeye Live	Sockeye Dead	Sockeye Redds
9	10-21-71	Lake Creek below weir near Lost [illegible]	Pool Below weir	Foggy overcast	Clear																est 100		
11	10-22-71	Lake Creek from 101 Bridge downstream	330 yds	Rainy	Slightly turbid																		
12	10-22-71	Lake Creek 100 yds downstream from weir	100 yds	Rainy	Slightly turbid				12	0	0							2	0	0	300	0	0
17	10-28-71	Lake Creek weir	weir	Clear	Clear				5	0	0										305	0	0
18	10-28-71	Lake Creek from mouth up	1/8	Clear	Slightly turbid																		
19	11-16-71	Lake Creek from 101 Bridge to [illegible] trap	1 3/4	Clear	Clear	172	53	28	71	0	0										522	1	2
25	11-30-71	Lake Creek from trap downstream to upper trestle	1/2 (coho) ✓	Overcast	Slightly turbid	3	17	5	23	0	3										est 300	0	0
26	11-30-71	Lake Creek from trestle above 101 bridge - 1/2 mi upstream	1/2 (chin) ✓	Overcast	Slightly turbid	14	11	3	5	0	2												0
27	12-14-71	Lake Creek weir area down 1/2 mile	1/2 (coho) ✓	Overcast	Slightly turbid	2	9	0	10	0	2												
28	12-14-71	Lake Creek index	1/2 (chin) ✓	Overcast	Slightly turbid	4	14	0	1	1	0												
29	12-21-71	Upper Lake Creek index	1/8 * High water prevented count of entire index (chin) ✓	Overcast	Slightly turbid				1	0	0										53	0	0
33	12-21-71	Lower Lake Creek index	1/2 (coho) ✓	Overcast	Slightly turbid	0	13	0															
37	12-28-71	Lake Cr index	1/2 (coho) ✓	Overcast	Slightly turbid	3	1	1	4	1	0												
38	12-28-71	Lake Cr index	1/2 (chin) ✓	Overcast	Clear	[illegible]	17	0	0	[illegible]	0												
39	1-4-72	Lower Lake Creek	1/2 (chin) ✓	Overcast snowing	Clear	0	31	Numerous	0	37	Numerous										0	80	0
40	1-4-72	Lake Creek - weir down	1/2 (coho) ✓	Overcast snowing	Clear	3	4	Numerous	1	15	Numerous										13	30	0
43	1-12-72	Lake Creek index	1/2 (chin) ✓	Overcast	Slightly turbid																		

1/ Coho: From Wier below Lake Pleasant downstream .5 miles.
Chinook: From old Railroad Tressel above Highway 101 upstream .5 miles.

2062

SOLEDUCK RIVER DRAINAGE

Lake Creek (Cont'd.)

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
43	1-12-72	LAKE CREEK	½ (CHIN) ✓	OVERCAST	SLIGHTLY TURBID															
46	2-2-72	LAKE CREEK	½ (CHIN) ✓	CLEAR	CLEAR	0	7	0	1	15	0									
47	2-2-72	UPPER LAKE CREEK INDEX	½ (COHO) ✓ Total miles walked Co. Index 3.00 Total miles walked Ch. Index 3.62 Total miles walked other than Index 2.11 Total miles walked 8.73	CLEAR	CLEAR															

1/ Coho: From Wier below Lake Pleasant downstream .5 miles.
Chinook: From old railroad trestle above Highway 101 upstream .5 miles.

SOLEDUCK RIVER DRAINAGE

Miscellaneous Streams
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	9-29-71	Below Sappho section 30-T30 N-R12W 1/4 mile above upper to lower bridge	1.0 mile	clear	clear															
2	9-29-71	main stem in sec 29 T30N R10W near road 2101	1.0 mile	overcast	clear				2	0	0									
3	9-29-71	main stem along road 2071 between 2 bridges section 27 T30N R11W	1.0 mile	overcast	clear	1	0	0												
4	10-5-71	Main stem 1st Soleduck bridge North of Fork(town) from R.R. Bridge 1 mi. North	1.0 mile	clear	clear	10	0	0												
5	10-5-71	Mainstem 1/2 mile up from public boat Ramp down to Beav Cr.	1.0 mile	clear	clear	1	0	several												
6	10-6-71	Mainstem Maxfield Rd. bridge to 1 mile north.	1.0 mile	clear	clear	1	2	0	50-100*	0	0									
7	10-6-71	Mainstem 6 miles east of Sappho T30N R11W section 32	1.0 mile	clear	clear															
8	10-7-71	Mainstem 1/2 mile south of Tyee a gravel pit to 1 mile east	1.0 mile	clear	clear	18	0	1												
10	10-21-71	[illegible] - Beckman CR. Trib From 296 RD. Downstream	0.13 mile	snow clear	clear				3	0	2									
13	10-28-71	Tassel Creek From mouth upstream	0.25 mile	clear	clear															
14	10-28-71	Schuwah Cr. upstream from crossing	0.25 mile	clear	clear															
15	10-28-71	Bear Creek to mouth	0.13 mile	clear	clear															
16	10-28-71	Beaver Cr. Vicinity Cement Br. Near Sappo	0.13 mile	clear	clear															
20	11-21-71	Beav Cr. Mouth up	0.25 mile	clear	clear															
21	11-22-71	Beaver cr At Cemet Bridge	0.25 mile	clear	clear				2	1	0									
22	11-24-71	2nd lake Pleasant Trib from bridge down stream	0.13 mile	foggy	clear															
23	11-24-71	3rd lake Pleasant Trib at Road crossing	100 yds	foggy	clear															

* not counted exactly but estimated population of entire pool.

SOLEDUCK RIVER DRAINAGE

Miscellaneous Streams (Cont'd.)

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
24	11-24-71	1st Lake Pleasant Trib downstream from road	0.25 mile	foggy	clear															
30	12-21-71	Bockman Cr. downstream To 96 RD.	0.25 mile	Snow Clear	clear															
31	12-21-71	Kugel CR. From Road Down	0.13 mile	clear	clear															
32	12-21-71	Shuwah Cr. near end of Maxfield Road	0.25	overcast	Clear	0	1	6												
34	12-22-71	Bockman Cr. from lowest Bridge down middle fork up South fork	0.25	overcast	slightly Turbid															
35	12-22-71	Kugel Cr from lowest bridge To mouth	0.50	rainy	clear															
36	12-22-72	Tassel Cr from lowest bridge upstream	0.25	overcast	slightly Turbid				5	0	1									
41	1-5-72	Beaver Cr. from falls - downstream	0.25	rainy	clear				2	1	1									
42	1-5-72	Bear Cr. 8mi past Brave Taking road to left walk Down Stream	0.60	rainy	clear	1	0	0	1	4	4									
44	1-12-72	Schawah from crossing upstream	0.25	overcast	slightly Turbid															
45	1-13-72	Tassel Cr. from mouth up	0.25	overcast	Slightly Turbid															
48	2-10-72	outlet stream Soul Dac Hatchery	0.13	overcast	Clear													6	0	0
49	2-17-72	outlet stream Soul Dac Hatchery	0.13	clear	clear				1	0	0							7	0	0
50	2-17-72	Tassel CR AT Culvert ½ mi from mouth	100 yds	rainy	slightly Turbid															
51	2-17-72	Shuwah CR from wet crossing to Maxfield Cr.	0.50	rainy	slightly Turbid															
52	2-17-72	Rainy Cr. AT washed out Bridge	0.13	overcast	clear															
		Bear Ck under 307 RD Bridge	100 YDS	Overcast	slightly Turbid															

SOLEDUCK RIVER DRAINAGE

Miscellaneous Streams (Cont'd.)
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
54	2-17-72	S. Fork Bear CR. From Br. Downstream	0.13 mile	clear	Slightly Turbid															
55		Swanson Cr. UNDWR HWY 101	100 YDS	overcast	Turbid													7	0	0
			Total miles walked 13.91																	

CALAWAH RIVER DRAINAGE

Cool Creek No. 1

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered		Visibility: Weather	Visibility: Water	Fish Data: Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
13	11-30-71	COOL CREEK #1 ROAD To N.F.	1		OVERCAST	CLEAR	1	9	18												
17	12-13-71	COOL CREEK #1 INDEX	3/4	✓	SLEET	SLIGHTLY TURBID	1	11	10												
10	10-28-71	COOL CREEK #1 FROM BRIDGE TO 3/4 MI UPSTREAM	3/4		CLEAR	SLIGHTLY TURBID															
20	12-21-71	COOL CR. #1 INDEX AREA	3/4	✓	OVERCAST	CLEAR	1	1	0												
21	12-28-71	COOL CREEK #1 INDEX	3/4	✓	RAINY	SLIGHTLY TURBID				1	0	1									
22	1-3-72	COOL CREEK #1 INDEX	3/4	✓	OVERCAST	CLEAR	0	1	0												
23	1-12-72	COOL CREEK #1 INDEX	3/4	✓	CLEAR	SLIGHTLY TURBID	0	1	0	1	1	0									
24	2-2-72	COOL CR. #1 INDEX	3/4	✓	CLEAR	CLEAR															
35	2-17-72	COOL CR #1 INDEX	3/4	✓	RAINY	SLIGHTLY TURBID													2	0	0
			Total miles walked on Index 5.25																		
			Total miles walked other than Index 1.75																		
			Total miles walked 7.00																		

1/ From mouth upstream .75 miles.

1of2

CALAWAH RIVER DRAINAGE

Miscellaneous Streams
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
2	9/29/71	Sitkum R. m.stem 1/2 mi. below mouth N. Fork	1	Clear	Clear															
1	9/29	Elk Cr. from Br. 2 1/2 mi above mouth to 1 mile above this	1	Overcast	Clear															
3	9/30	Calawah mainstem mouth of N. Fork to 1 mi S. on mainstem	1	Clear	Clear															
5	10/13	Calawah mainstem from Hyw 101 Br upstream	1 1/4	Clear	Slightly Turbid															
6	10/13	Calawah R. mainstem Hyw. 101 Br. downstream	1	Clear	Slightly Turbid															
7	10/14	Calawah R. mainstem T28N, R13W, Sect. 6	1 1/4	Rain	Clear	5	3													
8	10/14	Calawah R. mainstem - 1st. br. on S. Fork, to 1 mi. East	1	Rain	Clear			2												
12	10/28	Elk Cr. mouth up	3/4	Clear	Slightly Turbid															
11	10/28	Hyas Cr. mouth up	2	Clear	Clear															
14	11/30	Hyas Cr. mouth up	1/4	Overcast	Clear															
15A	12/1	Calawah R. mainstem - from N. Fork to Hyw 101 Br.	4 (Raft)	Overcast	Clear		29	18												
15	12/1	So. Fork - from Hayas Cr. to mainstem	5 (Raft)	Overcast	Clear	6	37	20												
16	12/1	Elk Cr. 1/8 DN 1/4 up from B.R	3/8	Overcast	Clear				3	0	0									
18	12/14	North Fork mainstem - from 301 br. to mouth	10 (Raft)	Overcast	Clear	1	66	55	0	3	0									
19	12/16	Elk Cr. upper BR. DN.	1	Rain	Slightly Turbid				0	4	0									
25	2/15/72	Short Cr. 2902 RD BR. - mouth	1/4	Rain	Clear															
34	2/16	Cool Cr. #2 on park	1/4	Clear	Clear													2	(+1 dead)	

CALAWAH RIVER DRAINAGE

Miscellaneous Streams (Cont.d)
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
33	2/16/72	2ND TRIB FROM RD. CROSSING UPSTREAM	1/4	Clear	Clear															
31	2/16	3RD TRIB UP FROM RD	1/2	Clear	Clear													4		
32	2/16	4TH TRIB UP ENTIRE LENGHT	1/8	Clear	Clear															
26	2/16	5TH TRIB	1/4	Clear	Slightly Turbid															
27	2/16	6TH TRIB UPSTREAM	1/4	Clear	Clear															
28	2/16	7TH TRIB UP AT W. CR.	1/4	Clear	Clear															
29	2/16	8TH TRIB UP WALKED DN.	1/4	Clear	Clear															
30	2/16	9TH TRIB UP WALKED DN.	1/4	Clear	Clear															
			Total miles walked 14.79																	
			Total raft miles 19.00																	

BOGACHIEL RIVER DRAINAGE

Morganroth Creek

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
9	11-30-71	MORGANROTH UP FROM MOUTH	1/2 ✓	OVERCAST	CLEAR				8	4	4									
16	12-8-71	MORGANROTH INDEX	1/2 ✓	RAINY	TURBID															
17	12-16-71	MORGANROTH INDEX	1/2 ✓	RAINY	SLIGHTLY TURBID				1	2	6									
18	12-21-71	MORGANROTH CR. INDEX	1/2 ✓	OVERCAST	CLEAR				5	1	5									
19	1-4-72	MORGANROTH INDEX	1/2 ✓	RAINY	CLEAR				2	1	0									
21	1-12-72	MORGANROTH INDEX	1/2 ✓	CLEAR	CLEAR				0	1	0									
22	2-1-72	MORGAN ROTH INDEX	1/2 ✓	CLEAR	CLEAR SLIGHTLY															
23	2-17-72	MORGAN CREEK INDEX	1/2 ✓	OVERCAST	TURBID															
			8 miles serveyed by foot																	

1/ From mouth .5 miles upstream

BOGACHIEL RIVER DRAINAGE

Miscellaneous Streams
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	10-13-71	Mainstem mouth of Eaton Cr to 101 Br.	1.0 mile	clear	Slightly Turbid															
2	10-20-71	mainstem near end of road on south side of river	0.25 mi	rainy	clear															
3	11-2-71	Eaton Cr from Br. To 1 mile above	1.0 mi	rainy	Slightly Turbid															
4	11-2-71	Hayfield Cr from Br. on 3902 rd. to Br. 3,000 Rd.	1.0 mi	rainy	Slightly Turbid															
5	11-22-71	Mainstem from head of road on south side to 101 Br with raft	5.0 mi raft	overcast	clear					1										
6	11-24-71	Mill Cr. 1/4 up & down from bridge just west of Forks (Town)	0.5 mi	overcast	Slightly Turbid															
7	11-30-71	Mill Creek, Fishladder to road downstream to house	0.5 mi	overcast	Slightly Turbid	3	3		3		1									
8	11-30-71	left arm mainstem near mouth of Morganroth Cr.	0.5 mi	overcast	Slightly Turbid	6	1	5	2		1									
10	12-1-71	Dowans Cr. from Mouth upstream	0.25 mi	overcast	Slightly Turbid					1										
11	12-1-71	Hay Cr from mouth up stream	.13 mi +	overcast	Slightly Turbid															
12	12-1-71	Grader Cr from 101 Br to mouth	.25 mi	overcast	Slightly Turbid															
13	12-1-71	Hayfield Cr. from [illegible] above mouth to mouth	0.5 mi	overcast	Slightly Turbid					1										
14	12-2-71	Mainstem from 101 to Quillute (Raft Trip)	-12 mi raft	rainy	Slightly Turbid		26													
15	12-2-71	Eaton Cr from mouth up stream	.75 mi	rainy	Slightly Turbid					1	2									
20	1-5-72	[illegible] Br. down stream	.25	rainy	Slightly Turbid															
			6.8 miles on foot																	
			17 mile by raft																	

HOH RIVER DRAINAGE

Nolan Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
2	10-27-71		✓	clear	clear	3	0	0												
13	10-27-71	Nolan cr above 101 Br	0.13 mile	clear	clear	3	0	0												
22	11-16-71		✓	clear	slightly Turbid	15	1	1												
37	11-29-71		✓	foggy	slightly Turbid	0	3	0	14	0	4									
41	12-18-71		✓	rainy	Turbid															
42	12-16-71		✓	rainy	slightly Turbid	0	2	0												
45	12-21-71		✓	overcast	slightly Turbid	0	2	0	4	0	2									
49	12-28-71		✓	overcast	Clear	0	2	0	5	0	0									
50	1-4-72		✓	rainy	slightly Turbid	0	1	0	3	0	1									
61	1-12-72		✓	clear	slightly Turbid															
62	2-1-72		✓	clear	Clear															
74	2-17-72		✓	rainy	slightly Turbid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Total miles walked on Index 11.00																	
			Total miles walked off Index .13																	
			Total walked 11.13																	

1/ From mouth upstream 1 mile to Highway 101 Bridge

HOH RIVER DRAINAGE

Winfield Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	10-26-71	WINFIELD CREEK INDEX	1/2 ✓	RAINY	SLIGHTLY TURBID	45	0	3												
15	11-9-71	WINFIELD CR, BRIDGE ON WINFIELD 3/4 MI ABOVE BRIDGE ON CLEARWATER RD TO 3/4 MI ABOVE	3/4	RAINY	SLIGHTLY TURBID	2	1	0	2	0	1									
16	11-9-71	WINFIELD CR, FROM BRIDGE ON HENOR CAMP RD TO 1 1/4 MI ABOVE	1 1/4	RAINY	SLIGHTLY TURBID	19	5	2												
19	11-10-71	WINFIELD CR. FROM MOUTH UPSTREAM	1 1/4	RAINY	SLIGHTLY TURBID	32	2	7												
25	11-23-71	WINFIELD CR INDEX AREA	✓	RAINY	SLIGHTLY TURBID	7	27	1												
36	11-29-71	WINFIELD CR. INDEX	✓	CLEAR	SLIGHTLY TURBID	8	11	4												
40	12-8-71	WINFIELD CR, INDEX	✓	RAINY	SLIGHTLY TURBID	0	9	0												
43	12-16-71	WINFIELD CR. INDEX	✓	RAINY	SLIGHTLY TURBID	1	7	0												
44	12-21-71	WINFIELD CR. INDEX	✓	OVERCAST	SLIGHTLY TURBID	0	3	0												
48	12-28-71	WINFIELD CR. INDEX	✓	OVERCAST SNOW	CLEAR	0	8	12	3	0	0									
51	1-4-72	WINFIELD CR. INDEX	✓	RAINY	CLEAR	0	5	0	2	3	1									
59	1-12-72	WINFIELD CR. FROM OLD BRIDGE @ END OF INDEX DOWN STREAM	1/2	CLEAR	SLIGHTLY TURBID	0	2	0												
63	2-1-72	WINFIELD CR. FROM LOWER INDEX BOUNDARY DOWN	1/2	CLEAR	CLEAR															
64	2-1-72	LOWER WINFIELD FROM WASHED OUT BRIDGE TO MOUTH	1/2	CLEAR	CLEAR				0	1	0									
73	2-17-72	WINFIELD CR. FROM INDEX AREA DOWNSTREAM	1/4	OVERCAST	SLIGHTLY TURBID															
			Index foot milage Total 8.00																	
			off Index foot milage 5.00																	
			Total 13.00																	

1/ From first bridge on 9X road downstream to small road with old bridge crossing

HOH RIVER DRAINAGE

Miscellaneous Streams

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
3	10/27/71	Anderson Cr. Oil City Brdg to mouth	3/4	Clear	Slightly Turbid															
4	10/27/71	Alder Cr. Down From Br.	1/8	Clear	Slightly Turbid															
5	10/27	3rd Trib 3.4 m From 101 Br.	1/4	Clear	Slightly Turbid															
6	10/27	Spruce Cr. Below Br. on Hoh Rd	1/4	Clear	Clear															
7	10/27	Trib 7 up From 101 13.1 mi.	1/4	Clear	Slightly Turbid															
8	10/27	Braden Cr. To mouth From 101	1/4	Clear	Clear															
9	10/27	1st Trib. .5 mi. up From 101	1/8	Overcast	Slightly Turbid															
10	10/27	6th Trib 8.2 From 101 on Hoh R. Rd. Dismal Cr.	1/8	Clear	Clear															
11	10/27	Trib 4. 7 mi From 101 Hoh R. Rd	1/8	Clear	Clear															
12	10/27	Tower Cr. Near Crossing	1/8	Clear	Clear															
14	10/27	Owl Cr. up From mouth	1/4	Clear	Clear	4		3												
17	11/10	Owl Cr. Mouth up	1/3	Rain	Slightly Turbid	9	1	1												
18	11/10	Owl Cr. - Br. on Hoh Camp Rd down	1/2	Rain	Slightly Turbid															
21	11/10	Anderson Cr. Oil City [illegible] Br. [illegible]	3/4	Clear	Clear		1		1											
23	11/22	Alder Cr. Br. upper Hoh Rd. [illegible]	1.0	Clear	Clear				3		4									
24	11/22	Hell Roaring Br. upper Hoh Rd. on	1/8	Clear	Slightly Turbid															
26	11/23	Spruce Cr. Br. - Mouth	1/4	Rain	Clear															

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HOH RIVER DRAINAGE

Miscellaneous Streams (Cont'd.)
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
57	1-7-72	Twin Cr. Br. To mouth	0.25 mi.	rainy	clear															
58	1-7-72	Taft Cr Near Ranger StA.	0.13 mi	overcast	clear				1	1										
60	1-12-72	Brader Creek 1/2 mile up from 101 Br.	0.50 mi	clear	slightly Turbid															
65	2-15-72	Taft Creek behind NPS. Visitors center	0.13 mi.	overcast	clear															
66	2-15-72	Taft Cr. Trib.	0.13 mi	overcast	clear															
67	2-15-72	2 side channel down stream from Taft Cr.	0.50 mi	clear	clear					1	5									
69	2-15-72	East Twin Cr	0.13 mi	overcast	clear															
70	2-15-72	Unnamed Trib. 4th Park Trib Past V. center Down Stream from road	0.13 mi	overcast	clear															
71	2-15-72	Spruce Cr. Bridge Down	0.25 mi	overcast	clear															
72	2-15-72	Pole Creek Above & below Br.	0.75 mi	overcast	clear					2								2		
99	2-15-72	Snider Cr.	0.13 mi	Overcast	clear					1	2									
			Total miles by foot 11.86																	
			Total miles by raft 13.06																	

HOH RIVER DRAINAGE

Miscellaneous Streams (Cont'd.)

(Run Year 71-72

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
27	11-23-71	TWIN CR. FROM BRIDGE TO MOUTH	1/4	RAINY	CLEAR															
28	11-23-71	WILLOUGHBY CR. FROM MOUTH TO FORKS	1/2	RAINY	CLEAR															
29	11-23-71	LINDNER CR. SPOT CHECK NEAR BRIDGE ON UPPER HOH	1/8	RAINY	CLEAR															
30	11-23-71	TOWER CR. FROM BRIDGE TO MOUTH	1/8	RAINY	CLEAR															
32	11-23-71	POLE CR. SPOT CHECK	1/8	RAINY	CLEAR															
33.	11-23-71	SNIDER CR. FROM BRIDGE TO MOUTH	1/4	RAINY	CLEAR															
34	11-23-71	CANYON CR FROM BRIDGE TO MOUTH	1/4	RAINY	CLEAR	0	0	1												
35	11-23-71	MAINSTREAM 1 1/2 MI. UPSTREAM FROM MOUTH OF WILLOUGHBY	1/8	RAINY	SLIGHTLY TURBID	0	3	0												
38	12-8-71	MAINSTRM FROM RAIN FOREST R.S. TO STATE PARK (RAFT)	13 raft	RAIN + SNOW	TURBID	3	4	0												
39	12-8-71	TAFT CR. BY RAIN FOREST R.S.	1/8	SNOW + RAIN	CLEAR				2	0	1									
46	12-28-71	1st TRIB UPSTREAM FROM HOH VILLAGE	1/8	OVERCAST SNOW	CLEAR															
47	12-28-71	ANDERSON CR. DOWNSTREAM FROM OIL CITY ROAD.	1/8	OVERCAST SNOW	CLEAR															1
52	1-6-72	WILLOUGHBY CR. FROM MOUTH UPSTREAM	1/4	RAINY	CLEAR															
53	1-6-72	LINDNER CR. HOH Rd BRIDGE DOWNSTREAM	1/2	OVERCAST	CLEAR															
54	1-6-72	CANYON CR @ MOUTH	1/16	OVERCAST	--															
55	1-6-72	SPRUCE CR. HOH Rd BRIDGE DOWNSTREAM	1/4	OVERCAST	CLEAR				0	0	1?									
56	1-6-72	SNIDER CR. BRIDGE TO MOUTH	1/4	OVERCAST	CLEAR															

SKOKOMISH RIVER DRAINAGE

North Fork
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	9-21-71	N. Fork up from Potlatch Park Road	7/10	Clear	Clear															
8	11-1-71	North Fork up from Potlatch Road Crossing	1/2	Clear	Clear				1	0	3									
15	11-8-71	North Fork Skokomish	1/4 ✓	Rainy	Slightly Turbid															
16	12-3-71	North Fork Skokomish	1/4 ✓	Overcast	Clear				2	2	10	4	0	0						
17	12-10-71	North Fork Skokomish	1/4 ✓	Rainy	Turbid															
18	12-13-71	North Fork Skokomish	1/4 ✓	Foggy Overcast	Turbid															
19	12-20-71	North Fork Skokomish	1/4 ✓	Rainy	Slightly Turbid															
22	1-7-72	North Fork Skokomish	1/4 ✓	Snow	Slightly Turbid				0	3	0	0	2	0						
25	1-14-72	North Fork Skokomish	1/4 ✓	Overcast	Clear				1	2	1	0	44	7						
32	2-2-72	North Fork Skokomish	1/4 ✓	Clear	Clear				0	1	0	0	13	0						
23	1-10-72	North Fork Skokomish	1/4 ✓	Clear	Clear				2	4	3	0	34	6						
			Total miles index 2.25																	
			Total miles other than index 1.25																	
			N. Fork Total 3.50																	

1/ .25 Miles from where Potlatch Park Road crosses North Fork downstream

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SKOKOMISH RIVER DRAINAGE

Vance Creek

(Run Year 71-72)
non-Index area

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
4	10-4-1971	from Bridge on left fork of hatchery road	1.4 mile	clear	clear	2	0	4												
11	11-1-71	mouth & above	.13 mi.	clear	clear															
14	11-18-71	1/8 mile above & below bridge	.25 mi	rainy	slightly Turbid															
20	12-20-71	1/8 mile above & below Vance Cr. 2nd Bridge	.25 mi.	rainy	slightly Turbid				3	20	12									
21	1-7-72	1/8 Above & Below Bridge	.25 mi	rainy	clear				0	26	10									
28	1-18-72	1st Bridge Vance Cr. 1/2 mile Down stream	.50 mi	rainy	clear				0	18	10	0	16	10						
31	1-31-72	1/8 mile above & below Bridge	.25 mi	snow overcast	clear				0	0	0	1	0	0						
			Total 3.03																	

SKOKOMISH RIVER DRAINAGE

Miscellaneous Streams

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (.) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
2	9/22/71	S. For Skok. R. 83.415 on Potlach Map	7/10	CLEAR	CLEAR	12						3								
5	10/4	SKOKOMISH S FORK HATCHERY RD. MARKERS	1	CLEAR	CLEAR	9	6	20												
6	10/18	S. FRK SKOK. VIC. GAGING STA	1/4	Overcast	CLEAR	1	0	0												
9	11/1	Res. BOUND. mainstem UPSTREAM	1/2	CLEAR	CLEAR		1													
10	11/1	2 MI. ABOVE RES. BOUND mainstem	100 YDS	CLEAR	CLEAR	1	6	1												
26	1/14/72	MAIN STEM POWER LINES UP	1/2	CLEAR	CLEAR	0	2	0	1	16		1	21							
29	1/18	MAIN TO POWER LINES	1/2	RAIN	CLEAR	0	2	0	0	23	0	0	57						2	
30	1/31	MAIN POWER lines UPSTREAM	1/4	OVER SNOW	CLEAR															
			total 3.76 mi																	

[redacted]

McAllister Creek

(Run year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
51	12/6/71		4.00 Raft	OVERCAST	CLEAR				28	1	7									
72	1/5/72		✓	OVERCAST	CLEAR					2	12	150	20	MASS						
75	1/13/72		✓	OVERCAST	CLEAR					6		100	50	25						
80	1/19/72		✓	RAIN	CLEAR							70	40	NUMEROUS						
89	1/28/72	-	✓	CLEAR SNOW	CLEAR							51	65	22						
91	1/31/72		✓	OVERCAST SNOW	CLEAR							75	27	NUMEROUS						
104	2/11/72		✓	CLEAR	CLEAR							29	40							
105	2/23/72		✓	OVERCAST	CLEAR								25							
112	3/2/72		✓	OVERCAST	CLEAR								15					1		
			[illegible] 4.0 mi																	

1/ Intake reservoir and springs immediately below it.

NISQUALLY RIVER DRAINAGE

Muck Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
4	10/5/71		✓	CLEAR	CLEAR															
15	10/15		✓	CLEAR	CLEAR															
22	11/5	ROAD END TO LEFT FORK	1/16	CLEAR	CLEAR															
31	11/12		✓	CLEAR	CLEAR															
39	11/19	-	✓	CLEAR	CLEAR						6									
43	11/26		✓	FOG	CLEAR						4									
46	12/3		✓	CLEAR	CLEAR				2		5									
68	12/29		✓	SNOW	S. TURBID				1	1	0									
69	1/5/72		✓	FOG	Slightly TURBID							15	0	11						
76	1/13		✓	FOG	Slightly TURBID							15	1	12						
82	1/19		✓	RAIN	TURBID							10	0	0						
84	1/27	UPSTREAM FROM BRIDGE HY 507	1/2	CLEAR	CLEAR							0	0	1						
95	2/1		✓	CLEAR	CLEAR							7	17	14						
111	2/8	EXITER SPR.	1/8	FOG	CLEAR				10	10	[illegible]	87	[illegible]	[illegible]						
98	2/8	JOHNSON GIL. (TRIB TO [illegible])	1/16	FOG	[illegible]															
99	2/8	CHAMBERS LAKE NEAR CULVERT	1/16	FOG	CLEAR															
100	2/8	EXITER SPRS, #2	1/16	FOG	CLEAR							5	15							

1/ From mouth .5 miles upstream

NISQUALLY RIVER DRAINAGE

Muck Creek (Cont'd.)
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Fish Data: Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
102	2/10/72		✓	U Sun	S. TURBID							4	6					3		
110	2/25	EXITER SPRING	1/8							20	Numerous	3	145	Numerous						
			Total miles walked on idex 6.00																	
			Total miles walked other than index .98																	
			Total walked 6.98																	

1/ From mouth .5 miles upstream

NISQUALLY RIVER DRAINAGE

Yelm Creek

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
6	10/8/71		✓	CLEAR	CLEAR										7	2	1			
32	11/12/71		✓	CLEAR	CLEAR											5	2			
40	11/19/71		✓	FOG	CLEAR				1	2	10				0	10	17			
42	11/24/71		✓	FOG							1					6	7			
45	12/3/71		✓	CLEAR	CLEAR															
59	12/21/71		✓	RAIN	Slightly TURBID					11								2		
67	12/24/71		✓	FOG	CLEAR															
70	1/5/72		✓	FOG	Slightly TURBID															
77	1/13/72		✓	FOG	CLEAR				34	0	14	3	2	2						
81	1/19/72		✓	RAIN	TURBID				17			26	3							
90	1/28/72		✓	CLEAR SNOW	CLEAR							9	1	7						
103	2/10/72		✓	RAIN	CLEAR							11	5	2						
108	2/25/72		✓	CLEAR	Slightly TURBID							1	1					1		
			Total miles of index walked 6.50																	
			Total 6.50																	

1/ From the mouth upstream .5 miles

NISQUALLY RIVER DRAINAGE

Ohop Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
11	10/14/71	From Hyw. Br. down stream	✓	RAIN	CLEAR										22	23	17			
19	11/5/71		✓	CLEAR	SLIGHTLY TURBID				1		1				7					
24	11/10/71	FROM LAKE TO ABANDONED BRIDGE	.125	FOGGY	Slightly Turbid															
36	11/17/71		✓	CLEAR	CLEAR				34		22									
48	12/3/71	ON CUTOFF JUST BELOW LAKE NEAR ORVILLE RD 20 MIN. DOWN FROM BRIDGE TO END 15	.125	CLEAR	Slightly TURBID				24		43									
52	12/9/71		✓	RAIN	TURBID															
56	12/14/71		✓	FOGGY	Slightly TURBID															
65	12/19		✓	OVERCAST SNOW	Slightly TURBID				2	0	0									
73	1/5/72		✓	OVERCAST	Slightly TURBID				2	0	1									
87	1/27/72		✓	CLEAR SNOW	Slightly TURBID															
94	2/1/72		✓	CLEAR	CLEAR.															
109	2/25		✓	CLEAR	TURBID															
			Total miles walked on index 4.50																	
			Total miles walked outside index 1.50																	
			Total miles walked 6.00																	

1/ From Highway 161 bridge near Eatonville downstream .5 miles

NISQUALLY RIVER DRAINAGE

Tanwax Creek

(Run year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
3	10/1/71	Tanwax Cr. from mouth to Ridge)	1/2	CLEAR	CLEAR															
9	10/8/71	HOUSE TO MOUTH	1/8	CLEAR	CLEAR															
14	10/15/71		✓	FOGGY	CLEAR															
16	10/21/71		✓	CLEAR	Slightly TURBID															
23	11/5/71	AT ROAD CROSSING	1/16	CLEAR	Slightly TURBID															
34	11/12/71	BRIDGE AT LOG R[illegible]	1/4	CLEAR	Slightly TURBID															
38	11/18/71		✓	OVERCAST	CLEAR				4		2									
41	11/26/72		✓	OVERCAST	Slightly TURBID				1		2									
44	12/3/72		✓	CLEAR	Slightly TURBID				2	1	3									
54	12/10/72		✓	RAIN	TURBID															
55	12/14/72		✓	FOG	Slightly TURBID															
60	12/21/72		✓		TURBID															
66	12/29/72		✓	SNOW OVERCAST	Slightly TURBID				0	2	0									
71	1/5/72		✓	OVERCAST	TURBID															
78	1/13/72		✓	CLEAR	Slightly TURBID					1		8		1						
83	1/19/72		✓	RAIN	TURBID							6								
85	1/27/72		✓	CLEAR	CLEAR															

1/ From mouth upstream .06 miles

NISQUALLY RIVER DRAINAGE

Tanwax Creek (Cont'd.)

(Run year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
92	2/1		✓	CLEAR	CLEAR							4		2						
101	2/10		✓	CLEAR	Slightly Turbid															
106	2/23		✓	FOG	CLEAR															
			Total miles of index walked .96																	
		-	Total miles other than index walked .93																	
			Total 1.89																	

1/ From mouth upstream .06 miles

NISQUALLY RIVER DRAINAGE

25 Mile Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	9/30/71	UPPER 1/4 MI. LOWER 200 YDS			CLEAR															
5	10/7		✓	CLEAR	CLEAR															
10	10/14		✓	RAIN	CLEAR															
17	10/21		✓	CLEAR	Slightly TURBID															
21	11/5		✓	CLEAR	Slightly TURBID				26	0	15									
33	11/12		✓	FOG	TURBID				3	0	0									
35	11/17		✓	CLEAR	CLEAR				49	0	33									
47	12/3		✓	CLEAR	Slightly TURBID				3	0	5									
53	12/9		✓	RAIN	TURBID															
57	12/14		✓	FOG	TURBID															
63	12/22		✓	FOG	Slightly TURBID															
64	12/29		✓	FOG	Slightly TURBID															
74	1/5/72		✓	FOG	Slightly TURBID															
79	1/13		✓	CLEAR	Slightly TURBID				1	0	1									
86	1/27		✓	CLEAR SNOW	CLEAR															
96	2/4		✓	FOG	CLEAR															
107	2/24		✓	CLEAR	Slightly TURBID															

1/ From railroad bridge crossing near Clay City downstream .25 miles

Total miles on index walked 3.75
Total miles other than index walked 1.37

NISQUALLY RIVER DRAINAGE

Miscellanous Streams

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
2	10/1/71	HORN CREEK, VIC. HARTS LAKE LOOP RD	1/2		CLEAR															
7	10/8	" "	1/8	CLEAR	CLEAR															
8	10/8	MASHELL FROM EATONVILLE BRIDGE UPSTREAM	1/4	CLEAR	CLEAR										4					
12	10/15	" "	1/2	CLEAR	CLEAR										3	3	1			
13	10/15	HORN CR.	.7	FOGGY	Slightly TURBID															
18	11/4	MASHELL	1/2	CLEAR	Slightly TURBID															
20	11/5	HORN - DOWN RD THROUGH GATE PAST BARN - WATERFALL	1/16	CLEAR	Slightly TURBID															
25	11/10	BUSY WILD CR FROM FORKS UPSTREAM	1/2	RAIN	CLEAR															
26	11/10	BEAVER CR ABOVE EATONVILLE	1/8	RAIN	CLEAR															
27	11/10	MASHELL UPSTREAM FROM FORKS	1/4	RAIN	CLEAR															
28	11/10	LITTLE MASHELL	1/4	RAIN	TURBID															
29	11/11	LYNCH CR UPSTREAM FROM MOUTH	1/2	RAIN	Slightly TURBID															
30	11/12	HORN CR at falls	1/16	CLEAR	TURBID				7		1									
37	11/18	HORN WOODS BELOW RD TO MOUTH	1	FOGGY	CLEAR				7	2	3									
49	12/3	MASHELL 1/2 MI ABOVE EATONVILLE CR	1/2	CLEAR	Slightly TURBID															
50	12/6	MEDICI CR. MOUTH UP 1/2 MI	1/2	OVERCAST	Slightly TURBID															
88	1/21/72	MASHELL & BRIDGE NEAR EATONVILLE BRIDGE HWY 7 AT MOUTH	1/2	CLEAR	Slightly TURBID															

1/

NISQUALLY RIVER DRAINAGE

Miscellaneous Streams (Cont'd.)
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Fish Data: Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
93	2/11/72	MASHEL R. MOUTH UP TO BRIDGE	1/2	CLEAR	S. TURBID															
97	2/4	CACAMAS CR. 1/8 MI UPSTREAM FROM BRIDGE AT ROW	1/8	OVERCAST	S. TURBID															
			Total mi. walked 7.43																	

PUYALLUP RIVER DRAINAGE

Fox Creek
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
21	11-3-71		✓	foggy	clear				16	0	14									
31	11-10-71		✓	rainy	clear				2	0	1									
41	12-1-71		✓	clear	slightly Turbid				0	3	0									
50	12-9-71		✓	rainy	Turbid															
51	12-14-71		✓	foggy	Turbid															
57	12-22-71		✓	overcast	slightly Turbid															
60	12-28-71		✓	overcast	clear															
64	1-4-72		✓	overcast	slightly Turbid				0	1	0									
70	1-12-72		✓	overcast	slightly Turbid															
78	1-26-72		✓	clear	clear															
81	2-3-72		✓	clear	clear															
93	2-24-72		✓	clear	slightly Turbid															
			Total miles walked in index 3.00																	
			Total 3.00																	

1/ From mouth .25 miles upstream

PUYALLUP RIVER DRAINAGE

Kelly Creek

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	9-29-71	house above bridge To mouth	1/2 mile	rainy	Clear															
20	11/3/71		✓	rainy	clear				6	0	2									
33	11/10/71		✓	rainy	clear				29	0	29									
37	11/16/71		✓	foggy	clear				47	5	36									
43	12/1/71	-	✓	clear	slightly turbid				2	3	48									
48	12/8/71		✓	rainy	clear				4	6	4									
53	12/16/71		✓	clear	clear															
56	12/22/71		✓	overcast	clear							8	0	0						
59	12/28/71		✓	snowing	clear				0	3	0	4	5	6						
66	1/4/72		✓	overcast	clear							160	11	*						
71	1/12/72		✓	overcast	clear							143	44	66						
73	1/20/72		✓	rainy	slightly Turbid							39	27	0						
76	1/26/72		✓	Clear	clear							9	48	16						
85	2/3/72		✓	clear	clear				2	1	1	1	60	15				2	0	0
88	2/7/72		✓	overcast	clear							0	70	*				15	0	3
90	2/23/72		✓	clear	clear				0	5	0	0	47	0				35	1	0
95	3/2/72		✓	overcast	clear						0	0	30	0				30	0	13

1/ From first road crossing downstream .25 miles

* massive spawning

Total miles walked on Index 6.00

Total miles walked other than Index .50

PUYALLUP RIVER DRAINAGE

Clark Creek

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
12	10/13/71		✓	clear	clear															
17	11/2/71		✓	rainy	clear				15	0	4									
38	11/26/71		✓	overcast	clear				17	9	36									
47	12/8/71		✓	rainy	clear				4	6	5									
54	12/15/71		✓	clear	clear				3	6	4									
58	12/23/71		✓	overcast	clear				4	2	5									
61	12/29/71		✓	overcast snow	clear															
65	1/4/72		✓	overcast	clear				1	4	10									
72	1/13/72		✓	overcast	clear				0	0	5									
75	1/24/72		✓	clear	clear				6	1	5									
84	2/3/72		✓	clear	clear				0	0	6									
94	2/24/72		✓	rainy	clear															
92	2/24/72	Hatchery out let	.25	rainy	clear													8	0	2
			Total miles walked on Index 3.00																	
			Total miles walked other than Index .25																	
			Total 3.25																	

1/ First .25 miles downstream from springs at head of creek

H.

PUYALLUP RIVER DRAINAGE

Miscellaneous Streams

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
2	9/29/71	Clear Cr. - from bridge down	1/2	Rain	—															
3	9/29/71	So Prairie Cr. - mouth to first bridge	1	Rain	Clear	2									580	84	133			
5	9/30/71	Kapowsin Cr. from mouth upstream	1	Clear	Clear															
8	10/6/71	White R. mainstem above Deringer	1 1/2	Fog	Clear	3		1												
9	10/6/71	White R. trib., left #1	1/4	Fog	Clear															
7	10/6/71	South Prairie Cr. - 1st bridge to 2nd bridge	1.4	Fog	Clear										2981	398	1400			
10	10/7/71	White R. mainstem - near Dieringer	1 1/4	Fog	upper clear lower sl. turbid	1	1		10											
11	10/13/71	White R. mainstem - from Auburn br. upstream	1	Clear	Clear															
13	10/14/71	Kapowsin Cr. - from mouth upstream	1	Rain	Clear										39	0	25			
15	10/20/71	Kapowsin Cr. - from br. to mouth	1/4	Clear	Slightly Turbid										2					
18	11/3/71	White R. trib. - mi. up Stuck R. Road	1/16	Rain	Slightly Turbid															
19	11/3/71	Clear Cr. - from br. down	1/4	Rain	Clear				1											
22	11/3/71	So. Prairie Cr. - 1/4 mi down + 3/4 mi. up from first bridge	1	Fog	Clear	1	11		1						5	125	numerous			
23	11/4/71	1st Cr. downstream from Le Doux Cr.	1/8	Fog	Clear															
24	11/4/71	Le Doux Cr. - to mouth	1/2	Fog	Turbid															
26	11/4/71	Niesson Cr.	1/4	Clear	Slightly Turbid															
29	11/10/71	White R. - 1st trib. on left ≈3mi. upstream	1/8	Rain	Slightly Turbid															

PUYALLUP RIVER DRAINAGE

Miscellaneous Streams
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
28	11-10-71	South Praire Last Bridge on side Road	<0.13 mi	rainy	slightly Turbid											3				
30	11-10-71	Kapowsin Cr. Rd To mouth	0.13 mi	Rain	slightly Turbid											10				
32	11-10-71	Clear Cr. from Bridge Down	0.13 mi	Rain	Clear															
34	11-10-71	So Praire From upper Bridge upstream	0.25 mi	foggy	clear											4				
35	11-16-71	Kapowsin Cr. ½ mi from mouth up	0.50 mi	Clear	Clear				3	3	9									
36	11-16-71	Clear Cr Br. Down stream	0.25 mi	clear	clear				19	1	20									
39	11-30-71	White R. Main stem above 1st Trib on L side	0.25 mi	Clear	slightly Turbid				2		4									
40	11-30-71	White R. 1st Trib on Left side	0.13 mi	Clear	Clear															
42	12-1-71	Clear Cr. From Br. Down stream	0.25 mi	clear	clear				2	6	5									
45	12-2-71	South Praire last bridge on side road	0.13 mi	clear	slightly Turbid						5									
46	12-2-71	Kapowsin 1/8 mi up & Down from Bridge	0.25 mi	clear	Clear				3		5									
49	12-9-71	South Prairie 2nd & 3rd Bridge	0.50 mi	rainy	Turbid															
52	12-14-71	South Prairie 2nd To 3rd Bridge	0.50 mi	foggy	Turbid															
62	1-3-72	White R. Trib, Cr Run Down Road	0.13 mi	clear	Clear					1	3									
63	1-4-72	South Prairie Cr. Between 2nd & 3rd Br.	0.5 mi	Overcast	slightly Turbid															
67	1-6-72	White R. side channle Crossing Dyke mouth up	0.25 mi	Overcast	Clear				0	36	18									
68	1-6-72	Clear Cr. Br Down	0.13 mi	Overcast	Slightly Turbid															
69	1-6-72	White R mainstem - end of dike Rd down to "R" St. Br.	5.00 (RAFT)	Rain	slightly Turbid					1										

PUYALLUP RIVER DRAINAGE

Miscellaneous Streams
(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
74	1-24-72	South Prairie between 2nd & 3rd Br.	0.50 mi	clear	clear															
77	1-26-72	Clear Cr. 3/8 down + 1/4 up from bridge	0.65 mi	Clear Snow	—							4	3	7						
79	1-27-72	Kapowsin Cr. Br. - To mouth	0.50 mi	clear	slightly turbid															
82	2-3-72	South Prairie Cr. Between 2nd & 3rd Br.	0.50 mi	clear	clear															
83	2-3-72	main stem from mouth of Fox Cr To R.R. Br.	0.50 mi	clear	clear															
86	2-3-72	Kapowsin Cr. Br. To mouth	0.25 mi	clear	clear															
87	2-3-72	Clear Cr. 1/8 up & Down from Br.	0.25 mi	clear	clear				2	1	3			3				1		
89	2-7-72	Kelly Cr. Old Channel	0.25 mi	Overcast	clear								50	13						
91	2-24-72	Wilkeson Cr. R.D. Side Park up	0.25 mi	Rain	slightly Turbid															
			Total miles walked 19.91																	
			Total walk miles 5.00																	
			Total 24.91																	

GREEN RIVER DRAINAGE

Mainstem

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	9-23-71	Above & Below Isaac Evans park in Auburn	2 mi	clear	slighty Turbid	7	0	0												
2	9-23-71	Below Kent-below Hyw 516.	1 mi	clear	slighty Turbid	3	0	0												
4	9-24-71	Flaming Geyser Br. down To whitney Hill bridge	1 mi	rainy	Clear	12	0	0												
5	9-24-71	Soos Cr. up Green To bridge where power lines cross	1 mi	rainy	Clear															
14	10-6-71	Green River at Black Dimond Hyw Bridge	1/16 mi	foggy	Clear	35	3	1												
15	10-7-71	Green R. near Palmer S.H. Hatchery	1/16 mi	clear	clear	1	0	0												
16	10-13-71	Mainstem above Soos creek	1 mi	clear	clear	64	20	53												
17	10-14-71	[illegible]	✓	rainy	clear	44	27	43												
18	10-14-71	1/4 mile up from Issac Evans Park	1/4 mi	rainy	clear	12	8	14	0	1	0									
27	11-2-71	up stream from Issac Evans Park	1/4 mi	foggy	Clear	0	4	0												
28	11-2-71	up stream from mouth of Soos Creek	1/4 mi	foggy	Clear	1	1	0												
36	11-15-71	side channel of Green near mouth of Burns Cr.	1/4 mi	foggy	Clear				36	0	24									
60	1-24-72	side channel of Green near mouth of Burns Cr.	1/4 mi	clear	slightly Turbid				6	1	0									
64	2-2-72	[illegible]	✓	clear	clear				2	0	8							2	0	0
71	2-23-72	side channel of Green near mouth of Burns Cr.	1/2	clear	slightly Turbid				2	0	0									
			Total miles walked on Index 2.00																	
			Total miles walked other than Index 7.87																	
			Total 9.87																	

1/ From Flaming Geyser Park downstream 1 mile

GREEN RIVER DRAINAGE

Spade Creek

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
13	10-5-71	2.3 mi up Gr. Valley Rd. from Burns Cr. Bridge	.75	clear	clear															
21	10-19-71	Mouth To Bridge	.13	rainy	slightly Turbid															
26	11-2-71	upstream from Hwy Bridge	.13	foggy	Clear				3	0	0									
34	11-9-71		✓	rainy	clear				57	0	29									
38	11-16-71	upstream from Hwy Bridge	.25	foggy	Clear				12	0	3									
44	12-8-71		✓	rainy	clear				33	19	15									
47	12-16-71		✓	overcast	clear				30	20	15									
49	12-23-71		✓	overcast	slightly Turbid				11	13	1									
51	12-27-71		✓	clear	clear				8	8	21									
53	11-29-71	from access 300 ft below drive way to bridge at road bend	.25+	foggy	slightly Turbid				23	7	24									
55	1-4-72		✓	overcast	slightly Turbid				9	11	28									
57	1-11-72		✓	overcast	slightly Turbid				1	2	9									
62	1-25-72		✓	snowing	Clear				14	4	20									
66	2-2-72		✓	Clear	Clear				15	1	10									
68	2-7-72		✓	overcast	Clear				10	8	9									
69	2-23-72		✓	Clear	clear				5	6	0									
			Total miles walked on Index 2.75																	

Total miles walked other than Index 1.51

1/ .25 Mile section from Green Valley Road crossing downstream

Total 4.26

GREEN RIVER DRAINAGE

Newaukam Creek

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area (✓) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
9	9/30/71	NEWANKUM Cr. from Br. on Whitney Hill Rd	1/2	CLEAR	CLEAR	6	1	2												
29	11/2	NEWAUKUM CR UP FROM BR	1/2	FOG	CLEAR		2	4	1											
10	10/5	Upper Newaukum Cr. from road at end of S.E.392nd up + downstream	1/4	CLEAR	Slightly TURBID															
43	11/30	NEWANKUM 1/4 UPS DOWN FRM BR	1/2	FOG	Slightly TURBID				6	1	3									
45	12/8		✓	RAIN	Slightly TURBID				3	0	0									
48	12/16		✓	Overcast	Slightly TURBID				6	3	0									
50	12/23		✓	Overcast	TURBID				1	0	0									
52	12/28		✓	SNOW Overcast	slightly TURBID															
56	1/4/72		✓	Overcast	TURBID				1	0	1									
59	1/11		✓	Overcast	TURBID															
63	1/25		✓	SNOWING overcast	Slightly TURBID															
65	2/2		✓	CLEAR	CLEAR															
67	2/7		✓	Overcast	TURBID															
			Total miles walked on Index 2.25																	
			Total miles walked other than Index 1.75																	
			Total 4.00																	

1/ .25 Miles from first paved road downstream

1 of 2

GREEN RIVER DRAINAGE

Miscellaneous Streams

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
8	7/28/71	COVINGTON CR. UP & DOWN FROM AUBURN BL. DIAMOND RD	1/2	CLEAR	CLEAR															
7	9/30/71	MILL CR.	1/4	FOG	TURBID															
6	9/30/71	Trib to Green on Franklin to Enumclaw Road	1/8	CLEAR	clear															
12	10/5/71	BANNS CR. BR- MOUTH	1/2	CLEAR	Slightly TURBID															
11	10/5/71	BLK. R. & SPRING BRK CR.	3/4	FOG	TURBID															
19	10/19	BURNS BR- MOUTH	1/8	RAIN	Slightly TURBID															
20	10/19/71	SOOS HATCHERY	Hatchery area	Overcast	Covert															
23	11/2/71	SPRINGBROOK CR. mouth up	1/8	RAIN	TURBID															
25	11/2/71	BURNS CR. mouth up	1/8	FOG	CLEAR				3											
24	11/2/71	MILL CR. NEAR KENT	1/16	RAIN	TURBID															
30	11/9/71	SPRINGBROOK UP FROM MOUTH	1/2	RAIN																
31	11/9/71	Mill Cr. VIC. KENT	1/16	RAIN	TURBID															
32	11/9/71	BURNS Cr. MOUTH UP	1/8	Clear	clear															
41	11/29/71	Burns Cr. MOUTH SIDE CHANNEL	.88	RAIN	Slightly TURBID				25	12	24									
40	11/29/71	MILL Cr VIC KENT	1/10	CLEAR	TURBID															
39	11/29/71	SPRINGBROOK Cr MOUTH UP	1/8	CLEAR	TURBID															
42	11/29/71	SOOS CR. HATCHERY	Hatchery Area	Clear	Slightly Turbid				0	0										

2 of 2

GREEN RIVER DRAINAGE

Miscellaneous Streams (Cont'd.)

(Run Year 71-72)

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook: Live	Chinook: Dead	Chinook: Redds	Coho: Live	Coho: Dead	Coho: Redds	Chum: Live	Chum: Dead	Chum: Redds	Pink: Live	Pink: Dead	Pink: Redds	Steelhead: Live	Steelhead: Dead	Steelhead: Redds
37	11/15/71	BURNS CR NEAR BR. UPSTREAM FROM MOUTH	1/8	FOG	CLEAR				21	1	9									
33	11/9/71	SOOS CR. HAT.	Hatchery area	RAIN	Slightly TURBID				3000 1000 1,000	over below taken	weir									
61	1/24/72	BURNS CR MOUTH UPSTREAM	1/8	CLEAR	CLEAR				1		1									
70	2/23/72	BURNS CR MOUTH UP	1/4	CLEAR	CLEAR															
			Total miles walked 4.92																	

Bogachiel River Drainage
Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	1/10/73	Bogachiel Pond-outlet to mouth	.13	overcast	clear													23	0	*
2	1/10/73	Horganroth Cr. from mouth upstream	.25	rainy	slightly turbid				2	2	*									
3	2/2/73	Bogachiel Pond-outlet to mouth	.13	rainy	slightly turbid													35	0	*
4	2/2/73	Horganroth Cr. from mouth upstream	.25	clear	clear				0	1	*									
5	2/7/73	Bogachiel Ponds from outlet to mouth	.13	clear	clear													20	0	*
6	2/21/73	Horganroth Cr. from mouth upstream	.25	clear	clear													0	1	0
7	2/22/73	Bogachiel Ponds - from outlet to mouth	.13	clear	clear													40 to 60	0	6
			Total miles walked 1.27																	

* indicates redds seen but not counted.

Soleduck Drainage
Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	1/11/73	Swanson Cr. Hyw 101 downstream	.25	rainy	slightly turbid	0	3	*	1	10	*									
2	1/31/73	Kugel Cr. 1/4 mi below + 1/2 mi. above Rd. 3	.75	overcast	slightly turbid	None														
3	2/8/73	Hah Cr. bridge to mouth	.50	clear	clear	None														
4	2/8/73	Swanson Cr. Hyw 101 downstream	.25	clear	slightly turbid				0	1	*									
5	2/20/73	Shuwah Cr. road crossing up + downstream	2.00	clear	clear	None														
6	2/22/73	Swanson Cr. Hyw 101 downstream	.25	clear	clear	0	1	*	0	1	*									
			Total miles walked 4.00																	

* indicates redds seen but not counted

Calawah River Drainage
Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	1/31/73	Cool Cr. Index road to N. Fork	.25 ✓	overcast	slightly turbid													1	0	0
2	2/9/73	Elk Cr. Bridge upstream	.50	foggy	clear				0	1	0							2	0	0
3	2/9/73	Elk Cr. from bridge downstream	.75	overcast	clear				0	2	0							2	0	0
4	2/8/73	Cool Cr. Index	.25 ✓	clear	clear	None														
5	2/22/73	Cool Cr. Index. also surveyed above index to culvert	.25 ✓	clear	clear													0	0	1
6	2/23/73	Elk Cr. from bridge upstream	.25	clear	clear	(Trout seen in pools)														
			Total Index miles walked .75																	
			Total miles walked other than Index 1.50																	
			Total 2.25																	

Hoh River Drainage
Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook Live	Chinook Dead	Chinook Redds	Coho Live	Coho Dead	Coho Redds	Chum Live	Chum Dead	Chum Redds	Pink Live	Pink Dead	Pink Redds	Steelhead Live	Steelhead Dead	Steelhead Redds
1	1/10/73	Winfield Cr, Old Br. below 9X Rd. Br., downstream	.13	rainy	slightly turbid				0	1	0									
2	1/10/73	Nolan Cr. 101 Br. downstream	1.00	overcast	slightly turbid	None														
3	2/5/73	Winfield Cr. (same as above)	.13	rainy	slightly turbid	None														
4	2/7/73	Nolan Cr. 101 Br downstream	1.00	clear	clear	None														
5	2/7/73	Winfield Cr. (same as above)	.13	clear	clear	None														
6	2/21/73	Nolan Cr. 1 mi. below + 1/4 mi above 101 Br	1.25	clear	slightly turbid	None														
7	2/21/73	Winfield Cr. (same as above)	.13	clear	clear	None														
			Total miles walked 3.89																	

NORTH FORK SKOKOMISH DRAINAGE

Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
						Chinook			Coho			Chum			Pink			Steelhead		
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	1/24/73	North Fork from [illegible] Road Crossing [illegible]	1/4	overcast	Slightly Turbid							3	5	0						
2	2/16/73	" " "	1/4	rainy	Clear							0	7	0						
3	3/2/73	" " "	1/4	overcast	Clear							0	1	0				0	0	1
			Total miles [illegible] .75																	

NISQUALLY RIVER DRAINAGE

Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook: Live	Chinook: Dead	Chinook: Redds	Coho: Live	Coho: Dead	Coho: Redds	Chum: Live	Chum: Dead	Chum: Redds	Pink: Live	Pink: Dead	Pink: Redds	Steelhead: Live	Steelhead: Dead	Steelhead: Redds
1	[illegible]/72	Muck Cr. - from [illegible] to mouth	.50	overcast	clear							331	27	*						
2	[illegible]/72	[illegible] - from mouth upstream	.50	overcast	clear							100	56	*						
3	1/2[illegible]/73	Tanwax Cr. - from mouth upstream	.06	overcast	slightly turbid							2	1	*						
4	1/[illegible]/73	Ohop Cr. from Hy[illegible] br. near Eatonville downstream	.50	overcast	slightly turbid	None														
5	1/2[illegible]/73	25 mi. Cr. - from R.R. Br. near Clay City downstream	.25	overcast	slightly turbid	None														
6	2/12/73	25 mi. Cr. - from R.R. [illegible] near Clay City downstream	.25	clear	slightly turbid	None														
7	2/14/73	Tanwax Cr. - from mouth upstream	.06	rainy	slightly turbid	None														
8	2/1[illegible]/73	Ohop Cr. from Hy[illegible] [illegible] Br. near Eatonville downstream	.50	rainy	slightly turbid	None														
9	2/1[illegible]/73	Yelm Cr. - from mouth upstream	.50	rainy	clear	([illegible] seen at upper end of [illegible])						1	121	*						
10	2/25/73	25 mi. Cr. - from [illegible] near Eatonville downstream	.50	clear	clear	None														
11	2/[illegible]/73	Tanwax Cr. - from mouth upstream	.06	overcast	slightly turbid	None														
12	[illegible]/73	Ohop Cr. - from Hy[illegible] [illegible] Br. near Eatonville downstream	.50	overcast	slightly turbid	None														
13	[illegible]/73	Yelm Cr. - from mouth upstream	.50	overcast	clear							0	110	*				1	0	*
			Total [illegible] 4.68																	

* indicates redd(s) seen but not counted

McALLISTER CREEK

Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility: Weather	Visibility: Water	Chinook: Live	Chinook: Dead	Chinook: Redds	Coho: Live	Coho: Dead	Coho: Redds	Chum: Live	Chum: Dead	Chum: Redds	Pink: Live	Pink: Dead	Pink: Redds	Steelhead: Live	Steelhead: Dead	Steelhead: Redds
1	1/22/73	McAllister Spring	0	overcast	clear							≈90	45	[illegible]						
2	2/16/73	" "	0	overcast	clear							40	77	[illegible]						
3	3/2/73	" "	0	overcast	clear							8	* many	[illegible]						

* [illegible]

PUYALLUP RIVER DRAINAGE

Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data														
				Weather	Water	Chinook			Coho			Chum			Pink			Steelhead		
						Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds
1	1/23/73	Fox Cr. [illegible] upstream	.25	overcast	slightly [illegible]				0	5	0									
2	1/29/73	[illegible]	.11	overcast	clear							1	148	*				4	0	*
3	2/10/73		.25	overcast	clear				Many	Coho	[illegible]	0	121	*				2	0	*
4	2/13/73	Fox Cr. from mouth upstream	.13	clear	clear	None														
5	2/16/73	[illegible] Cr. [illegible] mouth upstream	.25	overcast	clear				Many 0	Coho 7	[illegible] *									
6	2/26/73	" " "	.25	rainy	clear				Many	Coho	[illegible]									
7	2/27/73	Fox Cr. from mouth upstream	.13	clear	clear	None												(Two over	[illegible] Puyallup	R.F. Br. up)
8	2/27/73	Kelly Cr. from lowest road crossing upstream	.25	overcast	clear				Many	Coho	[illegible]	0	114	0				7 (4	0 0	* – [illegible] Ed.)
			Total miles walked 1.76																	

GREEN RIVER DRAINAGE

Steelhead Spawning Surveys
Run Year 1972-1973

Survey No.	Date	Area Description	Index Area ( ) 1/ or Mileage Covered	Visibility		Fish Data															
						Chinook			Coho			Chum			Pink			Steelhead			
				Weather	Water	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	Live	Dead	Redds	
1	[illegible]	[illegible] stream	.13	[illegible]	Slightly turbid													1	0	0	
2	[illegible]	[illegible]	.25	[illegible]	clear	[illegible]						0	8	[illegible]							
3	[illegible]	[illegible] Co. [illegible]	.50	clear	slightly turbid	None															
4	[illegible]	[illegible] Rd. [illegible]	.13	rain	slightly turbid	None															
5	[illegible]	[illegible] ½ mi. E. of [illegible] Rd. [illegible]	.25	rain	slightly turbid							0	5	0				0	1	0	
			Total miles [illegible] 1.26																		

5.

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Sport Fisheries and Wildlife
Division of Fishery Services

Tumwater, Washington

Special Report

SOCKEYE FISHERY INVESTIGATIONS ON THE QUINAULT RIVER SYSTEM

Quinault Indian Reservation
Grays Harbor County, Washington
December 1971

SOCKEYE FISHERY INVESTIGATIONS
on the Quinault River System

Quinault Indian Reservation
Washington

INTRODUCTION

The Quinault Indian Reservation is located on the Pacific coast in Western Washington. Quinault River is the largest river system traversing the reservation and it is the only river system on the reservation supporting a sockeye fishery. Taholah, the principal community on the reservation, is located at the mouth of the Quinault River. Historically, the Quinaults have depended upon the fish resources from the river for their livelihood.

Catches of sockeye salmon (*Oncorhynchus nerka*), the most abundant salmon species in the Quinault River system, have been declining during recent years. In 1969 the Tumwater office of the Bureau of Sport Fisheries and Wildlife, under tribal agreement, initiated studies to determine reasons for the reduced catches, and to recommend remedial action. This is the third report prepared for the tribe concerning the sockeye fishery. The report provides data collected from spawning ground surveys, downstream migrant studies, and trawling investigations which were not covered in either of the previous reports.

DATA COLLECTION

Index areas have been established on Big Creek, Alder Creek and Inner-Merriman Creek, all tributaries to the Quinault River above Quinault Lake, to monitor the sockeye spawning escapement. Counts were initiated in 1952 on Alder Creek and 1956 and 1962 on Big Creek and Inner-Merriman Creek, respectively. The earliest counts were made by Washington State Department of Fisheries personnel. Most state counts were made once a season by walking the streams and counting both live fish and carcasses. In 1962, Bureau biologists began conducting spawning ground surveys, and made one or two counts on each index area per season. In 1970, Bureau biologists expanded the spawning ground count program to include coverage of the index areas approximately once every two weeks.

Juvenile sockeye salmon rear mainly in Quinault Lake and in the summer of 1969 a midwater trawling program was initiated to sample the pre-smolt sockeye population to determine their growth rates in the lake. Twenty-six trawl samples were taken from 1969 to 1971. Location, depths, and lengths of tows were variable. Length frequencies were recorded for each sample. With the exception of a few early samples, the fish were divided into two-millimeter length groups and a mean individual weight recorded for each group. The condition factor (K) was calculated for each length group.

In order to expand the study of juvenile sockeye in Quinault Lake an informal cooperative program was developed with the Fisheries Research Institute of the University of Washington. Advanced acoustical echo integration equipment and techniques are being used to estimate the size of the pre-smolt population. Echograms are recorded monthly from a series of echo-sounding transects on the lake (Figure 1). A graduate student of the University of Washington will analyze the data collected on this portion of the sockeye study in preparation for his thesis.

To collect information on sockeye smolts leaving Quinault Lake a fyke net was installed approximately 500 yards downstream from the lake outlet. The net was one-half inch stretch mesh with an approximate 32 square-foot section opening. The net was first set when visual observations of schooling smolts were made near the lake outlet. The fyke net was operated through the smolting season when water conditions and work schedules permitted.

To continue a phase of the program covered in an earlier report, scales and length-weight data were collected from samples of adult sockeye commercially caught at Taholah. The average lengths, weights, and age of the adults taken in the Indian net fishery were then compared to previously reported findings.

RESULTS

Spawning ground count data are tabulated in Tables 1-3. Personnel representing two agencies and the tribe were involved in the data collection. Peak counts on the spawning grounds indicate a general downward trend in numbers of spawning adult fish in recent years.

Length-grequency curves for each trawl and fyke net sample are presented in Figure 2. Year classes and their respective mean lengths (μ) are defined where practical for each sample. Figure 3 exhibits the growth in length of progeny from the 1969 broodyear. Very few fish of the size 56-80mm T.L. were taken in the trawl samples; however, many schools of juvenile sockeye in this size range were observed in May and June around the perimeter of the lake. This suggests that the pre-smolt sockeye were not distributed homogeneously throughout the pelagic zone with the younger fish and thus not subject to capture in the trawl samples. Apparently the pre-smolt sockeye in Quinault Lake form shore oriented schools upon reaching approximately 50-60mm T.L. in size, actively feed during daylight hours, and change food habits to some degree, which results in a faster growth rate just prior to smoltification.

The calculated condition factors (K) appear in Table 8. Inspection of the 1969 year class indicate that the peak condition of the younger pelagic oriented fish occurred in June. Whether the timing of the peak condition was a result of the smoltification process reducing competition for food and space in the pelagic areas or a natural increase in the abundance of food is not known.

In a previous report, analysis of data collected from adults taken in the commercial fishery at Taholah strongly suggested that adults having spent three years at sea were dominant in the run until about mid-May. Adults having spent two years at sea were dominant from mid-May to the close of the season and were dominant in an "all-season" basis. Figure 3 depicts the length-frequencies of four samples taken in the 1970 season and supports the earlier findings.

DISCUSSION AND RECOMMENDATIONS

Data collected to date are limited and only suggest features that might be occurring in the Quinault sockeye salmon life cycle. Useful conclusive statements are not yet possible. Future investigations should be directed toward obtaining data which would be useful in predicting the future harvest potential and to maximize control of that harvest potential. Prerequisite to accomplishing these objectives are basic data concerning stock size, mortality rates, and factors affecting mortality rates. Only by attaining valid indices or estimates of these statistics can the ultimate goals be obtained.

Specifically, the following information will be necessary to develop a sound scientific management program:

An estimate or index of egg deposition

An estimate of survival to emergence

An estimate of the fry population size just after lake entry

An estimate of the smolt population size

An estimate of the returning adult population size

Acoustical techniques, though promising, required much more elaborate and refined electronic equipment than was available to our office. For this reason, assistance was solicited from the University of Washington's Fishery Research Institute where experimental gear being developed shows great promise. These acoustical techniques, in our opinion, have the greatest potential to obtain reliable estimates of escapement, juvenile population size, and biomass at any time during their lake residence.

To help provide a necessary portion of the acoustical studies, the lake trawling program should be refined and continued. Growth rates and condition factors should be among the primary considerations. These efforts should be coordinated with the Fisheries Research Institute staff.

Charles E. Osborn
Fishery Management Biologist
Date: March 31, 1972

APPROVED:

Richard J. Navarre
Richard J. Navarre
Project Leader
Date: April 10, 1972

REVIEWED:

D. H. Rasmussen
D. H. Rasmussen, Regional Supervisor
Division of Fishery Services
Date: April 13, 1972

Figure 1. Echogram of a Transect on Lake Quinault - September 8, 1971

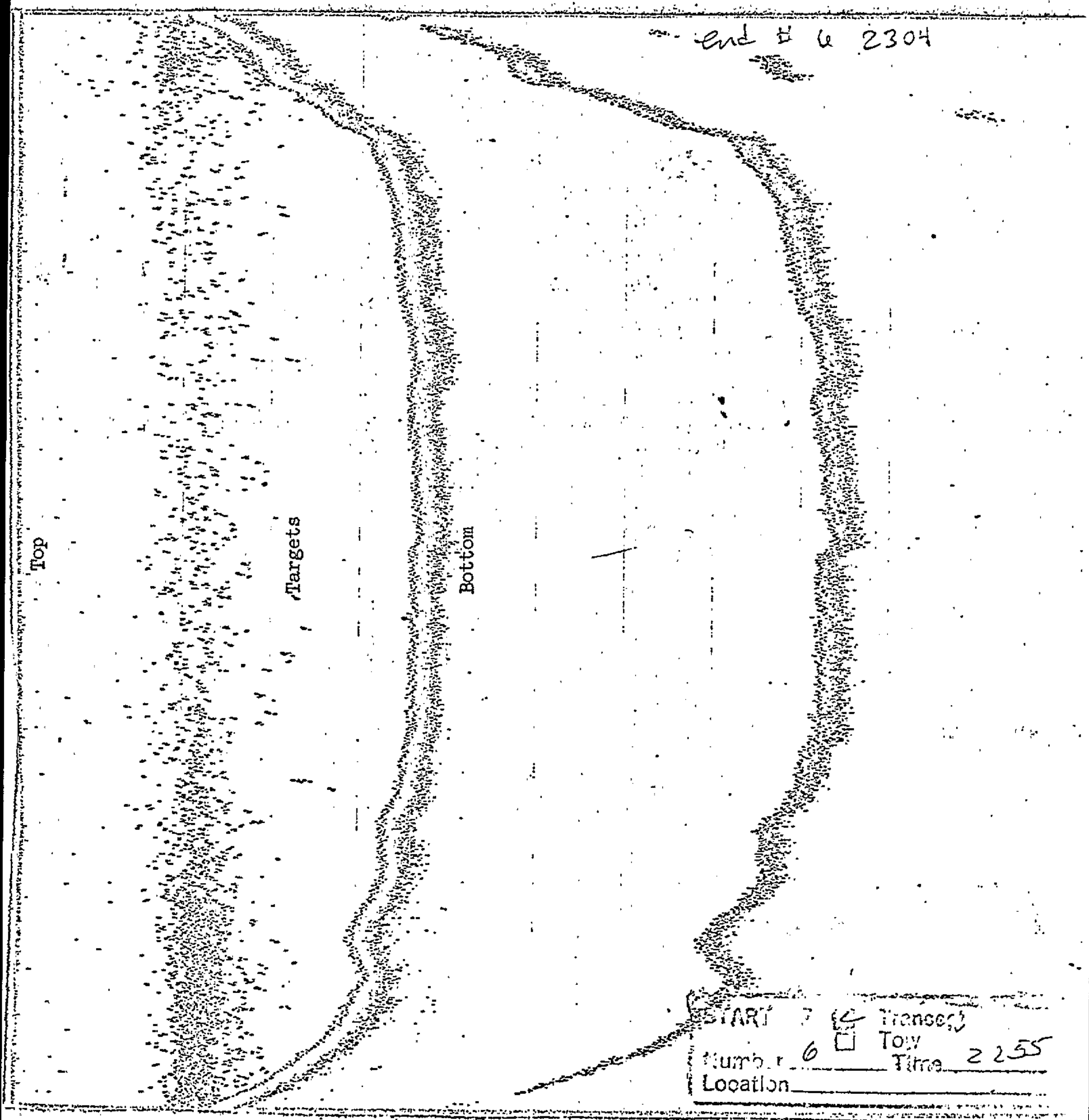
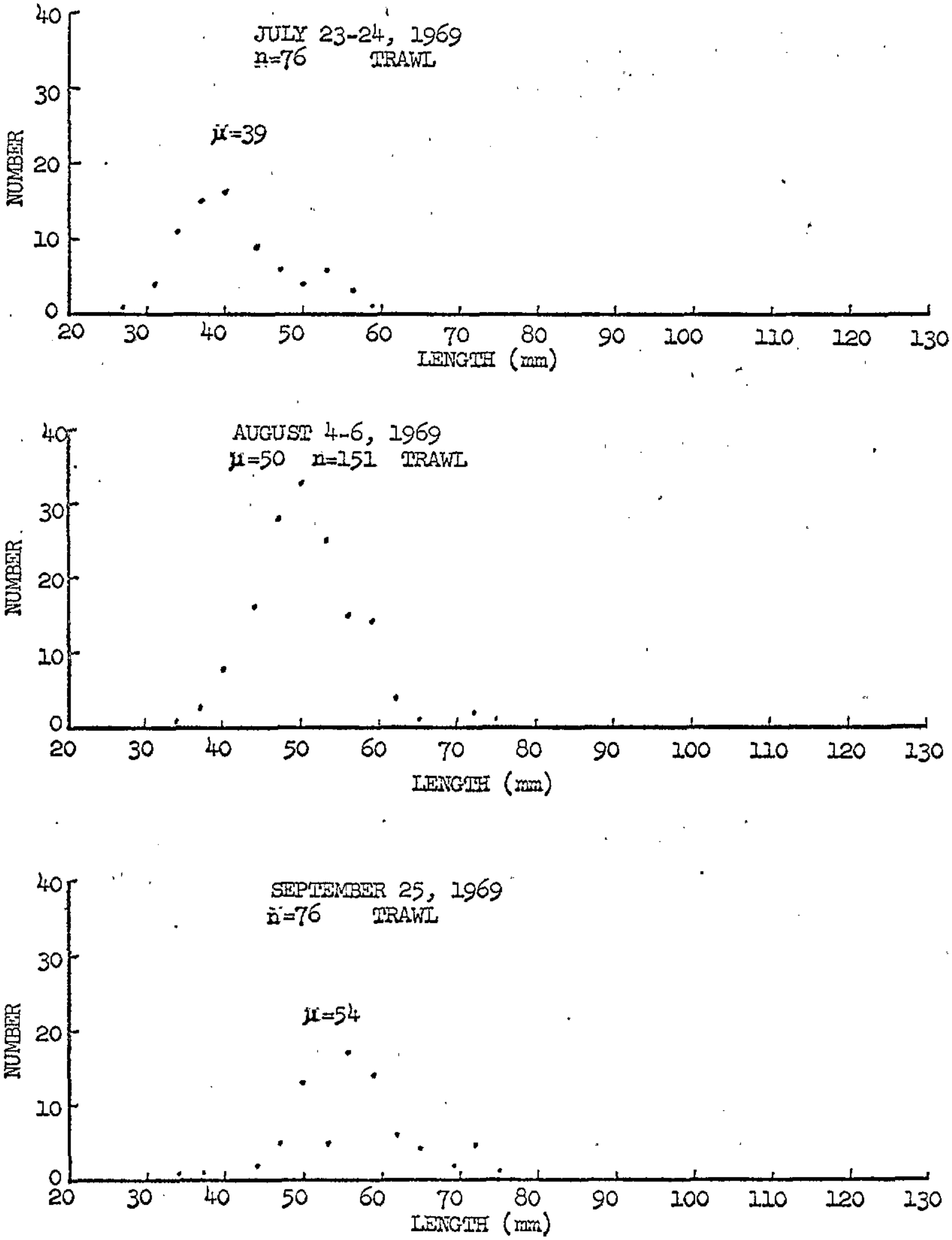


Figure 2a Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Where μ=mean length of year class as determined by length frequency inspection and n=sample size.



μ=mean length. n=number of fish in sample.

Figure 2b Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd

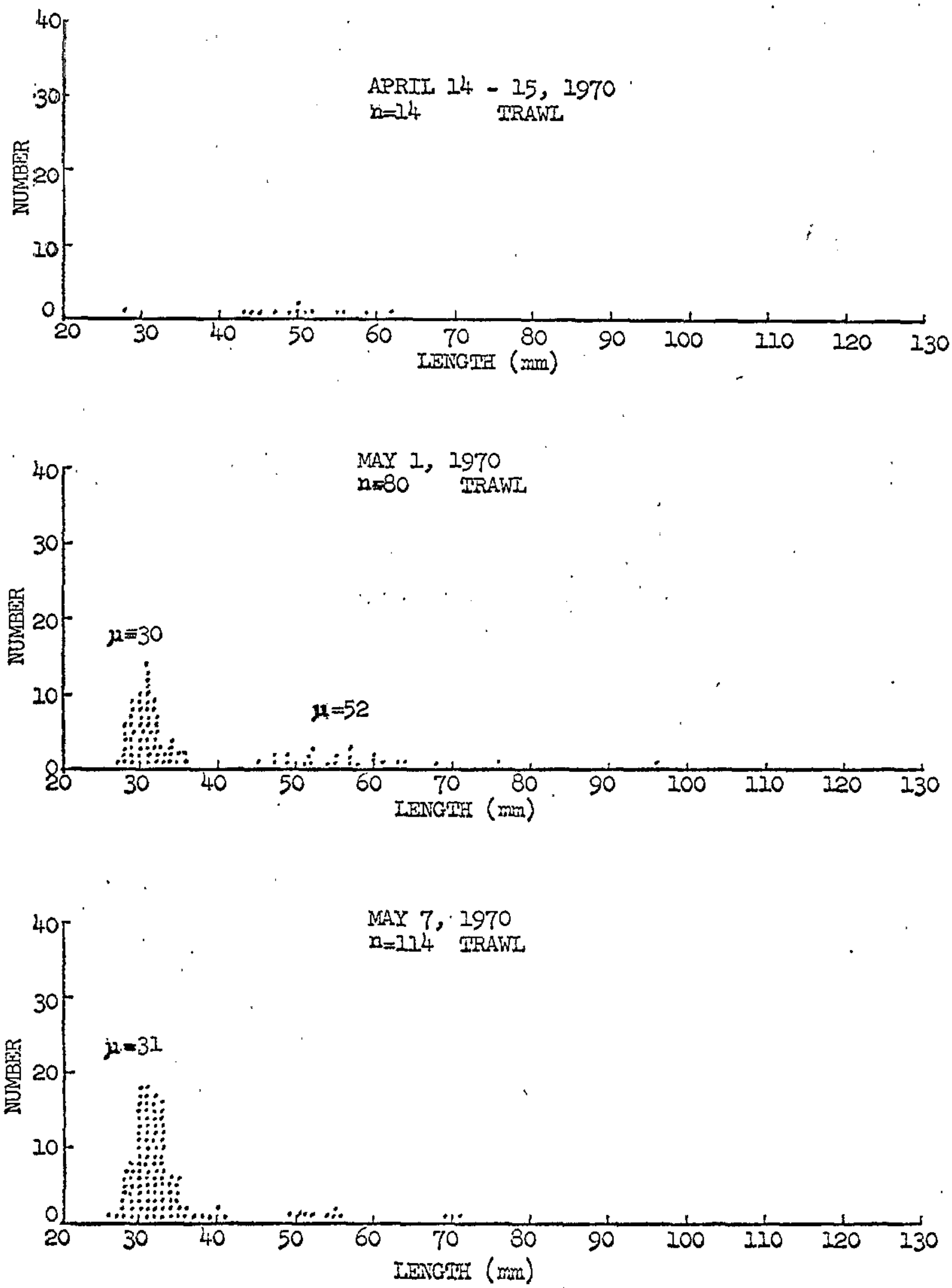


Figure 2c Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd

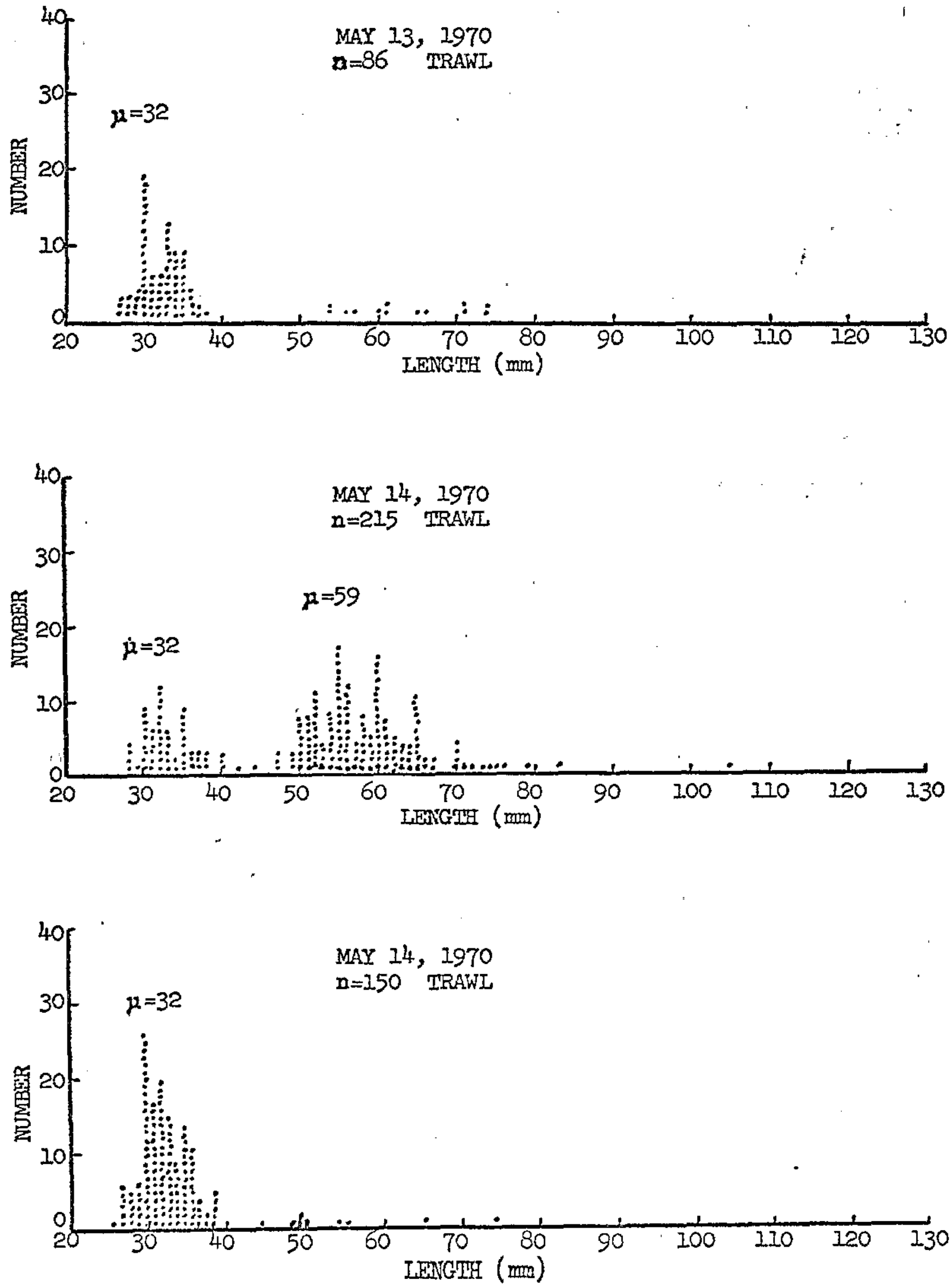
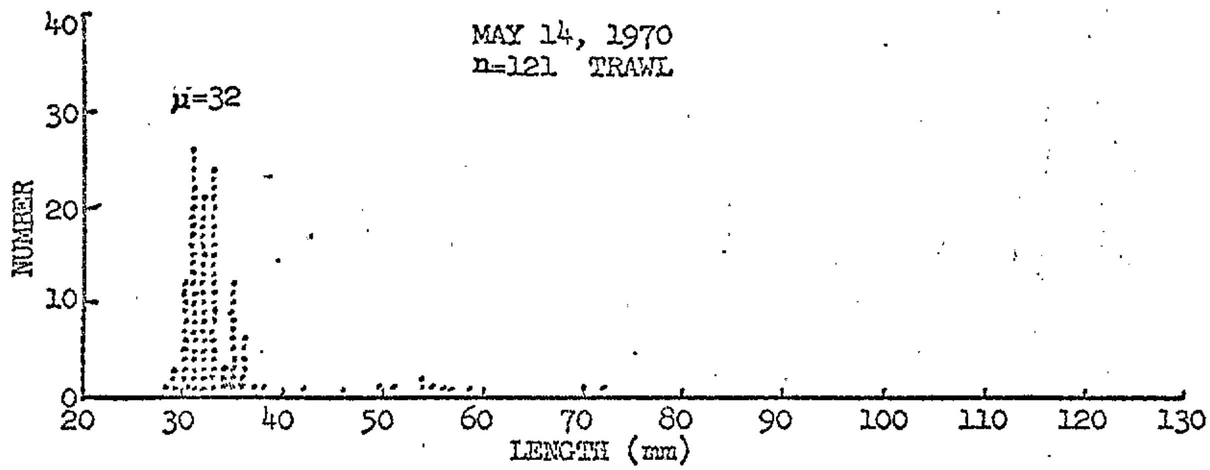


Figure 2d Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd



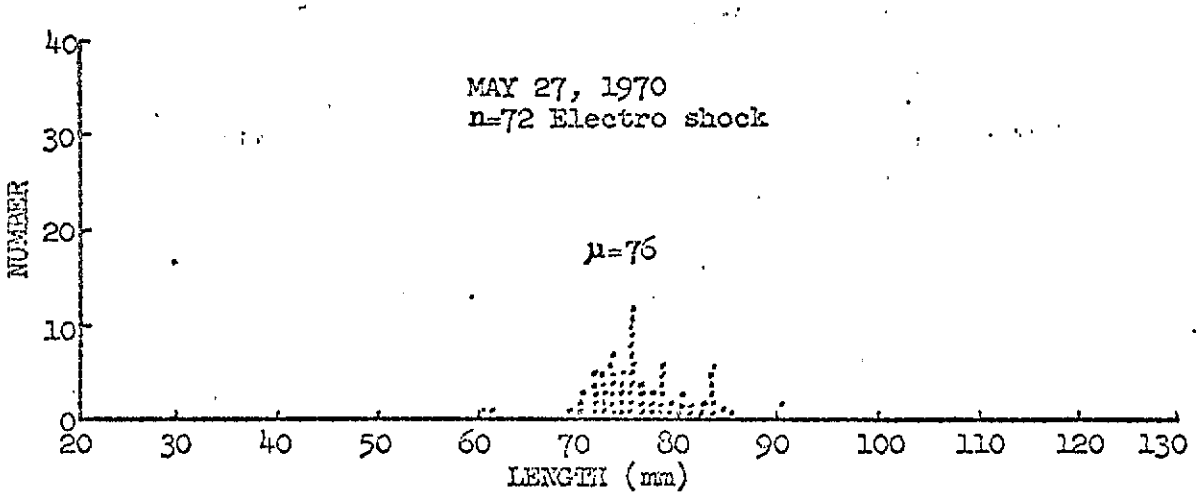
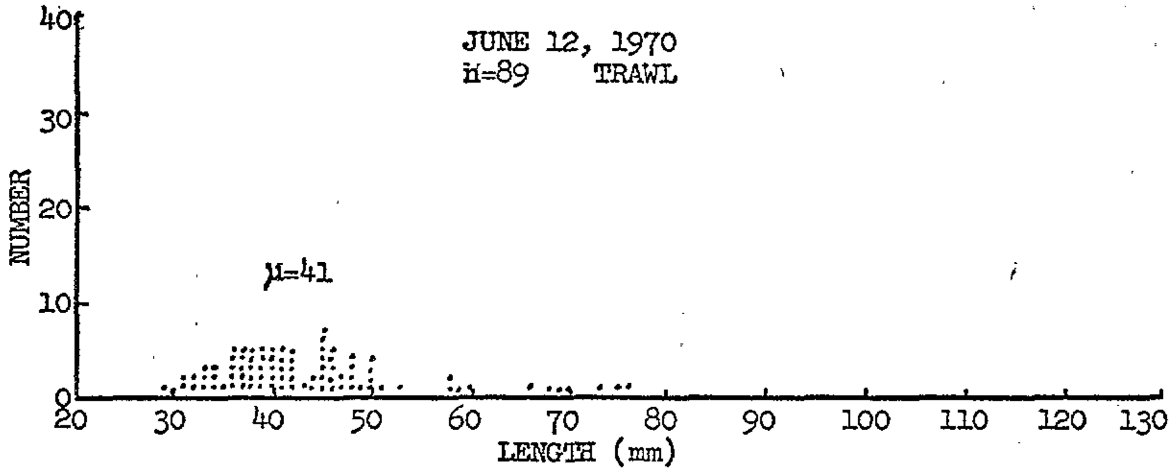
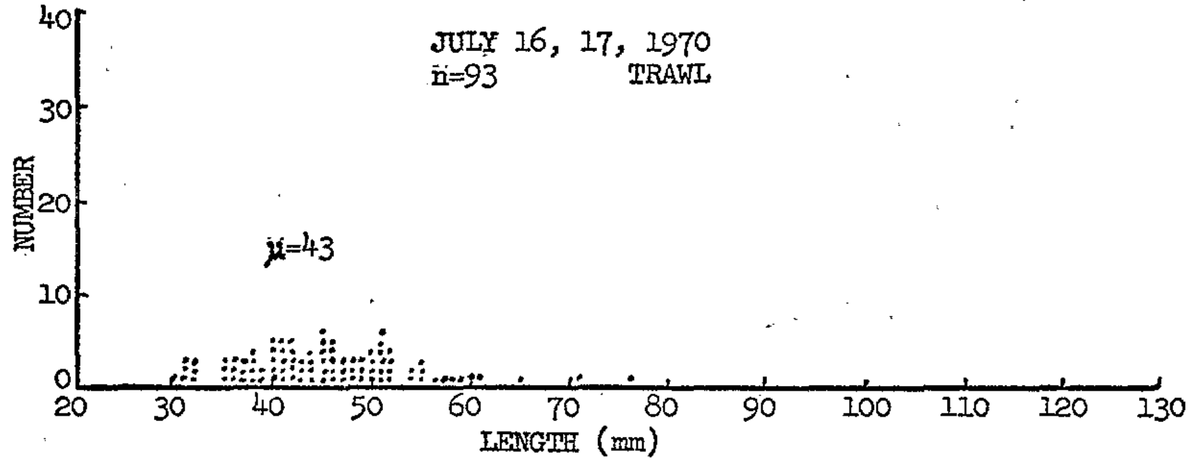


Figure 2e Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd





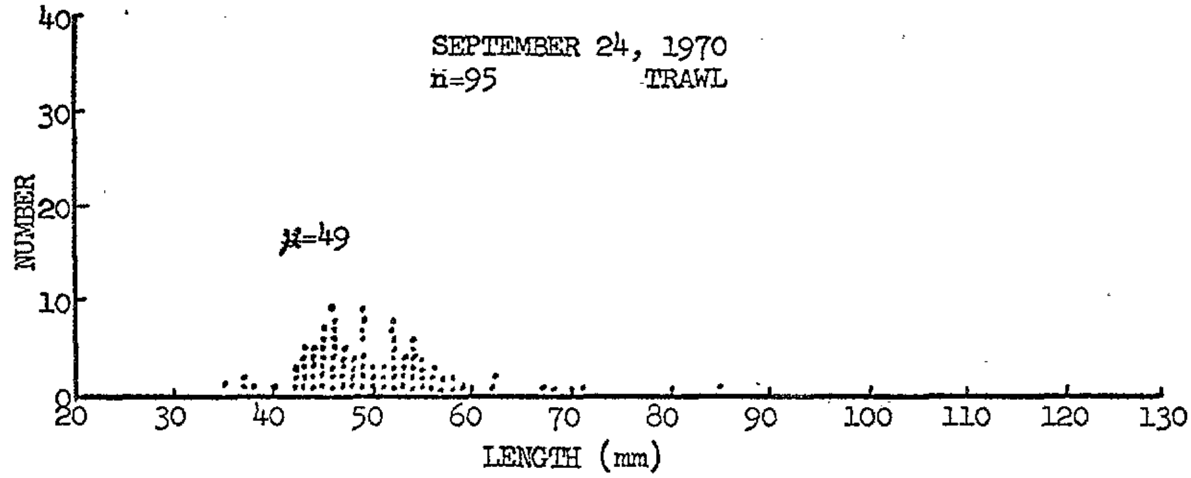


Figure 2f Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd

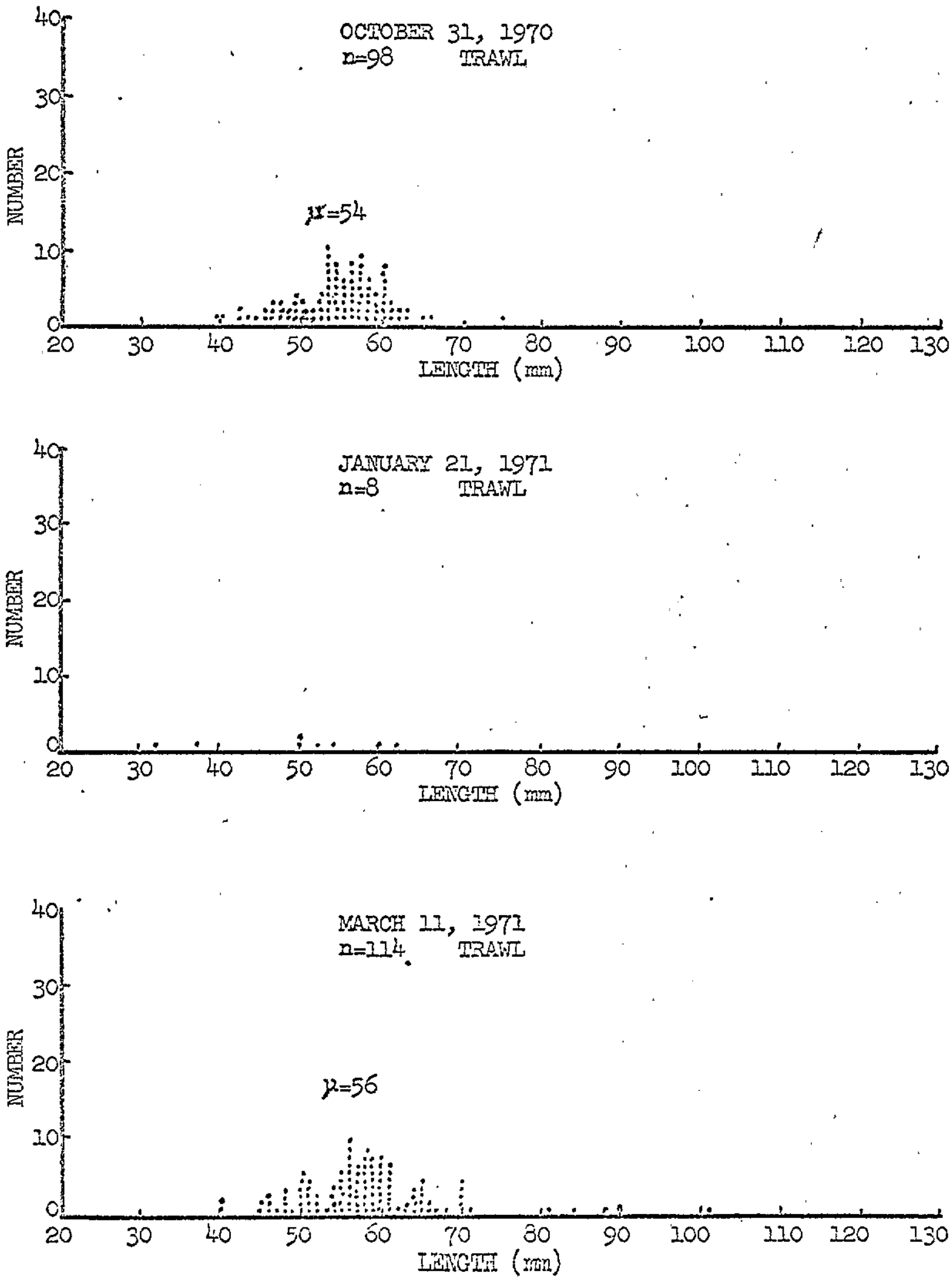


Figure 2g Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd

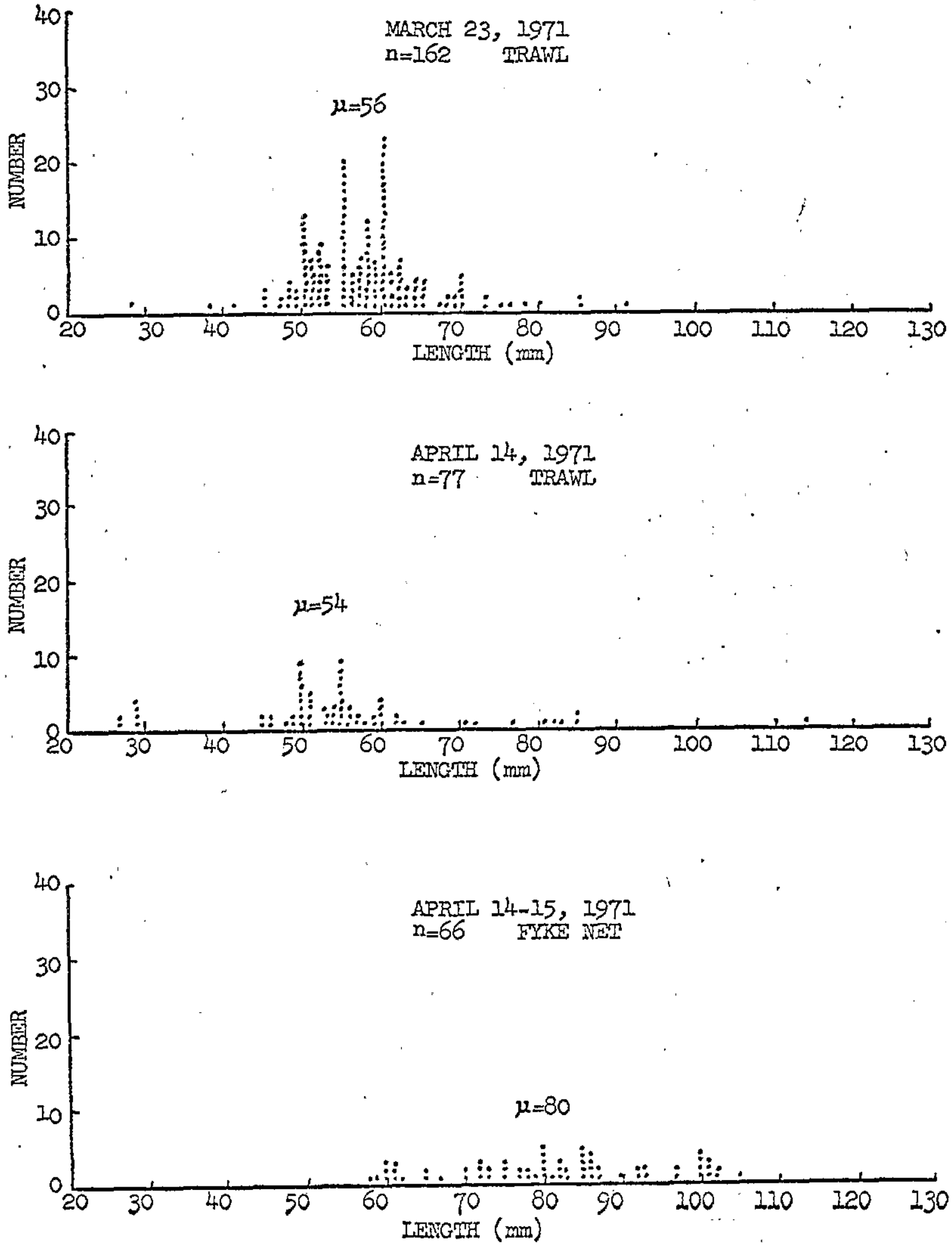


Figure 2h Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd

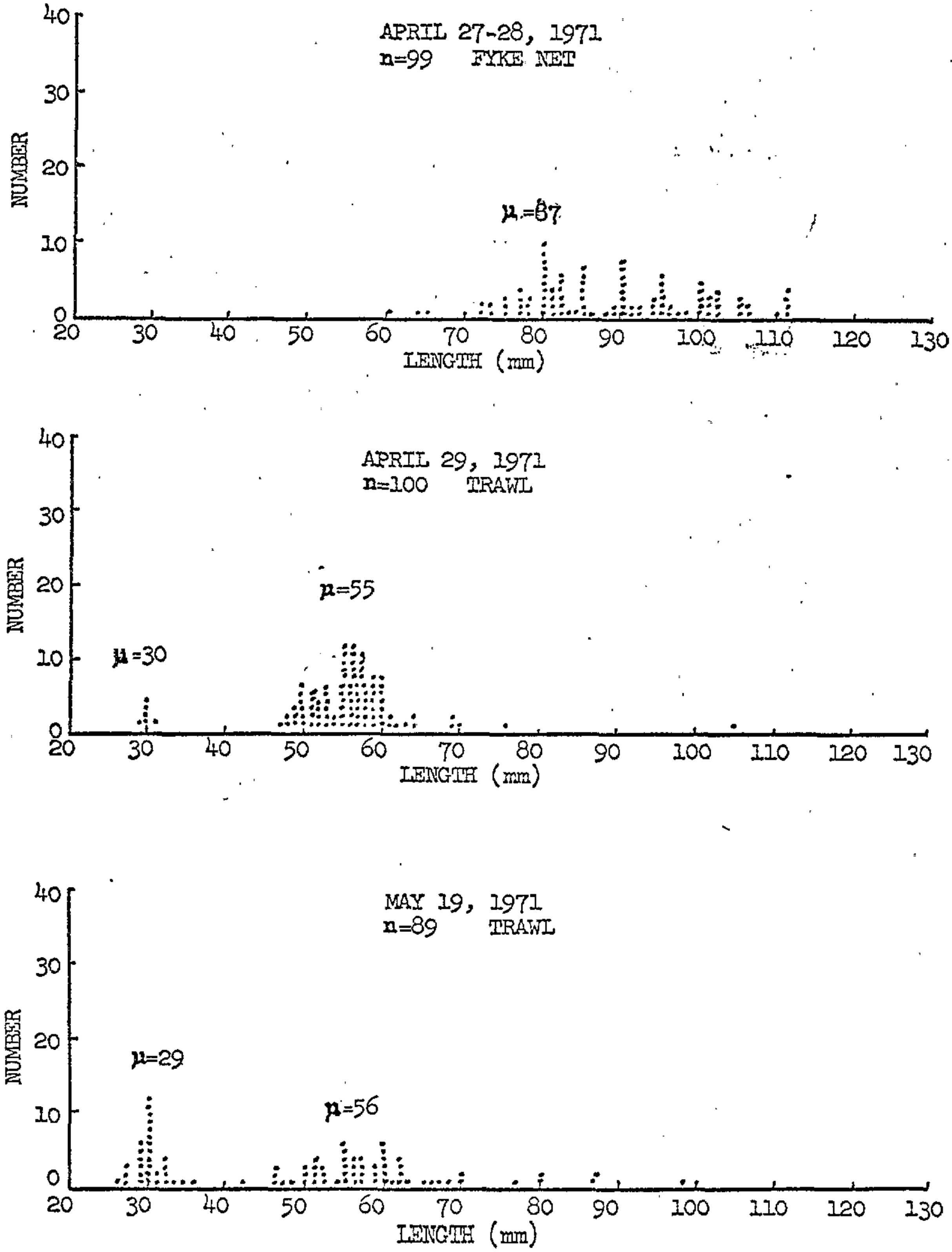


Figure 21 Length-frequencies of fyke and trawl samples taken in Lake Quinault since 1969 of juvenile sockeye. Cont'd

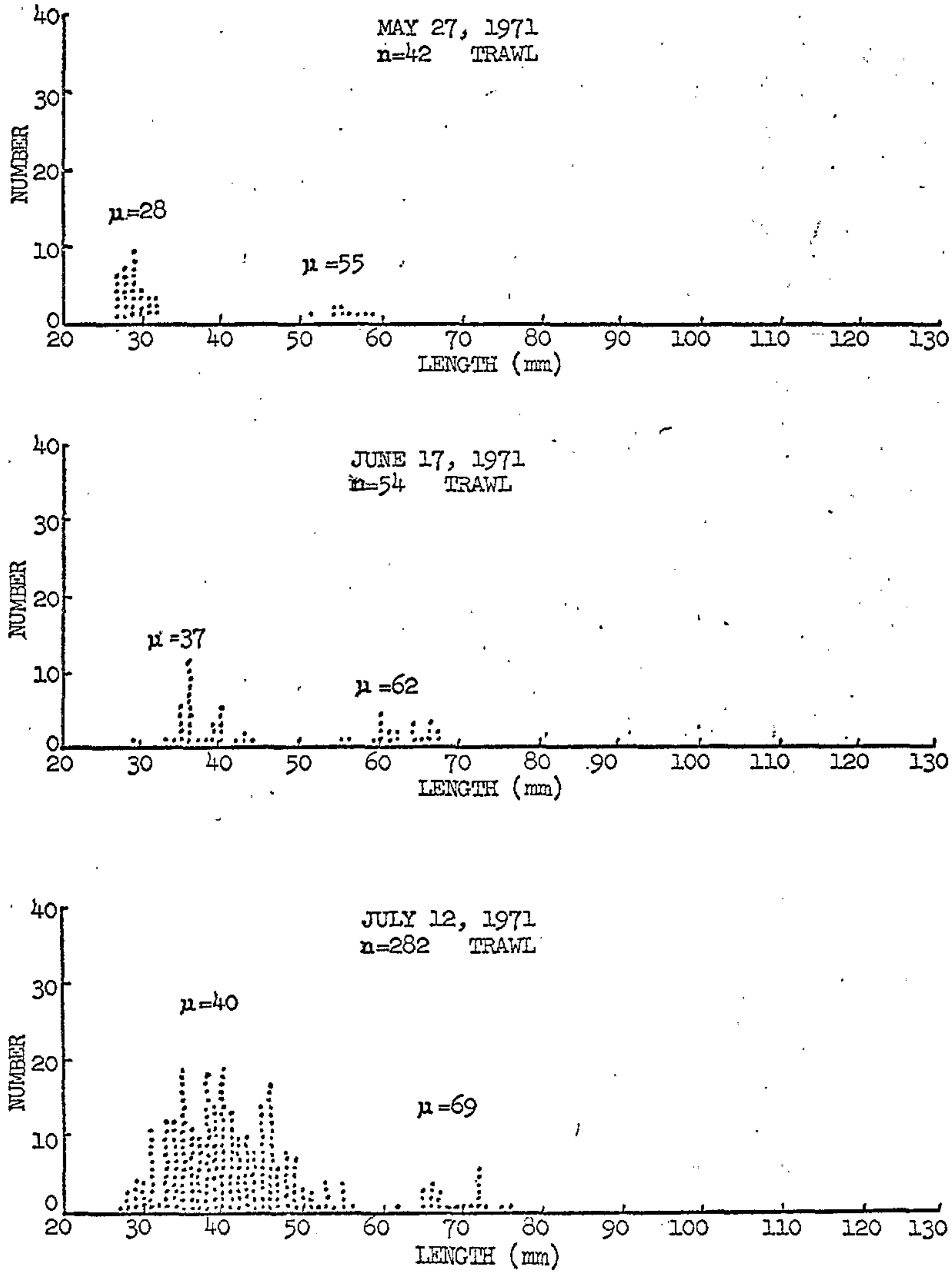


Figure 3. Mean lengths of fry from the 1969 broodstock

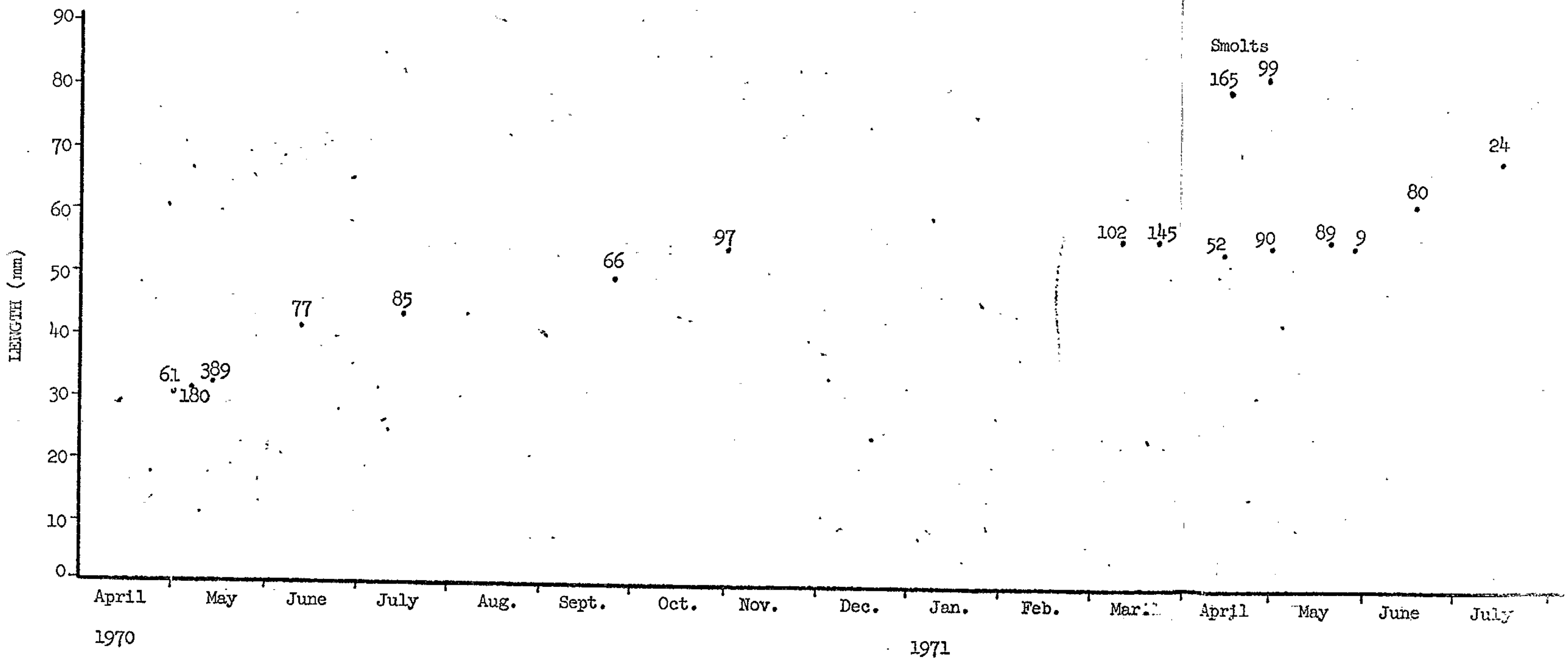


Figure 4. Length frequencies of two year classes of Quinault sockeye salmon as determined by monthly samples taken from the commercial fishery at Taholah in 1970-71.

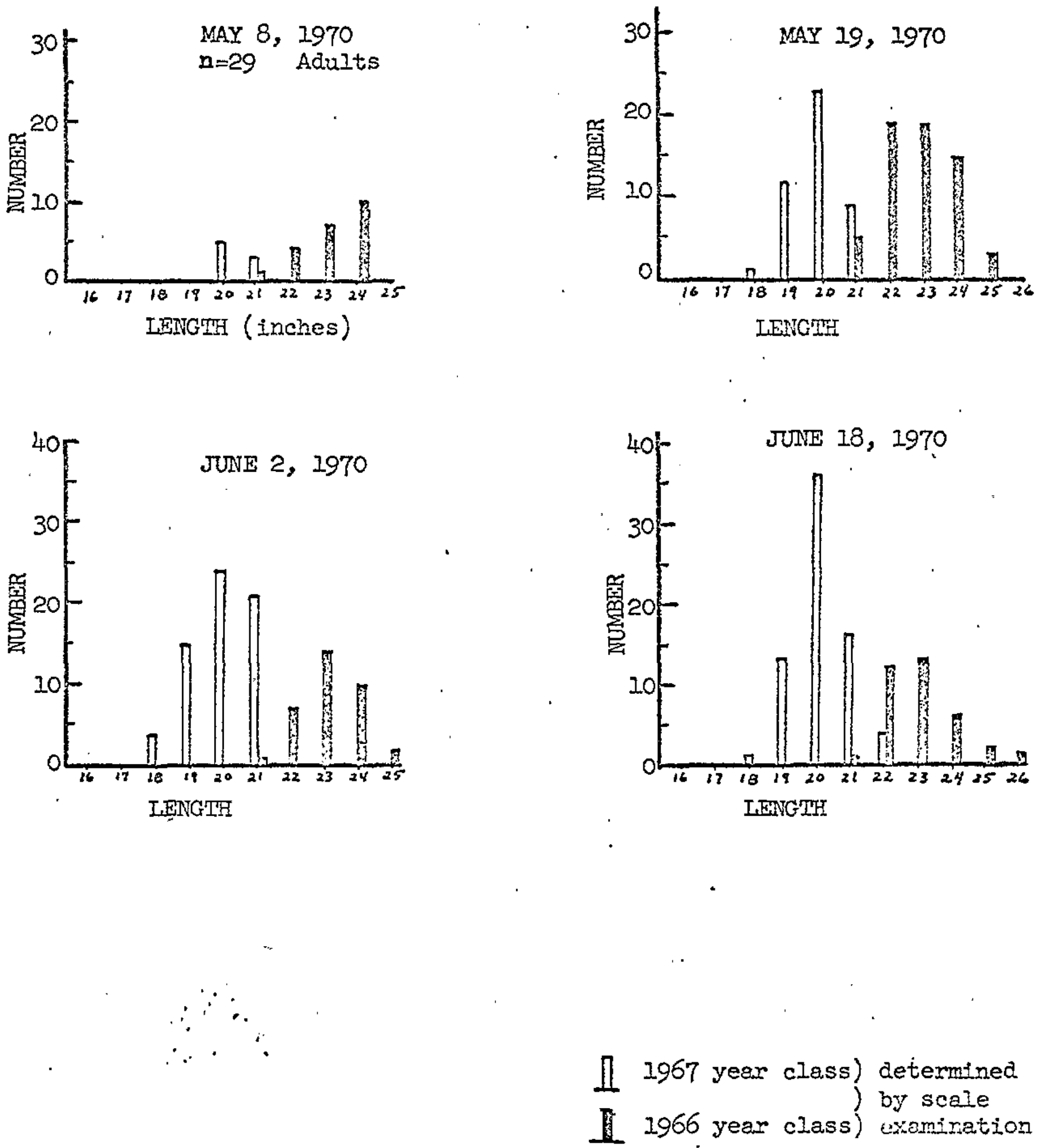


Table 1. Sockeye spawning index area counts in Alder Creek from 1956 through 1970.

Alder Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1952	UKN	0.6	1,273	2,123			State count
1953	UKN	0.6	286	477			" "
1954	UKN	0.6	2,803	4,667			" "
1955	UKN	0.6	1,720	2,850			" "
1956	UKN	0.6	1,593	2,658			" "
1957	UKN	0.6	1,119	1,865			" "
1958	UKN	0.6	1,280	2,132			" "
1959	UKN	0.6	919	1,532			" "
1960	UKN	0.5	1,403	2,806			" "
1961	UKN	0.5	745	1,490			" "
1962	UKN	0.5	436	872			" "
1963	11/25	0.5	936	1,872			" "
1964	UKN	0.5	1,734	3,468			" "
	11/19	0.5	1,080	2,160			FWS count
1965	11/18	0.5	925	1,850			State count
	12/16	0.5	945	1,890			FWS count
	12/17	0.5	1,156	2,312			State count
1966	UKN	0.5	1,543	3,086			State count
1967	UKN	0.5	966	1,932			FWS count
	12/11	0.5	815	1,630			FWS count
1968	10/26	0.5	100	200			McMinds count
	11/26	0.5	1,953	3,906			State count
	12/26	0.5	1,790	3,580			State count
1969	11/26	0.5	475	950			FWS count
	12/10	0.5	303	606	3rd wk.		" "
	12/23	0.5	664	1,328	in Dec		" "
1970	1/8	0.5	96	192			FWS count
	1/22	0.5	64	128			" "
	2/4	0.5	7	4			" "
	10/30	0.5	7	14			" "
	11/12	0.5	449	898			" "
	12/1	0.5	496	992	last wk.		" "
	12/17	0.5	222	444	of Nov.		" "
1971	1/5	0.5	96	192			" "

Table 2. Sockeye spawning index area counts in Big Creek from 1956 through 1970.

Big Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of Run	Remarks
1956	UKN	0.5 mi.	874	1,748		No. est.	
1957	UKN	0.5	1,018	2,036		" "	
1958	UKN	0.75	723	964		" "	
1959	UKN	0.75	853	1,137		" "	
1960	UKN	0.75	1,816	2,421		" "	
1961	UKN	1.5	1,575	1,050		" "	
1962	UKN	1.5	1,975	1,317		" "	State count
	12/13	1.5	1,465	976		" "	FWS count
1963	UKN	1.5	3,154	2,103		" "	State count
	12/3	1.5	2,438	1,621		" "	FWS count(Bridge t[o] mouth)
	12/4	1.5	1,109	738		" "	FWS count(Racks t[o] bridge)
1964	11/18	1.5	1,628	985		" "	State count
	11/20	UKN	975	UKN		" "	FWS count
	UKN	1.5	1,781	1,186		" "	FWS count (inclus[i]... of 11/20 count UK[N]
1965	12/17	UKN	1,043	UKN			State count
1966			NOT	SURVEYED			
1967	12/16	1.3	1,964	1,511		" "	FWS count
1968	10/26	1.3	11,017	8,460		" "	McMinds count
	11/26	1.3	2,282	1,755		" "	State count
	12/26	1.3	2,360	1,817		" "	State count
1969	11/26	1.3	1,760	1,352	last wk.		FWS count
	12/10	1.3	1,092	843	in Nov.		" "
1970	1/8	1.3	259	199			FWS count
	2/4	1.3	4	3			" "
	11/3	1.3	218	168			" "
	11/12	1.3	912	700	3rd wk.		" "
	12/1	1.3	455	350	in Nov.		" "
1971	1/5	1.3	14	10			" "

Table 3. Sockey spawning index area counts in Inner Creek from 1962 through 1970.

Inner Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1962	UKN	2.0	680	340			State count
1963	UKN 12/6 12/9	2.0 3.5 1.0	3,224 3,647 262	1,612 1,041 262			State count FWS count FWS count
1964	UKN 11/19	2.0 2.7	4,785 4,538	2,393 1,680			State count FWS count
1965	12/16	2.0	1,158	576			State count
1966	UKN	2.0	5,660	2,830			State count
1967	UKN	2.0	2,141	1,070			FWS count
1968	10/26 11/26 12/26	<2.0 2.0 2.0	3,540 5,645 3,810	 2,822 1,905			McMinds coun State count State count
1969	11/26 12/10 12/23	2.0 2.0 2.0	497 822 829	248 411 415	2nd week in Dec.		FWS count FWS count FWS count
1970	1/8 1/22 2/4 2/12 11/12 12/1 12/17 1/5	2.0 1.0 2.0 2.0 2.0 2.0 2.0 2.0	612 161 136 68 696 924 804 183	306 161 68 34 348 462 402 92	1st week in Dec.		FWS count " " " " " " " " " " " " " "

Table 4. A chonological comparison of the condition factors of progeny from the 1969 broodstock. Condition (K) = $\frac{W}{L^3} \times 10^5$ where (W) is the mean weight of all fish within a two millimeter length group (L).

Length Group in (mm)	5/14/70	6/12/70	9/24/70	10/31/70	3/11/71	3/23/71	4/14/71	4/29/71	5/19/71	5/27/71	6/17/71	7/12/71
26-27									.636	.761		.761
28-29	.410								.680	.696		.495
30-31	.559								.630	.707		.606
32-33	.470								.668	.724		.672
34-35	.757								.640		.832	.676
36-37	.690										.870	.674
38-39	.677										.795	.660
40-41	.633	.530	.512	.560							.820	.713
42-43	.630	.630	.693	.546		.630					.882	.708
44-45	.500	.578	.677	.622	.495	.568	.682				.825	.673
46-47		.615	.680	.545	.500	.606	.624	.576				.706
48-49		.662	.708	.568	.392	.597	.624	.605				.670
50-51	.803	.576	.668	.614	.485	.598	.651	.720	.796			.720
52-53	.855	.546	.717	.612	.517	.577	.650	.576	.738	.739		.718
54-55	.865		.680	.630	.578	.590	.639	.603	.753	.825	.943	.735
56-57	.738		.650	.604	.583	.569	.639	.730	.773	.811	.892	.649
58-59	.792			.616	.578	.582	.616	.568	.632	.854	.923	
60-61	.833			.605	.611	.588	.620	.580	.744		.890	
62-63	.829			.595	.580	.608	.664	.449	.816		.920	.720
64-65	.855			.667	.602	.591	.711	.584	.785		.913	.730
66-67	.820				.616	.517					.900	.766
68-69												.775
70-71												.777
72-73												.774

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT TACOMA

UNITED STATES OF AMERICA, et al., Plaintiffs, vs. STATE OF WASHINGTON, et al., Defendants.	CIVIL NO. 9213 AFFIDAVIT OF JAMES L. HECKMAN

STATE OF OREGON)
) ss.
COUNTY OF MULTNOMAH)

Comes now JAMES L. HECKMAN, being first duly sworn and affirms as follows:

In a deposition taken on April 24, 1973, in the above entitled matter the affiant testified, at pages 94 to 100 of Vol. I of the transcript of said deposition, that he believed his agency had in its files records of the commercial take of steelhead within the boundaries of the Hoh Indian Reservation and that he was not positive whether it had such information for the Quillayute River. The data on the Hoh Reservation was to be submitted as Deposition Exhibit No. 7 and the data for the Quillayute River, if he had it, was to be submitted as Deposition Exhibit No. 9.

Upon further checking of the records of his agency the affiant now states that the agency does not have such data with respect to the Hoh River and does have it with respect to the Quillayute River. Accordingly, the affiant has no data which can be submitted as Deposition Exhibit No. 7. The data which is submitted as Deposition Exhibit No. 9 is forwarded herewith.

With respect to Deposition Exhibit No. 8 the affiant testified, on page 96 of Vol. I of the deposition, concerning records of non-Indian sport catch of steelhead on the Quinault Indian Reservation, "I don't have any actual records, but I have some estimates made several years ago, that I made based upon the number of guides and consultation with those individuals to try to get an estimate of the sportsmen's take within the reservation." I have caused a search to be made of the records of my agency and said search has not uncovered any actual records of these estimates. To the best of my recollection the number of fishermen trips on the Quinault River within the Quinault Indian Reservation for the year in question, which is believed to be about the year 1965 or 1966, was 170.

James L. Heckman
James L. Heckman

Subscribed and sworn to before me this 15th day of June, 1970.

Notary Public for Oregon
My Commission Expires: ~~July 14, 1974~~
June 25, 1976

GPO:1963—O-713-713

AFFIDAVIT

STATE OF OREGON)
) ss
COUNTY OF MULTNOMAH)

JAMES L. HECKMAN, upon oath, deposes and says:

I am a Fisheries Biologist with the Division of Fishery Services, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, United States Department of the Interior, in the position of Manager, Northwest Fisheries Program, headquartered in Olympia, Washington, and with a Branch Office in Vancouver, Washington. I have been employed as a Fisheries Biologist by the Fish and Wildlife Service for 18 years.

The Northwest Fisheries Program covers the area encompassing the State of Washington and the Indian Tribes of Oregon and Idaho who have treaty fishing rights on the Columbia River. The principal function of the Program is to provide assistance to Indian Tribes and the Bureau of Indian Affairs pertaining to the treaty off-reservation fishing rights.

As a part of the Division of Fishery Services the Program provides assistance in fishery management to Indians and managers of Federal lands; and it participates in cooperative programs with various State fisheries agencies, including the States of Washington, Oregon, and Idaho. Programming the production and distribution of National Fish Hatchery fish to these cooperators is an activity of that Division.

Until March of this year I was Associate Regional Supervisor of the Division of Fishery Services, stationed in the Portland, Oregon, Regional Office which covered the activities of the Division over six western states.

I received my B.A. degree from the University of California in 1952. My first position after graduation was as a biologist for the United States Bureau of Reclamation in California in 1952.

I then went to work as a biologist for the Oregon Fish Commission in 1954. In this capacity, I worked in Columbia River investigations of the salmon and steelhead commercial fishery and participated in population studies of Columbia River steelhead.

I came to the Bureau of Sport Fisheries and Wildlife in 1955. With the Bureau, my work has been concentrated on salmon and steelhead, from Central California to Alaska. I have spent considerable time in salmon and steelhead population studies in Northern California and have worked closely with Indian salmon and steelhead fisheries throughout Washington for the past 10 years.

I am a member of the American Fisheries Society and the Pacific Fisheries Biologists. In addition to routine duties of my present position I am Chairman of the White River Fisheries Improvement Committee and a member of the Portland General Electric Company Fishery Project Review Committee.

I have compiled biological and fisheries management data concerning the spring chinook run of the Columbia River. I am personally familiar with the Columbia River and have caused an investigation to be made by employees of the Bureau of Sport Fisheries and Wildlife acting under my supervision and direction and have myself examined records of my agency and the Fish Commission of Oregon and Washington Department of Fisheries. I also have personally conferred with Mr. Burnell Bohn, Fish Commission of Oregon Staff Biologist in charge of Columbia River investigations and heard the statements presented by him at the Public Hearing of the Washington and Oregon regulatory agencies on April 20, 1973, in Portland, Oregon.

Based upon available information concerning Bonneville, The Dalles, John Day and McNary Dams' fish counts and flow conditions during March and April of this year; the information provided by the Fish Commission of Oregon and Washington Department of Fisheries from the Columbia River test fisheries; examination of past records; Mr. Bohn's Hearing report on April 20; and upon personal knowledge and investigation I state, on information and belief, that:

GPO:1971—O-713-713

In 1973 the biological staffs of Oregon and Washington have set a new escapement goal of 40,000 spring chinook salmon past Little Goose Dam. To achieve this, they desire an escapement of 110,000-115,000 fish above all commercial fisheries. This can reasonably be expected to occur if the total count of fish at Bonneville Dam reaches 150,000 to 160,000. The cumulative count at Bonneville Dam as of April 20, 1973, was 83,569 fish. This is the highest count of record on this date since completion of The Dalles Dam in 1959.

The low clear water conditions prevailing in the river are conducive to speedy passage of the fish over the dams above Bonneville. Commencement of this upstream movement is a key phenomenon which must be evident before the state agencies can normally select an opening for the commercial season. Under present conditions, the fish should not hold in the Indian fishing area as would be expected under normally high, often highly turbid water. By April 20, 56 percent of the Bonneville count has passed The Dalles Dam while the average for this during the years 1964-72 is only 38 percent. The average portion of the Bonneville count past McNary by April 20 is 11 percent, and in 1973 is 17 percent. A count of 7,004 fish passed The Dalles Dam on April 20, compared to the Bonneville count for that date of 5,201, further indicates that fish are moving swiftly through the Indian fishing area. Another positive aspect of the unusually low flow conditions which are prevailing this year is that fish mortalities normally resulting from nitrogen supersaturation, caused by large springtime spill discharges at the dams, should be much reduced in the current run.

The following table showing Bonneville counts illustrates the strength of the 1973 run compared to the average for the period 1959-71 and a comparable water flow year (1966) selected by the Fish Commission of Oregon.

GPO 1961—O-713-713

BONNEVILLE DAM COUNTS

	1973		1959-71 Avg.		1966	
	Daily	Total	Daily	Total	Daily	Total
March total		1,585		1,409		2,168
Apr. 1						
1	1,781	3,366	403	1,810	977	3,145
2	2,722	6,088	500	2,212	972	4,117
3	1,758	7.846	500	2,812	511	4,628
4	2,156	10,002	528	3,339	1,286	5,914
5	3,258	13,260	805	4.145	1,198	7,112
6	2,573	15,833	889	5,034	1,020	8,132
7	2,447	18,280	1,206	6,240	2,542	10,674
8	2,306	20,586	1,279	7,520	1,802	12,476
9	3,946	24,532	1,249	8,769	2,624	15,100
10	2,637	27,169	1,326	10,095	1,279	16,379
11	4,924	32,093	1,495	11,590	2,721	19,100
12	4,193	36,286	1,533	13,126	2,638	21,738
13	4,052	40,338	1,710	14,833	2,048	23,786
14	7,288	47,616	1,862	16,695	2,515	26,301
15	8,411	56,027	2,277	18,973	4,029	30,330
16	8,206	64,233	2,499	21,471	6,077	36,407
17	5,601	69,834	2,162	23,633	4,966	41,373
18	3,544	73,378	2,191	25,824	5,029	46,402
19	4,977	78,355	2,368	28,193	5,457	51,859
20	5,201	83,556	2,527	30,719	3,862	55,721

In 1972, the cumulative count at Bonneville Dam was 41,481, on April 20.

Investigation of past counts at Bonneville show that 50 percent of the total number has never passed before April 20. Thus, it can reasonably be expected that at least 167,000 spring chinooks will pass Bonneville Dam in 1973. This is further supported by results of the test fisheries by the Fish Commission of Oregon at Woody Island and Washington Department of Fisheries at Prescott. The 1973 cumulative catch of both test fisheries is at a record high and the individual catches have continued strong through April 18.

In recent years the average catch of spring chinook available to the Indian fishery has been 21 percent. The maximum for the past six years is 23 percent. The state agencies anticipate a record percentage take in the Indian fishery during the current season; however, this is conjectural. Assuming an above-average harvest by the Indian fishery of 25 percent, approximately 42,000 fish will be taken. If the harvest reaches this figure, the escapement should be 125,000, still leaving a safe margin to ensure the newly established escapement goal.

I attended the joint hearing of the Fish Commission of Oregon and the Washington Department of Fisheries held in Portland, Oregon, on April 20, 1973, to consider the opening date of the 1973 Columbia River spring chinook commercial fishing season. Copies of the public notice and agenda of that hearing are attached hereto as Exhibits 1 and 2.

In Mr. Bohn's presentation at the April 20 hearing, he stated in part that the staffs of the management agencies of Washington, Oregon, and Idaho have recently revised and recorded escapement goals for spring chinook salmon from a previous 90,000 fish to 110,000-115,000 upstream from all net fisheries and that the agencies seek to achieve a passage over Bonneville Dam of 150,000-160,000 to allow for a possible Indian catch of 40,000 fish. Mr. Bohn further reported that as of April 19, 1973, the passage over Bonneville Dam was 78,356 fish, the highest on record for this time of year; that the test fishery catches by each of the state agencies were the highest on record; and that, in the

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opinion of the state agencies' staffs, less than 50 percent of the above-Bonneville 1973 run had passed that dam at the present time. Daily passage on April 19 was about 5,000 fish. He further stated that passage levels at the dams above Bonneville was good, and rapid movement through the Indian fishing area was occurring. This, he said, was a result of the present low flow and clear water creating improved passage conditions.

At said hearing, the Department of the Interior presented, on its own behalf and on behalf of the four plaintiff Tribes herein, its recommendations regarding the opening of the Indian fishing season. A copy of the Department's statement as presented is attached hereto as Exhibit 3.

After receiving the staff reports and the statements from the public, the Chairman of the Fish Commission of Oregon recessed the hearing until 1:30 p.m. on April 24. The hearing was recessed without acting on the request of the plaintiff Tribes and the Department of the Interior. The agencies took no action to either approve or reject the request, and made no findings that it was necessary for conservation to continue the prohibition of the Indian treaty fishery after April 22.

I share the concern of the staffs of the interagency commission to establish adequate insurance for the provision of an optimum escapement. However, the evidence of a strong run which will support a commercial fishery is overwhelming.

In my judgment as a biologist, I find no conservation reason to delay an opening for the Indian net fishery beyond this date (April 22), and in fact see a distinct possibility of overescapement and wastage if an early opening does not occur. This is based upon that data and considerations above and with the assurance that controls may yet be employed should it be evident that the spawning escapement may be in jeopardy because of a run size failure or evidence of excessive mortalities which may occur by any means. The controls to ensure escapement are: (1) emergency closure of the Indian net fishery; (2) a delay in the opening of the lower river net fishery; and (3) emergency closure of the fisheries (sport and commercial) in the lower river.

DATED this 21st day of April, 1973.

S/ JAMES L. HECKMAN

SUBSCRIBED AND SWORN TO before me this 21st day of April, 1973.

Notary Public in and for the State of Oregon, residing at

Acknowledged under oath from witness stand by affiant April 21, 1973.

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Exhibit 1

FISH COMMISSION OF OREGON

ESTABLISHED 1878

MEETING NOTICE

FOR IMMEDIATE RELEASE
April 18, 1973

FISHERY AGENCIES TO CONSIDER SPRING CHINOOK RUN

The Fish Commission of Oregon and the Washington Department of Fisheries will hold a joint public hearing April 20 to review information on the spring chinook run now in the Columbia River. The meeting will convene at 1:30 p.m. in the auditorium of the Western Forestry Center. The Center is located in the OMSI-Portland Zoo Complex and is easily accessible via Canyon Road.

Low, clear water has caused an apparently large run of spring chinook to move rapidly through the lower Columbia River. The 69,845 chinook counted over Bonneville Dam through April 17 far exceeds the previous high count of 41,400 on this date in 1966. Test fishing conducted by the Washington and Oregon fishery agencies predicts an early run of above-average size. Catches at both states' testing locations are the highest ever recorded by this date.

Counts of chinook at dams upstream from Bonneville indicate that current water conditions are providing better than average passage to upriver areas. Passage conditions also appear favorable at Willamette Falls with over 1,600 fish passing in the last 3 days. The current count at the Falls is the second highest for this date since counting began in 1946.

If sufficient information is available at the time of the Friday hearing to assure the agencies that a good escapement to upriver areas will be attained, then the joint fishery agencies will consider possible opening dates for the Indian and lower river commercial fisheries.

Exhibit 2

WASHINGTON DEPARTMENT OF FISHERIES - FISH COMMISSION OF OREGON

Forestry Center, 4033 S. W. Canyon Road, Portland, Oregon

April 20, 1973
1:30 p.m.

AGENDA

JOINT HEARING

1. Call to order and preliminary remarks.
2. Consideration of the opening date of the 1973 Columbia River spring chinook commercial fishing season
   a. Staff report
   b. Comments from the floor.
3. Decision by regulatory agencies.
4. Next meeting date: to be announced.

FISH COMMISSION REGULAR MONTHLY MEETING

1. Approval of March 20 meeting minutes.
2. Other business.
3. Adjournment.

FCO 45R

AS DELIVERED

Exhibit 3

Statement of Roy H. Sampsel, Special Assistant to the Secretary, U.S. Department of the Interior, Pacific Northwest Region, as presented by Edward B. Johnson, Staff Assistant, at the Joint Public Hearing of the Fish Commission of Oregon and the Washington Department of Fisheries, Portland, Oregon, April 20, 1973.

Mr. Chairman & Gentlemen of the Commissions:

I am Edward B. Johnson, Staff Assistant, Office of the Secretary of the Interior, headquartered in Portland.

This statement is presented on behalf of the Nez Perce, Yakima, Umatilla, and Warm Springs Tribes and the Department of the Interior.

We met yesterday with representatives of the tribes and biologists from the Fish Commission of Oregon, the Washington Department of Fisheries, and the U.S. Fish and Wildlife Service, who discussed the status of the spring chinook run in the Columbia River system. I want to again express our appreciation for the continuing efforts of the two agencies to consult with the tribes and keep them informed.

On behalf of the four tribes we want you to know we are cognizant of the many problems involved in passage and escapement of spring chinook to the upper river systems and the fact that it is difficult to predict accurately the full nature and extent of these fish runs. The tribes are well aware of the need for conservation--the need to make sure that spawning goals are reached so that there will be a continuing supply of fish.

The four Indian tribes have considered the biologists' proposals and discussed them with the Fish and Wildlife Service biologists assigned to Indian fisheries. Our recommendations have been developed jointly with representatives of the four tribes. We believe that they represent a reasonable approach from the standpoint of the Belloni Decision and other federal court decisions; that Indian fisheries may be regulated only when such regulations are necessary for conservation, and that such regulations must be the least restrictive necessary to protect the fishery.

We have heard from your biologists that in the last four years the Indian catch has averaged 21% of the fish available to them. Based on last year's fishing effort they anticipate an Indian capability of 25% this year. They have advised us that they have increased the escapement goal of fish escaping all commercial fisheries to about 110,000 fish to allow for increased passage difficulties and to fulfill increased hatchery needs in Idaho. They have stated they desire a passage of 150,000/to 160,000 over Bonneville to allow for a possible Indian catch of 40,000.

From the information presented to us yesterday and again today, such fish passage is assured. This is based on the current count of fish ascending Bonneville, plus the test fishery below Bonneville indicating continuing run strength in the lower river. Comparison of 1973 run data with past years' records lends further assurance that we will witness a continuing strong run. Moreover, the low water conditions prevailing this year greatly minimize the nitrogen supersaturation conditions as well as speed the passage through the Indian fishing area.

Records of the timing and magnitude of the spring chinook run indicate that 50% of the run rarely passes Bonneville before late April and never before April 20. The current cumulative count of 78,356 indicates that escapement over Bonneville will well exceed the 150,000 to 160,000 goal established by the Fish Commission staff. Even if the Indian fishery were to commence today and if the Indian catch were at a record level of 25% of Bonneville passage, the upriver escapement goal would be achieved. No conservation reason exists for not opening the Indian fishery on April 22. Opening on that date would not interfere with the extensive downriver sports fishery. If there should be later evidence of a failing run the Commission has the necessary authority and capability of cutting back on both the Indian and the lower river fisheries.

Most of the Indian fishermen have established fishing places, a good many of which are in the Bonneville Pool. Within a very short time after the commercial nets below Bonneville are in the river, the movement of fish upstream passes them by, with virtually no fish getting by the lower river drift nets.

If these Indian people with established net sites in the Bonneville Pool are to have an opportunity at a comparable portion of the fish run, they must have lead time; otherwise they will have only two or three days of good fishing after the season opens.

With lead time, Indians have the opportunity to fish on a larger portion of the spring chinook run that has not been exposed to the intensive downstream fishery. We know that this results in Indians having a better opportunity to catch a fair share of the fish.

We, therefore, propose that the Indian fishery begin at noon, April 22nd, to operate on a five day per week basis. The results of the initial days of this fishery can be evaluated at a hearing next week. In view of the figures given here today we don't believe that a further delay would be consistent with the federal court decision.

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(4b)

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UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

UNITED STATES OF AMERICA, Plaintiff, v. STATE OF OREGON, Defendant, v. THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON: CONFEDERATED TRIBES & BANDS OF THE YAKIMA INDIAN NATION; CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION; and NEZ PERCE TRIBE OF IDAHO, Intervenors.	CIVIL NO. 68-513 MOTION FOR PRELIMINARY INJUNCTION OR TEMPORARY RESTRAINING ORDER

Comes now the United States of America, Plaintiff herein, on its own behalf and on behalf of the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribe & Bands of the Yakima Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe of Idaho, and each of said Intervenor Plaintiff Tribes on its own behalf and move this Court for a temporary restraining order or preliminary injunction in the above entitled cause restraining the Defendant, its agents, servants, employees and attorneys from in any way interfering with said Intervenor's members from fishing after 12:00 noon, April 22, 1973, in waters of the Columbia River or its tributaries between Bonneville Dam and McNary Dam which are not described in Oregon Administrative Rules 625-~~05~~ 30-045 as a closed commercial fishing area.

The grounds in support of this motion are:

(1) Failure of the Defendant and its management agencies to comply with the provisions of the judgment of this Court entered in this cause on October 10, 1969, through its failure to establish:

> " . . . by hearings preliminary to regulation that the specific proposed regulation is both reasonable and necessary for the conservation of the fish resource. In order to be necessary, such regulations must be the least restrictive which can be imposed consistent with assuring the necessary escapement of fish for conservation purposes; the burden of establishing such facts is on the state."

(2) Affidavit of James L. Heckman attached to this Motion.

DATED: April 21, 1973

Respectfully submitted,

SIDNEY I. LEZAK
United States Attorney
District of Oregon

George D. Dysart

GEORGE D. DYSART
Assistant Regional Solicitor
Department of the Interior
Of Counsel for the United States

The Confederated Tribes of the Warm Springs Reservation of Oregon

James B. Hovis

JAMES B. HOVIS, Attorney for the Confederated Tribes & Bands of the Yakima Indian Nation

ROBERT C. STROM, Attorney for the Nez Perce Tribe of Idaho

SIDNEY I. LEZAK
United States Attorney
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For the Confederated Tribes of the Umatilla Indian Reservation.

GPO : 1963—O-713-713

4c

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UNITED STATES DISTRICT COURT

DISTRICT OF OREGON

UNITED STATES OF AMERICA,

Plaintiff,

vs.

STATE OF OREGON,

Defendant,

vs.

THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON; CONFEDERATED TRIBES & BANDS OF THE YAKIMA INDIAN NATION; CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION; and NEZ PERCE TRIBE OF IDAHO,

Intervenors.

CIVIL NO. 68-513

INJUNCTION

The above-entitled matter came on for hearing on the 21st day of April, 1973.

The State of Oregon, being represented through Assistant Attorney General Raymond P. Underwood on behalf of the Defendant, and the Plaintiffs, being represented by their counsel, and notice having been given to the Defendant, and the Court having considered affidavits, evidence, arguments and statements, it is ordered that the Defendant, its servants, agents, officials and employees are enjoined from interferring with the fishing activities of members of the Plaintiff Tribes in waters of the Columbia River or its tributaries between Bonneville Dam and McNary Dam which are not described in Oregon Administrative

Rule 625-50-045 as a closed commercial fishing area until the appropriate State Regulatory Agency makes a finding that the specific restriction is necessary for the conservation of the fish resource.

Dated this 21 day of April, 1973.

UNITED STATES DISTRICT JUDGE

Presented by

Exhibit 5

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ARNIE J. SUOMELA, COMMISSIONER

NORTHWESTERN CALIFORNIA

A PRELIMINARY SURVEY OF FISH AND WILDLIFE RESOURCES

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ARNIE J. SUOMELA, COMMISSIONER

A PRELIMINARY SURVEY

OF

FISH AND WILDLIFE RESOURCES

OF

NORTHWESTERN CALIFORNIA

Portland, Oregon
October 1960

Northwestern California consists of abundant forests with extensive areas of wilderness. A variety of fish and wildlife habitat occurs from the mountainous divides to the Pacific Ocean. View of Trinity Alps from Canyon Creek, a tributary of Trinity River.

REPORT OF THE REGIONAL DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

1001 N. E. LLOYD BLVD.
P. O. BOX 3737
PORTLAND 8, OREGON

ADDRESS ONLY THE
REGIONAL DIRECTOR

PACIFIC REGION
(REGION 1)
CALIFORNIA
IDAHO
MONTANA
NEVADA
OREGON
WASHINGTON

October 20, 1960

Memorandum

To: Chairman, Pacific Southwest Field Committee, Department of the Interior, Salt Lake City, Utah

From: Regional Director, Bureau of Sport Fisheries and Wildlife, Portland, Oregon

Subject: Fish and Wildlife Resources, Northwestern California (1-RB)

This is our survey report on fish and wildlife resources of Northwestern California. It has been prepared at the request of the Secretary of the Interior in accordance with the Fish and Wildlife Coordination Act, (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The attached substantiating report gives emphasis to the fish and wildlife resources as they exist today in Northwestern California. Many problems which presently limit fish and wildlife production and utilization or may limit it in the future are summarized. The report considers the possibilities of improving conditions and of compensating for losses which have been caused by past developments and which may be caused by those of the future.

This report has been reviewed by the California Department of Fish and Game. The report has been endorsed by that department as indicated in a letter from Deputy Director Harry Anderson, dated September 19, 1960, a copy of which is appended to the attached substantiating report.

Northwestern California is an extensive semiprimitive region of more than 13,000 square miles of forested, mountainous terrain which contains several thousand miles of streams and a great variety of fish and wildlife habitat. More than 90 percent of the region is forested, over half of which is administered by the U. S. Forest Service. More than 600,000 acres of National Forest land are devoted to wilderness areas. The region is surrounded by areas which are experiencing rapid increases in population.

Utilization of this region for recreational purposes has shown a marked increase in the past ten years, and growth of urban populations and development of better highways indicate an even greater increase for recreation in the future. The area has a high potential for meeting much of the increasing demand for fishing and hunting. Consequently, planning for fish and wildlife should be made an integral part of future industrial and water development. Fish and wildlife resources of Northwestern California are not only of great value to the area under consideration but also to the entire State and to areas outside California.

Conservation and development of the salmon and steelhead trout fisheries in coastal streams are of prime importance. These fish are migratory and depend on passage to and from their native spawning habitat for continued existence. They need clear, cool waters, abundant gravel areas, and unobstructed migration routes. These needs must be met to insure perpetuation of the resource and fulfillment of future demands for fishing.

Census studies indicate that approximately 160,000 chinook salmon, 56,000 coho salmon, and 580,000 steelhead trout return annually to Northwestern California streams from the ocean. These fish form the basis of an important sport fishery in the area which accounts for more than 300,000 fisherman-days-use and an annual sport catch of about 350,000 fish. This represents an annual expenditure by fishermen of more than $5,000,000. Salmon also serve as the basis of important sport and commercial fisheries in the offshore ocean waters. Annual commercial catches amount to more than 2,000,000 pounds.

Big game, upland game, fur animals, and waterfowl are widely distributed throughout Northwestern California in moderate to high numbers. Estuarine and offshore areas are valuable for both fish and wildlife.

Black-tailed deer are common throughout the area. They are currently subjected to moderate hunting pressure but will be increasingly sought by sportsmen from growing urban centers. Elk, occurring in small numbers in parts of the Prairie-Maple Creek drainages and adjacent areas, have not been hunted in recent years. Historically, elk were widespread in Northwestern California and reestablishment in the more remote parts of this region appears to offer some possibility. However, attempts at stocking and dispersal of this species by California Department of Fish and Game have been only partially successful. Black bears are common in Trinity, Humboldt, and Siskiyou Counties.

California and mountain quails are common throughout the area. The former inhabit the floodplains and deltas of all the drainages where agriculture is practiced, while the latter occur at higher elevations and show a preference for brushy cover along streams, cut-over land, and the edges of clearings in timbered areas. Band-tailed pigeons provide good hunting throughout the area. About 5,000 of these birds are harvested annually in Humboldt County alone. Mourning doves are also abundant but are subjected to much lighter hunting pressure. Other upland game species in the area are hunted lightly and include gray squirrels, brush rabbits, and snowshoe hares.

Northwestern California supports a variety of fur animals. Minks, river otters, and beavers are the most important of the group and are common throughout the numerous drainages. Muskrats inhabit the marshes near Crescent City. Fur animals are lightly harvested due to the low market demand for fur. Other fur animals of the area are raccoons, weasels, skunks, ringtail cats, gray foxes, and bobcats.

Numerous bays and estuaries attract a variety of waterfowl during the winter. A mode[illegible] number of mallards, cinnamon teal, and wood ducks nest along the streams and sloughs. Humboldt Bay is an important wintering area for black brants. In recent years as many as 25,000 to 50,000 of these birds have been counted in the bay. This goose is peculiarly dependent upon the large beds of eel grass found in South Humboldt Bay for food. Brants are eagerly sought by local sportsmen who kill more than 3,000 geese annually in Humboldt Bay. Castle Island offshore from Crescent City is frequented by the Western Canada goose and represents the southern limit of the winter range for this subspecies.

The substantiating report is intended to provide information on fish and wildlife needs to agencies planning water, industrial, and civic developments in Northwestern California. If these needs are to be met, contemplated water development plans should include measures for conservation and development of fish and wildlife resources including specific proposals for accomplishing the following:

1. Prevention of destruction of fish and wildlife habitat caused by gravel removal, mining activities, highway construction, logging activities, flood control measures, and harbor development.

2. Maintenance of adequate streamflow for the needs of fish and wildlife.

3. Prevention and abatement of pollution in streams and estuarine areas.

4. Establishment of a management area in a portion of Humboldt Bay for protection and improvement of habitat utilized by black brant.

5. Improvement of public access for hunting and fishing areas.

Keith Forsythe

SUBSTANTIATING REPORT

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PREFACE

This report is a preliminary survey of the fish and wildlife resources of Northwestern California. It supplements and brings together existing knowledge of the fish and wildlife resources of the region.

In 1952, the Pacific Southwest Field Committee of the Department of the Interior initiated an over-all survey of the natural resources of this coastal area with the objective of presenting a unified report. Early in 1954, the U. S. Department of the Interior gave recognition to the need for a study of the fish and wildlife resources of Northwestern California. The need for this presentation was apparent because of rapid and imminent development of the area. Seven agencies of the Department of the Interior subsequently undertook assignments for completion of various facets of the report. This report is the contribution by the Bureau of Sport Fisheries and Wildlife of the United States Fish and Wildlife Service to the comprehensive study.

Previous Fish and Wildlife Service reports on river basin development for Northwestern California have been: "Branscomb Reservoir, South Fork Eel, California," 1950; "Trinity River Division, Central Valley Project, California," 1951. Both of these reports on specific areas were preliminary evaluation reports on the fish and wildlife resources. In 1956 a joint report was prepared by the Service and the California Department of Fish and Game entitled "A Plan for the Protection and Maintenance of the Fish and Wildlife Resources Affected by the Trinity River Division, Central Valley Project." In January 1957 the Service prepared for administrative purposes a report entitled "Progress Report on Fish and Wildlife Resources of the North Coast, California."

The purposes of this report are threefold: (1) to summarize pertinent information on fish and wildlife resources; (2) to supplement the existing knowledge, particularly of the fisheries, by summarizing recent investigations; (3) to make a general analysis of the existing needs of fish and wildlife resources and their needs in relation to proposed and potential development of the area.

In January 1954, a fish and wildlife steering committee was formed. The committee included representatives of the U. S. Fish and Wildlife Service, U. S. Bureau of Reclamation, California Department of Fish and Game, and California Division of Water Resources. The function of this committee has been to establish the general objectives of the fish and wildlife investigations.

The Bureau of Reclamation, the California Department of Fish and Game, and the California Water Resources Board and its successor, the Department of Water Resources, have participated in activities of the fish and wildlife steering committee and cooperated in supplying valuable information and suggestions. Other agencies contributing significantly to information contained in the report or used as the basis for conclusions have been the California Division of Beaches and Parks, the U. S. Forest Service, the Division of Natural Resources of Humboldt State College, U. S. Geological Survey, National Park Service, and numerous other agencies and individuals. Indians of the Hoopa Reservation and Extension have supplied valuable information on fish and wildlife resources.

DESCRIPTION OF THE AREA

Physical Features

The area under consideration comprises about 13,200 square miles, all in Northwestern California except for some minor tributaries which drain the southern fringes of Oregon. This area includes the Klamath River drainage below Copco Dam, near the Oregon-California state line. It extends approximately 200 miles along the Pacific Coast, and 60 to 90 miles inland. All of Del Norte, Humboldt, and Trinity, about half of Siskiyou and Mendocino, and small portions of Lake and Glenn Counties, California are within the area. Small portions of Curry, Jackson, and Klamath Counties, Oregon form the upper reaches of some of the watersheds.

Most of the region is mountainous with many peaks reaching an elevation of 6,000 feet. Maximum elevation, 14,161 feet, is attained at Mt. Shasta on the eastern divide. Principal mountain ranges in the region include the Coast Range on the south and southwest, the Cascade Range on the northeast in Oregon and California, and the Klamath Mountains in northwestern California and southwestern Oregon. Other important mountain groups include the Siskiyou Mountains in Oregon and California; the Yolla Bolly Mountains in the Coast Range; and the Marble, Scott Bar, and Scott Mountains and Trinity Alps lying between the Cascade and Coast Ranges.

Principal streams of the region include the Smith, Klamath, Mad, Eel, and Mattole Rivers and Redwood Creek. More than half of the region of concern is drained by the Klamath River and its major tributaries including the Shasta, Scott, Salmon, and Trinity Rivers. The drainage basins of Lost River and Lower Klamath Lake, outside the study area, are virtually non-contributing to the Klamath River flow because of the use and loss of water in such areas. The drainages of the Coast Range generally occur at much lower elevations and, as a consequence, there are differences in runoff and water temperature as compared to those drainages of the higher, more extensive Klamath Mountains.

Northwestern California terrain is mostly rugged and mountainous. Small areas of valley land exist in the lowermost portions of the basins and are scattered along the drainages in the interior such as Round, Butler and Hoopa Valleys. About 93 percent of the area is forested.

More than 50 percent of Northwestern California is included in Six Rivers, Klamath, Trinity, Mendocino, and small portions of Siskiyou and Rogue River National Forests. There are three wilderness areas: Marble Mountain (214,543 acres), Salmon-Trinity (285,432 acres), and Yolla Bolly (111,091 acres). Public domain accounts for 170,000 acres and Indian land 126,000 acres. State parks and redwood groves include about 56,000 acres. Privately owned lands, located principally in Humboldt and Mendocino Counties, comprise less than half of the entire area.

The Cascade Range consists of volcanic rocks of the Tertiary and Quaternary ages. Principal mineral deposits of the latter are found as lode deposits in intrusive rock or as deposits formed by stream concentration of lode materials. The Northern Coast Range is underlain by rocks that are sedimentary or volcanic in origin. Younger rocks overlie these in some areas. Early Pleistocene lake sediments and valley fill occur in small patches in some of the valley lands of the Eel River.

Arable soils of Northwestern California consist of recent alluvial deposits, those derived from coastal plain and old valley filling materials, and wind deposited soils. The alluvial soils are the most valuable for agricultural development and are found in the lower valleys of the Mad, Eel, Smith, and Trinity Rivers and in the valleys located along the upper tributaries. These soils are further classified as to their textures and ease of drainage. Those occupying highest positions on the alluvial fan are well-drained soils and suitable for farming. Those soils occurring in the lower alluvial fan are poorly drained with clay loams predominating in texture. Wind-deposited soils, occurring only near the coast, are also poorly drained and have limited agricultural use. Coastal plain and old valley fill soils are derived from water-laid deposits which have undergone modification and weathering. They are found in a series of terraces which are marine in origin. Some of the better soils are covered by heavy stands of timber, largely redwoods and firs. These soils comprise the more extensive arable soils in the area occurring from Table Bluff to Trinidad, Crescent City to Smith River, and in the lower Eel and Van Duzen River areas.

Temperatures along the coastal portion of Northwestern California are mild and equable. The July average temperature in Eureka, which typifies areas adjacent to the ocean, is about 56° F., and January the coldest month, averages only 9° F. less, although extremes are much greater. Temperatures along the coast seldom get above 70° F. in the summer or below freezing in the winter. A great amount of fog occurs along the coast, particularly in the summer months. Further inland, where the maritime influence decreases and altitude increases, summers are much warmer and winters much colder. At Weaverville, 90 miles east of Eureka, the July average is 71° F. with summer highs frequently about 90° F. and sometimes above 100° F. The growing season at Weaverville is only 97 days, in contrast to 245 days in the Eureka area.

Storms move inland from the Pacific Ocean, resulting in high precipitation in the winter months. The wet period extends from November to June but highest precipitation occurs during December and January. During the summer, precipitation is light. Smith River basin has an average annual precipitation of about 100 inches. The Klamath River basin has about 90 inches near the coast and has the greatest variation inland of any of the coastal drainages. Annual precipitation in much of Shasta River basin, which is tributary to Klamath River, is only 20 inches. However, the remainder of Northwestern California has abundant precipitation, ranging from annual averages of 40 to 90 inches. Along the coastal region snowfall is meager. Inland, at the higher elevations, particularly above 4,000 feet, snowfall is much greater.

High rainfall contributes to a lush growth of vegetation throughout the area. A combination of the equable climatic conditions and fog along the coast provides the requirements for the renowned redwood forests. Undergrowth is dense and shrubs rapidly appear in areas that have been cut or burned.

Six major streams and several smaller ones are covered in the discussions of fish and wildlife resources that follow. Descriptions of the stream-flow and existing water developments are included in the fishery discussions. The cover, topography, climate, and other pertinent features of the main basins are described briefly in succeeding paragraphs.

Smith River

The Smith River watershed is largely forest-covered. Except for the lowermost narrow coastal plain, it drains large areas of virgin timber in Six Rivers National Forest in California. The reach of the North Fork within Oregon is located in the Siskiyou National Forest. The uppermost reaches and crest portions, reaching elevations of more than 5,000 feet, receive moderate amounts of snowfall in the winter. The main stream, arising on the forested westward slopes of the Siskiyou Mountains, follows a northwest course after joining the North and South Forks, and flows into the Pacific Ocean about four miles south of the Oregon-California state boundary. Smith River drainage receives the highest rainfall of any of the coastal streams, with the annual average precipitation exceeding 90 inches over most of the watershed.

Klamath River

The Klamath River watershed is extensively forested and large areas contain stands of virgin timber. Most of the drainage lies within the Six Rivers, Klamath, Shasta, and Trinity National Forests. The Marble Mountain Wilderness Area, containing 214,000 acres of remote mountainous area, which is drained by tributaries of the Salmon, Scott, and Klamath Rivers, is located in the Klamath National Forest. The Salmon-Trinity Alps Wilderness Area, consisting of 285,000 acres of the spectacular Salmon and Trinity Alps, is situated within the Trinity National Forest. In this primitive area arise New River, North Fork Coffee Creek, and smaller tributaries of Trinity River.

Downstream from Copco Lake, the Klamath River flows westward and is joined on its left bank by the Shasta and Scott Rivers and then turns rather abruptly southward and is joined by the Salmon and Trinity Rivers. After its confluence with Trinity River, it changes its course and flows northwestward and empties into the Pacific Ocean near Requa, California. Throughout most of its course, Klamath River and its tributaries drain forested, deeply cut, mountainous terrain with only the valleys of the Shasta, Scott, and Trinity Rivers providing appreciable amounts of land suitable for agriculture.

The higher elevations of the Klamath Mountains occur at the headwaters of Trinity River. Peaks with elevations of over 9,000 feet are found in the Trinity Alps and the Scott Mountains. Mt. Shasta, rising to 14,161 feet, borders the eastern upper limits of Shasta River. Numerous peaks and ridges of 5,000 feet or more in elevation occur in many portions of the drainage.

Rainfall is exceedingly variable in this basin. Near the coast the annual average is 90 inches. Inland about 25 miles, the average decreases to 50 inches. Further inland, the average is reduced to less than 40 inches over large portions of the watersheds of Shasta and Scott Rivers. Lower Shasta River Valley has an average of less than 15 inches. High ridges and peaks, receive 50 to 70 inches of precipitation.

Redwood Creek

Redwood Creek drainage, with minor exceptions, consists of privately owned forest lands. It falls largely within the Coast Redwood Belt. Most of the slopes are forested with redwood and fir. Elevations of the basin range up to 5,000 feet.

Average annual rainfall for the entire basin is about 67 inches. The seasonal rainfall occurs during November through March with very little precipitation during June through September. Stream flows are distinctly dependent upon the pattern of precipitation.

Mad River

Upper Mad River watershed is within the Six Rivers National Forest, whereas about the lower two-thirds is in private holdings with the exception of a small State park and public roads. This drainage has been actively logged for many years and the lower portions are being cleared and converted to pasture for cattle and sheep. Highest peaks rise to 6,000 feet, but most of the drainage lies at 2,500 feet or less. Annual average rainfall for the basin is 62 inches, but only about 50 inches in the coastal portion.

Historically, placer mining for gold has occurred along the channel, but mining is no longer active.

Eel River

Eel River arises in the interior portions of the Coast Range. It flows in a northwesterly direction, joining the Middle Fork at Dos Rios, 113 miles above its mouth. It then joins the South Fork about 40 miles above the tidewaters and Van Duzen River 14 miles above the mouth. The Middle Fork drains Etsel Ridge with elevations as high as 5,500 feet and Shell Mountain and Anthony Peak which approach 7,000 feet. Headwaters of the Middle Fork are in the western portion of the Yolla Bolly Wilderness Area. Most extensive valley lands of Northwestern California are found in the delta plain extending downstream from Rio Dell to the stream mouth. Interior valley lands of some significance are Laytonville Valley on the South Fork and Round Valley in the Middle Fork drainage.

The headwater portions of Eel, Middle Fork Eel, North Fork Eel, and Van Duzen Rivers are within Six Rivers and Mendocino National Forests. A significant acreage of public domain land and Indian land is located in Round Valley. The world-famous redwood groves are located in four State parks along the Redwood Highway (U. S. 101), which parallels the South Fork Eel. These parks comprise a total of 24,000 acres.

Grizzly State Park, another redwood grove with camping sites, is located adjacent to Van Duzen River. Privately owned lands make up most of the remainder of the drainage.

Average annual rainfall for the basin varies from about 40 inches along the coast to 70 inches in the upper South Fork. Far inland, areas of the Middle Fork and upper Eel River receive an average of 50 to 60 inches. Rainfall is seasonal, and heavy precipitation begins in October and increases to a maximum in December and then gradually decreases to a low in June, July and August.

Mattole River

The Mattole River drainage area is slightly larger than that of Redwood Creek, the smallest of the six principal streams given individual consideration.. Rugged ridges of the coastal range, with the peaks ranging up to 4,000 feet, separate the main stream from the ocean. Crest elevation seldom exceeds 2,500 feet. The drainage is extensively forested except for the slopes adjacent to the coastline, several small farm tracts scattered along the main stream, and lower portions of the drainage which are mostly in pasture.

Average annual rainfall for this basin ranges from about 60 to 90 inches, with the central part receiving the most. Rainfall is seasonal, with high precipitation occurring in late fall and winter. Snowfall has little effect upon spring runoff.

Economic Features

The most important industry of Northwestern California is lumbering. It accounts for 70 percent of all employment. More than 300 sawmills and numerous processing plants are distributed over the area. Agriculture, including livestock production and dairy farming, is another important basic industry. Recent appraisal of existing arable flat lands shows 132,000 acres with about 22,500 acres presently irrigated. Most of this land and about 300,000 additional acres of unforested lands are used for pasture.

Historically, mining was a much more important industry than at present. Extensive placer gold extraction was practiced along the Trinity River and other streams through the first quarter of this century. Sand and gravel mining comprises the mainstay of the present-day industry. Commercial and sport fishing rank high in importance to the area. Sport fishing and hunting are in many instances tied to other recreational pursuits such as the tourist attraction of the redwoods, other forests, State parks, and primitive mountainous areas.

Economically, the recreational industry of Northwestern California is second only to lumbering. Although other sources of income in Northwestern California have been reduced, expenditures for recreation, of which hunting and fishing are important components, are expected to show accelerated growth. The notable salmon and steelhead fishery would be subjected to greatly increased pressure during the peak of the tourist season and during the off-season periods. This area of more than 13,000 square miles of forested, mountainous terrain, with several thousand miles of fishing streams, offers great potential for meeting much of the fishing and hunting needs in future years.

The population of Northwestern California is relatively sparse. Based on estimates by the California Department of Finance, the total population in 1955 was 132,500. This shows an increase of 38,000, or 40 percent since the 1950 United States census. Most of the population was designated as rural with about one-third being urban. The largest towns and greatest density of population are near Humboldt Bay. The Eureka-Arcata area accounts for most of the urban population. The rural population is widely scattered along the rivers and coastal fringe.

It is estimated that in 1955 the area received about 600,000 visitors who spent more than 4,000,000 days in the area. Interviews by the Forest Service and by the State Division of Parks have revealed that a high percentage of these persons list fishing as a first purpose for visiting the area.

Sport fishing for salmon, steelhead trout, and resident trout ranks high in its attraction to visitors. Current studies show that more than 300,000 fisherman-days are annually spent on the north coastal streams.

With scheduled improvement in the principal north-south U. S. Highway 101 and other roads and great increases in California's urban population, future visitation to this area is expected to be even more marked. Northwestern California is in a position to meet many of the increased demands on fishing and hunting if favorable consideration is given to fish and wildlife resources in water development projects.

The area is served by a highway system, a railroad, and airlines. Redwood Highway (U.S. 101) is the principal north-south route, paralleling the coast north of Humboldt Bay. The highway leaves the coast south of Eureka and follows the South Fork of the Eel River. Paralleling the South Fork Eel River for 90 miles, Redwood Highway receives heavy traffic because of the attraction of numerous redwood groves and the proximity of tourist facilities. Travel from the north and south has almost doubled in the past ten years.

State or county roads give ready access to the lower Van Duzen and upper Eel Rivers and other points in the basin. Many towns of moderate size have grown in the delta plains. Eel River and tributaries are provided with better access than other drainages of Northwestern California.

U. S. Highway 299 serves both coastal and inland California, and U. S. Highway 199 connects the northern portion of the area with the interior of Oregon. State and county roads generally parallel streams and the remaining coastline and provide the numerous small towns and villages with access to main highway routes.

Northwestern Pacific Railroad connects Northwestern California with San Francisco by way of Santa Rosa. The main service is for transport of lumber products. A limited passenger service is provided from

Willits to Eureka. Pacific Air Lines serves the north coast area at Arcata. Connections are provided to San Francisco and Sacramento, California and Portland, Oregon. Several seaports, notably Humboldt Bay and Crescent City, provide dock facilities for ocean-going freight and fishing vessels.

FISHERY SECTION

General

The Fishes

Anadromous fish are an outstanding fishery resource in this north coastal area. Species of greatest importance, occurring in all of the more important streams, are chinook salmon, coho salmon, and steelhead trout. These fish form the basis for important sport fisheries in the streams of the area. Salmon are of first importance to the commercial and growing sport fishery in the ocean. The sea-run cutthroat trout also uses the ocean and freshwater during various stages of its life cycle and is of importance to the sport fishery in the northernmost streams. Sturgeons, shad, eulachon, long-finned smelt, and Pacific lampreys are also anadromous, returning principally to the Klamath and Eel Rivers. They contribute to small, yet distinctive, fisheries. Fishing for sturgeon is apparently of increasing interest on the main Klamath River in the vicility of Orleans and elsewhere. Resident fishes support important fisheries in some streams and lakes, but are restricted in their distribution in the region. For convenience they are described only under the sport fishery headings, below.

Life Cycles of Anadromous Fishes

The life cycles of salmon and steelhead trout are similar in many ways. Adult fish return from the ocean waters to the streams of their origin to spawn. Selection of sites and preparation of redds is accomplished by the females. After the eggs are deposited and fertilized, they are covered by gravel in the redds. Pacific salmon die after the completion of spawning. Steelhead trout may live to return to the ocean and subsequently spawn again in fresh water, although many succumb to the rigors of migration and spawning. After the young have hatched and emerged from the gravel they remain for varying lengths of time in the stream. Young chinook salmon generally move oceanward soon after hatching with a variable amount of delay, particularly in the estuarine waters. Some young chinook salmon may remain for a year in fresh water but the number is thought to be insignificant. Almost all young coho salmon remain in fresh water about one year after hatching and migrate to stream estuaries or the ocean when about four to five inches in length. Young steelhead trout remain in fresh water for varying periods with a majority staying in fresh water for one or two years and a few may remain for three years.

The stages of the life cycle spent in fresh water are exacting in their requirements. Passage to spawning gravel must be permitted and proper flow, temperature, and water quality must prevail through the period of emergence of the young fish. Whereas most young chinook salmon migrate toward the ocean soon after spawning, the majority of coho salmon and steelhead trout are dependent upon suitable year-round stream conditions if they are to mature and contribute to future runs and the important ocean and stream sport fisheries.

Populations of Anadromous Fishes

Studies were conducted on Eel River for a four-year period (1955-1958) to gain an understanding of the anadromous fish population of this stream (figures 1, 2). Knowledge gained was used in determining a population estimate for Eel River and for supporting population estimates made on other streams. A one-year study on the Klamath River and information already available for the Trinity River and at counting stations were valuable in determining the approximate population of this stream and for comparison with other streams. A summary of estimates is presented in table 1. This summary pertains to the study of recent years and is not indicative of the much larger runs of prior years. Recent trends in fish populations indicate a progressive decline. The populations and production of ocean-run species in these streams are impressive. Most coho salmon and steelhead trout populations of California are located in these north coastal streams. The number of chinook salmon originating from these waters is comparable to the number originating in the Sacramento River, the principal California producer outside of these north coastal streams.

Table 1. Estimates of Average Annual Salmon and Steelhead Trout Populations in Rivers of Northwestern California.

Drainage	Chinook Salmon	Coho Salmon	Steelhead 1/
Smith River	15,000	5,000	30,000
Klamath River	100,000	20,000	400,000
Redwood Creek	5,000	2,000	10,000
Mad River	5,000	2,000	6,000
Eel River	25,000	15,000	100,000
Mattole River	5,000	2,000	12,000
Other Smaller North Coastal Streams (Little R., Maple Cr., etc.)	4,000	10,000	25,000
Total	159,000	56,000	583,000

1/ These estimates include the so-called "half-pounders."

Spawning Habitat

One of the most important links in the life cycle of salmon and steelhead trout is the successful spawning of the adults. To achieve success, spawning runs of sufficient size must reach suitable spawning habitat where young fish may hatch and grow until they migrate to the ocean. Plans for dam development and water diversions are numerous for Northwestern California streams. Many streams would be blocked, inundated, and possibly dewatered by developments. It is considered essential in planning for the salmon and steelhead trout resources that preservation of existing spawning grounds be given every consideration.

Spawning bed surveys were made for all of the important streams of the area. Some of the studies involved assessment on the basis of assumed criteria such as velocity, stream depth, gravel composition, accessibility, and other factors considered important for production.

Other studies were based upon observations of redds and of salmon carcasses along streams following the peak spawning periods. Redds were measured to find the average nest area utilized by salmon in these north coastal streams and the average was then used to determine the total number of redds which could be accommodated in these various streams.

A summary of spawning gravels used by chinook salmon in recent years of this study is presented on plate II.

Based on stream surveys, it was estimated that all streams of Northwestern California could accommodate about 340,000 chinook salmon redds Spawning gravel for coho salmon and steelhead trout is widespread, with steelhead trout choosing the smaller streams and tributaries and coho salmon choosing these as well as areas used by chinook salmon. It is estimated that about 230,000 coho salmon redds and almost 800,000 steelhead trout redds could be accommodated in the numerous streams.

The Fisheries of Individual Streams

Smith River

Smith River drains about 720 square miles of rugged, mountainous terrain located in the northwestern corner of the area, confined largely to Del Norte County, California.

Smith River, with its two main tributaries, has one of the most dependable flows of the several coastal streams of the study area.

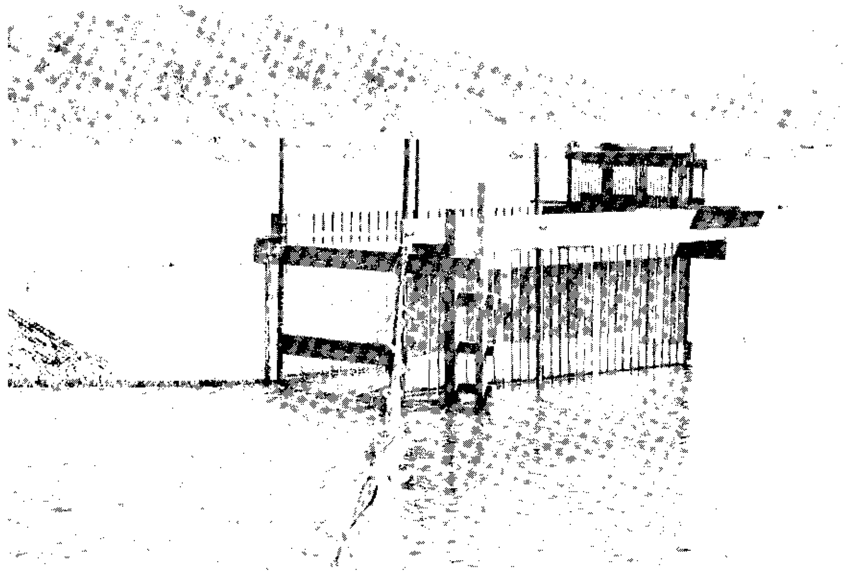


Fig. 1. Large runs of salmon and steelhead trout enter Eel River in the fall to spawn. The above-type weir was used to trap ocean-run fish for population studies.

Fig. 2. Chinook salmon are of outstanding importance to Eel River fishery. This chinook and others were caught and tagged during a study to determine the size of spawning runs.

Forested slopes and geological characteristics provide for numerous springs and apparently account for prolonged flow even during summer and fall periods of little rainfall. Lowest seasonal flow extends from July through September. The minimum mean monthly flow recorded at Crescent City near the stream mouth is about 300 second-feet. Daily mean flow has seldom been less than 200 second-feet. The flow does not become low enough to prevent anadromous fish from entering the river. High stream flow rapidly follows high rainfall which typically begins during the latter part of October and continues to the end of March. The main stream and tributaries become turbid following frequent heavy rains but become clear within a few days after rainfall ceases.

There are no significant water development projects within this drainage. A small power diversion dam is located near the mouth of Patrick Creek, tributary of the Middle Fork Smith River.

Anadromous Fishes of Smith River. The Smith River commercial salmon fishery supported a local cannery beginning in 1878. Annual packs as high as 6,950 cases of chinook salmon and 3,000 cases of coho salmon were recorded during the first quarter of the century. Today, the river still accommodates important spawning runs of salmon, steelhead trout, and cutthroat trout. Smith River is third in importance among streams of the area in the contribution of these species to the sport and commercial fisheries.

Population estimates of the salmon and steelhead runs in Smith River were made by examining data collected in creel censuses, spawning ground surveys, and by comparison with the Eel River where detailed studies were made. Estimates give consideration to the stable flow and year-round habitat of this stream.

While only a fragment of the once important spring chinook salmon run remains, the fall run is estimated to number 15,000. Fish in the fall run begin entering the river in mid September, but the heaviest migration occurs in October. Peak spawning activity occurs through November and December in all major branches of the system. Smith River chinook salmon are noted for their large size in comparison to those caught in other California streams.

About 5,000 coho salmon are estimated to enter Smith River on their spawning migration in November and December. Spawning occurs from November to January. The sustained flow of Smith River provides optimum conditions for the growth and survival of juvenile coho salmon, steelhead trout, and cutthroat trout.

Smith River accommodates an estimated run of about 30,000 steelhead trout. Some steelhead trout migrate up the river all year, although peak spawning migration occurs during winter wet season. These fish are widely distributed throughout the system during their spawning activity in the early spring.

Smith River is the most important sea-run cutthroat trout stream in California. Most of these fish enter the river in September and

October and spawn in the late winter or early spring. Cutthroat trout spawn throughout the entire drainage in small tributaries often inaccessible to other anadromous species.

Fish Habitat of Smith River. Spawning areas accessible to anadromous fish runs occur in all of the tributaries as well as the main stem of Smith River. The major tributaries, which include the North, South, and Middle Forks, flow through deep rocky canyons. Usable spawning gravel is not abundant in these tributaries although well-distributed, long, deep pools provide excellent cover and resting habitat for adult salmon and steelhead trout. Gravel in the spawning riffles is predominantly large, interspersed with boulders.

The main stem of Smith River has broad flat riffles consisting mostly of small and medium gravel in the lower reaches. The upper section, above the Mill Creek confluence, has extensive bedrock exposed in the streambed with a scarcity of riffle areas. Rowdy and Mill Creeks are important spawning tributaries.

It is estimated that sufficient suitable spawning area exists to accommodate at least 22,500 chinook salmon nests in the total drainage. More than 73 percent of the riffles available for chinook salmon spawning are located in the main stem. The remaining riffles are located in the major tributaries. This includes 11 percent in the North Fork, 8 percent in the South Fork, and 8 percent in the Middle Fork. Several minor tributaries are heavily utilized by spawning chinook salmon. Most of the larger tributaries have bottoms with a preponderance of boulders and large size gravel but still accommodate many spawning chinook salmon. The general distribution of available spawning area in Smith River drainage, based on existing chinook salmon redds is shown on plate II.

Several tributaries with suitable sized gravel are heavily utilized for spawning by coho salmon. It is estimated that more than 10,000 pairs of coho salmon could be simultaneously accommodated in this drainage. Steelhead trout find adequate spawning habitat in accessible headwater areas throughout the drainage. The present spawning runs number about 30,000 steelhead trout. Probably double this number could spawn in this drainage.

Barriers consist mainly of falls or cascades. Blocks formed by logging debris have not been as serious a problem in this system as in some other Northwestern California streams. This stream is characterized by a relatively high, stable flow during the late summer months when flows in other streams are usually low. Mining activity is minor and siltation is low.

High summer water temperatures during August 1957 in the lower stream sections varied from 67° to 72° F. for a period of 19 days. Water temperatures of the upper reaches ranged in the low 80's during the summer. Winter temperatures fell to between 43° to 50° F. Fertility of the waters in terms of bicarbonates is relatively low.

Sport Fishing of Smith River. Angler-use is similar to that of most other major Northwestern California streams with one important exception. Periods of roily high flow are short, and high, clear flow usually occurs at all seasons. No significant reduction of fisherman-use occurs during the winter and anglers are attracted to Smith River from other Northwestern California and Southern Oregon streams where turbid waters usually prevail for extended periods during the winter months.

The trout fishing season in the Smith River drainage extends from June through October with most fishing pressure occurring during July and August. Fishing for sea-run cutthroat trout is enjoyed especially by local residents in the lower South Fork and main river early in the season. With the sharp decline in numbers of tourists in the area after Labor Day, trout fishing pressure becomes light during the remainder of the fishing season.

Five U. S. Forest Service camps along Middle Fork Smith River and the large Jedediah Smith State Park on the main river attract many camper-anglers who usually stay for several days primarily to fish for trout in the adjacent river. Less intensive use occurs on the South Fork and on the less accessible upper reaches of the North and Middle Forks. Roadside tourist facilities and ready access provided by adjacent U. S. Highway 199 are important factors in the heavy concentration of angler-effort on the main stream and the Middle Fork. Posting is of little consequence, since most of the watershed is within a national forest.

On the other hand, poor roads give limited access to the upper North Fork, South Fork, and upper reaches of the Middle Fork. Those areas receive only a small part of the seasonal fishing effort.

Steelhead trout fishing extends from November through February, with the peak effort occurring in mid-winter. Steelhead trout fishing is concentrated along the main stem and Middle Fork upstream to the Patrick Creek confluence. Less fishing occurs on the lower South Fork and North Fork. Only a few early-run steelhead trout are caught in the lower river.

Fishing for chinook salmon begins near the mouth of Smith River as early as mid-August and extends through December. In October and November, most of the fishing occurs in the estuary. The estuary fishing follows that in the Klamath River by several weeks. Following the seasonal decline in the Klamath, anglers seek out the better salmon fishing in Smith River. As the run moves upstream, angling is distributed along the main stream until the run declines in December. During the latter period of the salmon run, steelhead trout contribute significantly to the catch. Fishing for chinook salmon in the estuary is done princiaplly from boats, but upstream it is done from stream banks. A large proportion of the estuary fishermen are from Southern California, many of whom return to fish year after year.

Nonresident salmon and steelhead trout anglers usually live in motels or personal trailers. Most of the nonresident trout anglers camp along the streams in the summer, and smaller numbers use housing facilities in the area.

Combined fishing for adult salmon and steelhead trout is equivalent to the effort devoted to trout fishing in the Smith River drainage. About 27 percent of the anglers fishing during the winter season travel 100 miles or more to reach Smith River (figure 3).

Trout fishermen were almost four times as successful as steelhead trout or salmon fishermen on the basis of number of fish caught. However, on a poundage basis, a much higher value is shown for the salmon and steelhead catch.

The sport fishery of Smith River has a high value. It is estimated to have provided an average of 44,100 days of angling for the 1956 and 1957 seasons, of which 22,900 days were for trout, 8,700 for salmon, and 12,500 for steelhead trout. The catch was estimated at 32,400 trout, 3,400 salmon, and 4,400 steelhead trout.

Klamath River

This report gives consideration to that part of the Klamath River downstream from Copco Dam in California near the California-Oregon state line. Except for about 200 square miles mainly in the Jenny Creek drainage in Oregon, which contributes to the Klamath River downstream from Copco Dam, the area lies within California. For purposes of this report the area upstream from Copco Dam, lying principally in Oregon, is not considered. The lower Klamath River, with a drainage of 7,870 square miles, is the largest watershed in Northern California.

The Klamath River is a large stream, frequently exceeding a flow of 10,000 second-feet from November through June. Low flow occurs during the period of July through October. Highest flow occurs from January to May when monthly flow is frequently many times larger than the low fall flow.

The flow of the Klamath River is considerably influenced by operation of the California-Oregon Power Company facilities. Iron Gate Dam when completed will regulate severe changes in river level resulting from peaking-plant operations. Numerous irrigation diversions, occurring at several points along the Klamath, Shasta, Scott, and Trinity Rivers, have marked effects upon flows in these streams.

The Trinity River is by far the largest tributary of the Klamath River and has a drainage of 2,970 square miles. A 27-year record shows an average flow of 5,644 second-feet near Hoopa, California about 10 miles above the mouth. Flow from December through June frequently exceeds this amount. Lowest flow occurs from July through October with September showing the lowest average of about 461 second-feet. Lowest daily flow in September and October shows an average of 322 second-feet with a range from 162 to 574 second-feet. During the past, the Trinity River has been unregulated, but in the near future Trinity Dam and Lewiston Diversion will impound stream flow and divert water to the Sacramento Valley.

Shasta River has a drainage area of about 800 square miles. The flow on this stream has been regulated to some extent since 1928 by Lake

Dwinnell, located in the upper portion of the watershed near the western slopes of Mount Shasta. Large springs originate in this upper watershed, giving a reliable source and steadying effect to the flow below Dwinnell. However, irrigation diversions are numerous throughout its course, and significantly affect the downstream flow. Adequate flow for the support of fish usually occurs October through March. Storage and diversion result in serious reductions from April through September, with July showing the lowest monthly average of 33 second-feet during 1945 to 1956.

Scott River also drains about 800 square miles, which vary in topography from the rugged Scott Mountains in its upper limits, with elevations to over 7,000 feet, to the relatively flat Scott Valley, adjacent to the main stream. Many small irrigation diversions have an influence on the streamflow before it enters the narrow canyon portion of its lower reaches where it flows between the rugged Marble and Scott Bar Mountains. At the flow gage below Fort Jones, which is essentially below most of the diversions, the flow for 14 years of record has averaged 637 second-feet. High flood flow up to 38,000 second-feet, but most frequently of two to three thousand second-feet, may occur in any month from December to June. Lowest monthly flow occurs from July through September as a result of diversions and of seasonal reductions in runoff. The September average for the period of record is 65 second-feet in contrast to the annual average of 637 second-feet.

Salmon River drains about 750 square miles of some of the most rugged mountainous terrain in the Klamath watershed. Wooley Creek and the North Fork drain the south slopes of the Marble Mountains and portions of the Marble Mountain Wilderness Area with elevations ranging upward of 7,000 feet. This stream follows a tortuous course through deeply cut canyons which have only a narrow strip of valley land.

There are no significant storage reservoirs nor large diversions on the Salmon River. A water supply dam is present on the North Fork Salmon River near Sawyers Bar. Near its mouth, at Somesbar, this stream has had an average annual flow of 1,682 second-feet for 30 years of record. A high flow of 20,000 second-feet frequently occurs during December to March. Low flow similar to that in the drainages of the higher Klamath Mountains occurs from July through October. The lowest flow has almost consistently occurred in September, with an average for recent years of 216 second-feet. In spite of these extremes, Salmon River provides fine year-round habitat for anadromous and resident fish.

Anadromous Fishes of Klamath River. Salmon and steelhead trout which spawn in the Klamath River form an important segment of the sport and commercial fisheries of California. Chinook salmon of this stream supported an impressive commercial gillnet fishery until its closure in 1933. Two canneries were frequently operated near the town of Klamath. A pack of 18,000 cases was recorded in the 1912 season. Coho salmon were often taken in the gillnets but were not distinguished in the catch records.

Field studies in 1958 were conducted to determine the size and general distribution of the chinook salmon runs. A site near Ah Pah Creek on the lower river was selected as the base of operations for fish tagging. Several types of gear were used in the capture of salmon, including drift and set gillnets, fyke nets, a beach seine, and partial weirs. Most of the fish were captured in gillnets. All fish were tagged with plastic Peterson discs affixed below the anterior portion of the dorsal fin. Tagging began in mid-July and was concluded in mid-October. Counting stations operated by the California Department of Fish and Game were the principal source of recovery samples. A weir located below the site of the Trinity River Diversion Dam near Lewiston supplied the most substantial sample. Information from cooperative Indian fishermen at Hoopa and Pecwan was used to supplement the counting station data.

An aerial redd count on major spawning areas was made on October 30, 1958, the peak of the spawning activity, to furnish more comprehensive data on the runs. Streams included in this survey were the Trinity River mainstem above the North Fork, the South Fork Trinity downstream from Hyampom, Scott River, and Salmon River. The survey did not include areas above the Klamath and Shasta River counting stations. A ratio of redds to numbers of chinook salmon was secured above the Lewiston weir where a known number of fish had been transported. By applying this ratio to the other stream sections included in the survey, a population estimate was made. In addition to supporting the tagging study estimates, this survey provided information regarding population distribution.

Results of tagging studies by the California Department of Fish and Game on the Trinity River in 1955 and 1956 were valuable in making final population estimates.

Population estimates for coho salmon and steelhead trout were made on the basis of existing counting station records, creel census, and from information gained from the Eel River study. This information was also used to support estimates of the chinook salmon population. As a result of the tagging program, it was estimated that 42,500 chinook salmon comprise the escapement above Ah Pah Creek. Another estimate, derived from the aerial redd survey for the same area, totalled 38,750 fish. The average of these estimates, nearly 41,000, was accepted as a reasonable figure for the chinook salmon escapement above Ah Pah Creek in the fall run.

An estimated 4,000 chinook salmon comprise the late fall run that spawns in the tributaries downstream from the Trinity River confluence. Blue Creek is the principal contributor.

Sport fishermen normally take about 14,000 chinook salmon from the lower riffles and estuary according to creel census data. During the 1958 season, the take was estimated to be 7,000 fish, about one-half of normal. An estimate of the Klamath River adult chinook salmon population for 1958-59 includes a spawning escapement of 45,000 and a sports catch of 7,000 for a total 52,000 fish. This is considered an unusually small run. Estimates of 35,000 and 55,000 chinook salmon, one-third to one-half of the total Klamath drainage population, were made for the Trinity River in 1955 and 1956 respectively. The adverse effects of flooding in December 1955 were perhaps partially responsible for the small run. Fish from the 1955 hatch would have returned as the three-year-old group so prominent in the Klamath salmon population. Runs of 100,000 to 125,000 fish are perhaps more commonly expected and are considered to be the present-day average.

Chinook salmon enter Klamath River on their spawning migrations in two main runs. The spring run enters from the ocean during March, April, and May. The summer or fall run is composed of two peaks. The run begins in July, peaks in August, tapers off through September, and peaks again in October and November. This latter component of the fall run spawns in the tributaries of the lower river.

Approximately 20,000 coho salmon spawn in the Klamath River. They begin entering the stream near the end of September, but their migration does not get well under way until late October and November. Coho salmon are believed to be widespread in their spawning distribution.

The steelhead trout population, including "half-pounders," is estimated to be approximately 400,000. "Half-pounders" are steelhead trout which have usually spent less than one year in the ocean before returning to fresh water. Creel census data and comparisons with information obtained from Eel River studies form the primary basis for this estimate.

Steelhead trout enter the Klamath River during all months of the year. There are three obvious migration peaks although steelhead migrations are often considered to consist of two major runs; the spring run and fall-winter run. Steelhead trout are spring spawners. Their migration to the spawning grounds from the ocean in some cases begins almost a full year before they become sexually mature. The early arrivals, referred to as the spring run, begin showing up in the river in April and May. These fish move through the lower river areas, remain in the headwaters near the gravel riffles, and spawn early the following spring.

An important migration in early-fall consists principally of "half-pounders." The bulk of these fish are 10 to 20 inches in length. There has been considerable controversy as to whether or not these fish are stimulated to migrate by sexual development. The results of gonadal examination of these fish in 1958 indicate that about 30 percent would probably mature sexually in time to spawn during the season of migration. Sexual development appeared to be positively correlated with size of the fish. Most of the fish that measured less than 17 inches in fork-length displayed no signs of sexual maturation.

Another wave of progressively larger fish begins to enter the river shortly following the ebb of the early-fall run. The peak of the later run occurs in late December and January. Fish continue to arrive on the spawning grounds through the late winter into early spring, when they spawn.

Sturgeons are known to migrate up the Klamath to Ishi Pishi Falls, a short distance above the confluence with the Salmon River. These fish migrate through the lower river in the spring and are found near Orleans where they support a sport fishery of increasing importance. They are not known to use the Trinity River to any extent.

Eulachon or candle fish are most familiar to the Indian residents in the vicinity of Pecwan. These fish migrate into fresh water in March and April. Little is known of the area used by these fish for spawning, but it is believed that they use the lower reaches of the system. Like salmon, eulachon die after spawning. Their prime importance in the Klamath River lies in their support of an Indian dip-net fishery. Spawned-out eulachon carcasses are considered an important food source for sturgeon.

Shad have been observed in increasing numbers in recent years. The extent of their range of migration on the Klamath River is not well defined. First observations of these fish in the vicinity of the Salmon River confluence were reported by residents in 1957. Indians, unfamiliar with the palatability of the species, have reported that these fish have entered their nets in "menacing numbers" in late years. The shad ascend the river in the spring to await suitable water temperatures before spawning.

<u>Pacific Lamprey</u>. According to the natives, the Pacific lamprey enters Klamath River in two apparent migration waves. The first wave enters the lower river following winter freshets in late December or January.

The second and largest group enters during March, April, and May. The Pacific lamprey is a spring spawner. It migrates to gravel riffles in the headwaters where it deposits its eggs. Like salmon, it dies after spawning. Large numbers of lampreys have reportedly spawned above the counting stations at Klamathon and Lewiston. Pacific lampreys are eagerly sought by Indians along the lower reaches of the drainage.

Fish Habitat of Klamath River. The relatively small run of spring chinook salmon uses spawning areas in the Trinity and Salmon River tributaries. The early portion of the summer or fall run is widely distributed throughout the drainage. The later portion of the run is confined largely to the tributaries below the Salmon River confluence, particularly Trinity River and Blue Creek.

Based upon spawning ground surveys, sixty percent of the chinook salmon spawning area is located in the Trinity River and its South Fork. The combined areas of the Shasta, Scott, and Salmon Rivers comprise 25 percent. The mainstem Klamath River, between the Klamathon Racks and Copco Dam, and miscellaneous tributaries make up the remaining spawning area. Minor spawning occurs on the Klamath River mainstem below the Shasta River confluence. In the Trinity River the bulk of the mainstem spawning area lies above its North Fork confluence. Extensive riffle areas in the lower Trinity are apparently little used by spawning salmon or steelhead trout. The distribution of available spawning area in the Klamath River drainage along with other drainages is shown on Plate II.

Surface water temperatures in the upper river often approach the critical point for fingerling salmon during the summer. Fertility of the waters is high, as indicated by measurements of carbonates and bicarbonates throughout the system.

Sport Fishing of Klamath River. Several characteristics differentiate the sport fishery of the Klamath River from that of other Northwestern California drainages. On the basis of overall use and catch, it is the most important stream in the region. The early-run steelhead trout or "half-pounder" fishery is the most valuable of this type in California and probably the entire Pacific Coast. The chinook salmon estuarine fishery is the most valuable of its type in California. The many natural lakes and streams in the several wilderness areas in this drainage support a valuable trout fishery.

Most of the mainstem of the Trinity River is readily accessible from U. S. Highway 299. The Klamath is accessible near its mouth via U. S. Highway 101, and the upper reaches via U. S. Highway 99. Access to the middle reaches is relatively poor although a graded and maintained road follows the river from its mouth upstream to U. S. Highway 99.

Most trout fishing occurs from June until November throughout the system with concentration of effort during July and August. Many of the anglers use the facilities provided by U. S. Forest Service camps, particularly along the South Fork Trinity, Salmon, and Scott Rivers.

The trout fishery, in streams accessible to anadromous fish, is supported mostly by juvenile steelhead trout, but resident rainbow trout in the headwaters and moderate numbers of brown trout in the Trinity River drainage also contribute to the fishery. The early season anglers are largely local residents, and summer anglers are mostly nonresidents. The high fishing pressure in the upper reaches of the Klamath River during the first month following the opening of the season declines during summer. Trout fishing pressure is equal to that exerted on chinook salmon, but approximates only two-thirds the steelhead trout fishery. Alpine streams and lakes support an excellent sport fishery for eastern brook, rainbow, and brown trout. The California Department of Fish and Game maintains a planting program for most of these lakes.

Steelhead trout fishing occurs from July into early spring with a slack period between runs in October and November. Most fishing during winter is done along the accessible upper main Klamath River above the Scott River confluence and on the Trinity River from Willow Creek upstream to Lewiston. Fishing for early-run steelhead trout begins in the riffles just above tidewater and gradually extends upstream with the run. Highest fishing pressure occurs in the lower riffle areas below the Trinity River confluence. Less than 12 percent of the early-run steelhead fishermen of the lower river are local residents. A large portion are from Southern California, more than 800 miles away. Turbid winter flows often terminate fishing for periods of several weeks, especially in the mainstem.

The early-run steelhead trout angling effort (August-October) is five times the effort for late-run steelhead trout (November-February).

The early-run catch was found to be 13 times that of the late-run fishery.

The Klamath River salmon fishery begins during the summer as a boat fishery at the mouth of the stream. This fishing begins in July and peaks in August. Shortly after boat fishing starts near the mouth, salmon fishing develops upstream as the run moves toward the spawning areas. Angling effort reaches a climax in October in the upper reaches of the Klamath and Trinity. The bulk of the catch consists of chinook salmon but the proportion of coho salmon increases rapidly toward the end of the run in late September. Twenty percent of the salmon catch in the Klamath River estuary consists of coho salmon. Few coho salmon are caught in upstream areas.

Based on the 1956 and 1957 creel censuses, the Klamath-Trinity River fishery supports over 160,900 angler-days annually of which over 51,400 are for trout, 39,700 for salmon, and 69,800 for steelhead trout. Over 56,500 of the angler-days were for early-run steelhead trout. The estimated average catch was 21,100 salmon, 58,200 steelhead trout, and 104,000 trout.

Indian Fisheries of Klamath River. Anadromous fish runs were the principal food of a population of about 5,000 indians formerly inhabiting the lower Klamath River area. Much of the ritual and labor of these people was related to capturing and curing of these fishes.

The migration times of the various species were so distributed that the catch of fresh fish was possible at any season of the year. The fall run of chinook salmon was most important to the Indians because low river flows and large numbers of fish provided optimum fishing conditions. In addition, the flesh was ideal for smoke curing for winter use. The spring chinook salmon, lamprey, sturgeon, and eulachon were also taken for the fresh and cured food supply. Steelhead trout were not considered desirable.

The Indians relied almost completely on wildplants and animals for their food, showing little inclination toward agriculture. The centers of heaviest Indian population were the areas of greatest fishing potential. Weirs were constructed annually at Hoopa and upstream from Pecwan near Capell Creek. The weirs were composed of a lace-work of saplings strung on parallel poles supported by wooden tripods driven into the gravel across the streams. At Capell, the fish were dipped from traps built at intervals across the dam, while at Hoopa, seines were used to take fish which concentrated below the weir. The Indians were conservation conscious, purposely permitting a part of the spawning run to escape upstream from the weirs. The weirs washed out each year with the first high flows in the fall, which permitted the remainder of the run to pass largely unmolested.

Seines, made from the fibers of the wild iris, were used to catch sturgeon as well as chinook salmon. Spring salmon and eulachon were taken in dip nets. Saplings, woven into funnel shaped baskets, were used to catch lampreys.

Today, only a fragment of the historical fisheries remains although the Indians still enjoy their fishing and hunting rights as set forth in treaties with the Federal Government. Restrictions have not been placed upon the methods used, but a considerable transition is evident. Gillnets have become the principal means of taking fish. The use of the Capell weir was discontinued shortly following the turn of the century and the Hoopa weir construction was abandoned within the past decade. Dip netting for spring salmon and smelt and the use of eel baskets are still common along the lower Klamath. In recent years shad have been taken in increasing numbers but these fish are usually discarded as trash. Only a few Indians are now dependent on the fish runs as an important supplement to their food supply. Most of them are occupied with other interests, primarily the lumber industry. Competition of industry and depletion of the fish populations have lessened the role of the fisheries in the lives of the Klamath River Indians.

Redwood Creek

Redwood Creek, one of the smaller of the major coastal streams of Northwestern California, drains about 280 square miles, all in Humboldt County. The stream is relatively narrow and straight, with few tributaries Prairie Creek, about 14 miles in length and draining 30 square miles, is the most important tributary. It joins Redwood Creek a few miles above its mouth, near the town of Orick.

There are no water development projects on Redwood Creek. The greatest obstacles to fish utilization of the stream are the extremes in natural flows. Low flow limits year-round habitat for resident species and migration of ocean-run fish. During summer, sand bars may be formed at the mouth which do not open until the first fall rains, thus limiting the migration of anadromous species for long periods. High flows result in turbid water and after recession fine sediments are deposited which adversely affect spawning habitat.

Anadromous Fishes of Redwood Creek. Redwood Creek supports runs of all anadromous salmonids common to California's north coastal region. An Indian village once located near the mouth of the creek was dependent upon these runs for food. During the first quarter of the century gillnetters operating in the tidal area shipped their catches to the canneries at Eureka and Klamath.

The fall run of chinook salmon is estimated to be 5,000. No spring run is known on Redwood Creek. The latter part of October and first of November mark the period of heaviest migration to the spawning grounds. Chinook salmon begin arriving on spawning grounds during the first week in November and new arrivals are noted following intermittent high water until January. December is the center of the spawning period.

Approximately 2,000 coho salmon spawn annually in Redwood Creek. Their entrance time and general distribution in the drainage is similar to that of chinook salmon. The peak of spawning activity lags about two weeks behind that of chinook salmon and continues into February. Similar to their selection of spawning areas in other drainages, coho salmon move to the headwaters of the small tributaries to spawn.

Redwood Creek accommodates a winter run of steelhead trout numbering about 10,000. Their distribution is similar to that of coho salmon but extends higher into the headwaters. Spawning time is centered in March.

The creek has a large run of sea-run cutthroat trout. Prairie Creek accommodates the bulk of this species which spawns in early spring. Resident cutthroat are also believed to inhabit streams in Redwood Creek basin.

Fish Habitat of Redwood Creek. Redwood Creek is accessible to chinook salmon for about 48 miles of its lentth. It has a moderate gradient and there are no known complete barriers to the spawning runs. Most of the drainage area was heavily forested in the past but recent accelerated logging, especially in the headwater area, has resulted in heavy erosion with the deposition of much fine material in the streambed. The abundance of fine gravel and silt on the riffles is especially noticeable in the middle and lower reaches. Predominant gravel size in the riffles is medium in the lower reaches, small to fine in the middle reaches, and medium in the upper reaches.

The estimated available chinook salmon spawning area in the Redwood Creek drainage is considered sufficient to accommodate about 5,400 redds. Riffles judged to be of highest value to chinook salmon runs were observed in Prairie Creek and sections of the upper and middle reaches of the main stream. In the latter section, Lacks and Minor Creeks are tributaries of considerable importance. These streams do not have the large amount of fine gravel and silt noted elsewhere in the drainage.

Coho salmon spawn in the same riffles used by chinook salmon in Prairie Creek. Cohos also utilize other portions of Redwood Creek. Steelhead trout spawn in accessible headwater areas throughout the drainage.

The range of water temperatures in this drainage is considered to approximate that of Smith River, a similar adjacent stream. Summer temperatures rarely exceed 80° F., and winter temperatures range from 40° F. to 50° F. Water in this drainage is moderately fertile, based on randum bicarbonate tests.

Sport Fishery of Redwood Creek. Because of limited access, trout fishing is confined mostly to Prairie Creek and the lower main stream. Juvenile steelhead trout comprise the bulk of the catch, but cutthroat trout are taken in the lower reaches in fair numbers, particularly in Prairie Creek.

The winter salmon and steelhead trout fisheries have been restricted by state regulation to the lower reaches of the main stream. Some chinook salmon are caught near the town of Orick in tidewater during the fall prior to high, roily flow. The extent of steelhead trout fishing is dependent upon flow conditions. Some steelhead trout may be caught during brief favorable periods in late winter.

The sport fishery of Redwood Creek is moderate in value compared to the more attractive and accessible streams. It is estimated to have provided

4,000 days of angling annually. About 2,500 man-days are attributed to trout fishing, 500 to salmon, and 1,000 to steelhead trout. The estimated annual catch is 6,000 trout, 600 steelhead trout, and 250 salmon.

Mad River

Mad River, located in Humboldt and Trinity Counties, drains about 500 square miles of the Coast Range, southward slopes of the South Fork Trinity Mountains, and coastal plain. Flow and annual rainfall records show a seasonal pattern with a dry period during August through October. The seasonal low flow for a day frequently has been 30 second-feet or less. The stream becomes very turbid, even with moderate rains. Presumably, extensive logging activity has had an aggravating effect on low flow conditions and has resulted in increased turbidity during rises in flow.

Sweasey Dam located 17 miles above the stream mouth has provided the source of Eureka's water supply since 1938. A little over five second-feet are diverted continuously at the dam, but otherwise the impoundment has little regulating effect upon the streamflow. The dam is equipped with a fish ladder where anadromous fish runs of chinook and coho salmon and steelhead trout have been counted for several years by the California Department of Fish and Game.

Anadromous Fishes of Mad River. Estimates of the size of salmon and steelhead trout runs on Mad River were made from California Department of Fish and Game tagging studies in 1954. These studies included Sweasey Dam fish counting records and spawning ground surveys.

According to these data, about 5,000 chinook salmon ascend the stream. The early fall entrance of these fish is usually blocked by a sand bar at the mouth of the river. Fall rains are required to flush a channel through the bar, normally by mid-October, before fish can enter. Approximately 2,000 coho salmon were estimated to comprise the average spawning population. The coho salmon migration follows that of the chinook salmon by about a month. About 6,000 steelhead trout were estimated in the annual run which begins in early fall and reaches a high in February and March.

The Mad River produces a sea-run cutthroat trout population of minor significance.

Fish Habitat of Mad River. The Mad River is accessible to runs of chinook salmon, coho salmon, and steelhead trout up to a 25-foot falls near Bug Creek, about 33 miles above the mouth. Sea-run cutthroat trout spawn in several tributaries of the lower reaches.

Low water bars in the lower reaches form partial barriers especially to chinook salmon during the initial part of the run when streamflow is low. Barriers in the tributaries consist mainly of log jams, similar to those on Lindsay Creek, or low water and natural falls like those on North Fork. Sweasey Dam becomes more of a barrier to salmon both when the flow is low and during flood stages. The gradient of the streambed is gradual in the lower reaches and moderate to high in the upper reaches. Numerous cascades and riffles with an abundance of large boulders occur below the high falls on the mainstem.

About 4,000 pairs of chinook salmon could find suitable spawning in the accessible reaches of the Mad River. Good populations of coho salmon and steelhead trout, similar to that of chinook salmon, could be accommodated for spawning in this drainage. Spawning by chinook and coho salmon is largely confined to reaches below Sweasey Dam. In contrast, most of the steelhead trout spawn above the dam.

Thermograph records of water temperature in the upper reaches of Mad River show a range of 70° to more than 80° F. during July and August. This drainage is moderately fertile in terms of bicarbonates.

Sport Fishing of Mad River. An exceptionally productive resident trout fishery in the upper reaches is probably the most distinctive feature of this drainage. Trout fishing is concentrated along accessible portions in the vicinity of the Ruth damsite where success is unusually high. During the 1957 season the catch per angler-hour was more than 1.4 fish for that stream as compared to a 0.8 fish-per-hour average for other streams in the region. The California Department of Fish and Game found similar success rates for the 1958 season. Relatively minor fishing effort is expended in the middle and lower reaches although good catch success in the less accessible portions is shown. Most of the catch in the upper reaches consists of resident rainbow trout. In the section below the barrier falls, juvenile steelhead trout and some cutthroat trout enter the catch. Cutthroat trout are taken primarily in the estuary and in lower tributaries. Local anglers concentrate in the upper area during the first month of the trout season. The proportion of nonresident anglers increases through the remainder of the summer, but total angling pressure decreases markedly.

Angling effort for both salmon and steelhead trout is largely confined to the lower eight miles of stream. The early run of steelhead trout is negligible. The principal steelhead trout run begins in November. Fishing for this species runs from November through February. A high turbid flow during the winter may limit steelhead trout fishing to only a small portion of the season. Mad River was fishable for less than 40 percent of the 1957-58 winter season, which was considered typical. Such adverse conditions limit fishing for coho salmon as well as steelhead trout. Chinook salmon fishing is less affected since they make an earlier run when the flow is reduced and less turbid. Relatively few coho salmon normally are caught in Mad River.

Mad River presently receives about 7,600 angler-days of fishing annually, of which 3,800 are for trout, 1,000 for salmon, and 2,800 for steelhead trout. An estimated 12,400 trout, 200 salmon, and 1,100 steelhead trout are caught. Anglers travel an average of more than 134 miles to fish in Mad River.

Eel River.

The Eel River system, including its principal tributaries, the Van Duzen, and Middle and South Forks, drains an area of 3,700 square miles, and is the second largest drainage within northwestern California. It is next in size to the Klamath River in runoff as well as drainage area, although its extremes in flow are much more divergent. Its maximum discharge is equal to that of the Klamath River.

Only in the upper Eel drainage does enough snow accumulate at the higher altitudes to affect the spring runoff. The flow in the Eel River averages about 6,600 second-feet annually. It has varied from a monthly average low of 91 second-feet in September 1955 to peak discharge of 540,000 second-feet during the following December. August to October are the months of lowest flow, with September showing an average of 125 second-feet. The Van Duzen shows a similar pattern of extremes with a September average of 14 second-feet. South Fork has a September average of about 46 second-feet. Middle Fork and North Fork Eel River have September average flows of 15 second-feet and 5 second-feet, respectively.

Besides the limitations placed on streamflow by natural conditions, Scott Dam, located 163 miles from the mouth, has a marked effect on the upper Eel. This dam is a barrier to anadromous fish. Van Arsdale Diversion Dam, located 12 miles downstream, is equipped with a fish ladder and also serves as a collecting and counting point for steelhead. Throughout the year, 200 to 300 second-feet of water are diverted at the Van Arsdale Dam and transported by a tunnel through the mountain to East Fork Russian River. During most months of the year Eel River is virtually dry for many miles downstream from this diversion point.

Benbow Dam is located on South Fork Eel River about 27 miles upstream from its mouth. The dam, still in existence even though power is no longer produced, is equipped with a fish ladder where upstream counts of salmon and steelhead trout are made by the California Department of Fish and Game. Operation of the powerhouse at Benbow Dam formerly provided attraction water for the fish ladder. Under present conditions, attraction to the ladder is inadequate and probably less effective than when the powerplant was in operation.

Anadromous Fishes of Eel River. Eel River is the third largest producer of chinook salmon in California and is second only to the Klamath River in the production of coho salmon and steelhead trout. A commercial gillnet and seine fishery was supported by the Eel River salmon runs, beginning in the mid-nineteenth century and continuing until 1926. Most of the fish were salt- or smoke-cured. Cannery records beginning in 1877 indicate a peak of 15,000 cases in 1883.

Population estimates of anadromous salmonoids on the Eel River was a principal objective of a four-year study begun with the 1955-56 spawning season and concluded in 1958-59. Information gained from these studies was valuable in the appraisal of fish populations of other Northwestern California streams where specific studies were not made.

Population studies were carried out by tagging and subsequently collecting a portion of the annual migratory spawning runs. This study provided information for population estimates, distribution, timing of entrance to the stream, spawning, and speed of migration.

Weirs and gillnets were the most successful devices employed in the capture of fish for tagging. Fyke nets and seines were also used and, although generally less effective, helped supplement the catch. A weir was used successfully to capture a large portion of the early part of the migration although it washed out when the fall freshets occurred. Gillnetting was then employed to obtain good tagging distribution. Gillnetting was the most successful method employed. This type of gear was used in all except extreme flow conditions. Various mesh sizes, ranging from 4- to 7-inch stretched mesh, were used to insure a representative cross section of all sizes and age groups of fish. Contrary to common belief, the mortality occurring from the careful use of gillnets was insignificant. Fish caught in the nets were detected at once by disturbances along the floating cork line and were freed instantly by cutting the webbing to prevent injury. Numbered plastic Peterson discs were attached with stainless steel pins to the fish below the anterior portion of the dorsal fin.

Upstream recovery samples were secured through counts at Benbow and Van Arsdale Dams and from spawning ground carcass counts.

Chinook salmon population estimates based on the results of the tagging are shown in table 2.

Table 2. Chinook Salmon Population-Estimates, Eel River.

Year	Total River Escapement	Limits of 95 percent confidence Lower	Upper
1955-56	38,045	26,504	46,638
1956-57	19,794	13,378	27,870
1957-58	25,104	17,190	34,994
1958-59	14,500	10,218	17,595

Stream populations include estimates of the fish caught by sport fishermen below the site of tagging. The small run of 1958-59 may have been partially caused by the adverse effects of the large floods of 1955 upon survival of young and, hence, a subsequent reduction in the spawning run of the important three-year-old group. The average number of chinook salmon in runs during the four-year study period was 25,000. This figure probably does not adequately indicate the historical or potential productivity of Eel River runs. A review of the counts at Benbow Dam (table 3) shows that chinook and coho salmon runs since the 1952-53 year have averaged less than half those recorded before this time. The precise reasons for this drastic reduction are not clear although a number of factors are probably involved.

Table 3. Fish Counts at Benbow Dam Ladder, South Fork Eel River. 1/

Year	Chinook Salmon	Coho Salmon	Steelhead Trout
1938-39	6,051	7,370	12,995
1939-40	3,424	8,629	14,476
1940-41	14,691	11,073	18,308
1941-42	21,011	13,694	17,356
1942-43	10,612	15,037	25,032
1943-44	7,264	13,030	23,445
1944-45	13,966	18,309	20,172
1945-46	12,488	16,731	13,626
1946-47	16,024	14,109	19,005
1947-48	13,160	25,289	18,225
1948-49	16,312	12,872	13,963
1949-50	3,803	7,495	13,715
1950-51	14,357	12,050	15,138
1951-52	12,476	11,441	13,774
1952-53	7,256	3,711	19,448
1953-54	7,948	3,052	15,425
1954-55	5,406	6,016	14,000
1955-56	3,974	6,054	11,443
1956-57	1,530	5,717	12,333
1957-58	3,050	5,432	7,910
1958-59	1,472	3,344	11,984

1/ Data furnished by California Department of Fish and Game.

Chinook salmon initially arrive on the riffles downstream from Fernbridge in the latter part of August. During late August and September they enter the lower pools and estuaries to await a large enough flow for their migration. Some of the early arrivals are ready to spawn upon entrance into the Eel River and are believed to spawn in streams of the lower portion of the system such as the Van Duzen River. These early fish are often delayed in their migration by shallow riffles. The bulk of the movement occurs in October and the first half of November. Variation in the time of the fall rains is a principal factor governing extent and time of spawning migration and distribution.

In years of extended low flow, most spawning is confined to the mainstem of the drainage. This phenomenon is considered rather precarious from the standpoint of productivity, since egg deposits so confined are more often vulnerable to destruction from a high flow than those more widely distributed throughout the tributaries. During years of ample flow, tributaries near the upper extremity of the system are heavily used. Spawning begins in late October, reaches a peak in November, and, in some years, continues through January.

The heaviest migration of juvenile chinook salmon from spawning areas to the lower estuaries is noted in June. Movement of these fish from the estuaries to the ocean occurs through July and August of the same year.

The results of three years of population studies of coho salmon are given in table 4.

Table 4. Coho Salmon Population Estimates, Eel River.

Year	Total River Escapement	Limits of 95 percent confidence Lower	Upper
1956-57	15,908	9,938	23,982
1957-58	22,094	12,094	36,787
1958-59	8,732	6,286	11,691

As in the case of chinook salmon, the small run of coho salmon in 1958-59 may have resulted from adverse effects of flooding during the 1955-56 season. Most coho salmon return to the streams to spawn when they are three years old, after spending about two years in the ocean.

The coho salmon migration begins in mid-October, reaches a high in November, and continues through December. Coho salmon are usually not confronted with low water obstacles because their migration coincides with high flows. The bulk of the run may pass in four to five days.

Steelhead trout are the most abundant salmonoid species in the Eel River. Population estimates obtained from a three-year study are given in table 5.

Table 5. Steelhead Trout Population Estimates, Eel River.

Year	Total River Escapement	Limits of 95 percent confidence Lower	Upper
1956-57	96,196	77,300	118,916
1957-58	106,693	73,919	147,453
1958-59	89,621	73,364	109,888

Steelhead trout enter the river in varying numbers during all months of the year. A small spring run enters during April and May and migrates to the upper reaches of the Van Duzen and the Middle Fork. Similar to the Klamath River, the Eel River receives a significant run of small steelhead trout in later summer and early fall. Summer and early fall steelhead trout migrations are often impeded by low water conditions. Large numbers concentrate in the pools near tidewater until an adequate flow allows them to move upstream. December and January mark the height of the migration.

Adult shad migrate 40 to 50 miles up the Eel River to spawn. The sturgeon population of the river is now negligible. At one time this species supported an important sport fishery as far upstream as Rio Dell. In late years, only an occasional green sturgeon has been seen in the lowermost part of the river. In some areas the Pacific lamprey is eagerly sought by local residents in the spring. It is particularly vulnerable to harvest during its ascent over Benbow and Van Arsdale Dams.

Fish Habitat of Eel River. Chinook salmon, coho salmon, and steelhead trout spawn in accessible areas throughout the system. The extent of suitable spawning habit available to salmon and steelhead trout is considerably limited by barriers, most of which are formed from logging debris. Low flow, especially during the initial part of the chinook salmon run, also greatly restricts the areas accessible to those fish. Salmon and steelhead trout distribution in this drainage is further affected by Benbow Dam on the South Fork, Scott Dam on the mainstem, and natural falls and cascades on many tributaries. Pollution from sawmill wastes also affects fish habitat.

It is estimated that enough spawning habitat exists in the Eel River drainage to support more than 142,000 chinook salmon redds. Distribution of riffles judged to be usable is about as follows: Main Eel, 62 percent; South Fork, 16 percent; Middle Fork, 12 percent; Van Duzen River, 9 percent; and North Fork, 1 percent. Distribution of spawning chinook salmon in the Eel River in recent years is shown on plate II.

Small tributaries are selected for spawning by coho salmon in preference to mainstem streams. Tag recoveries at Benbow Dam show that 35 to 40 percent of the run spawn above Benbow Dam. Spawning ground surveys show that the Van Duzen River and South Fork are the most important Eel River tributaries for coho salmon.

About 40,000 coho salmon redds could be accommodated in the upper South Fork and lower mainstem tributaries, which are presently used by these runs. All areas observed to be used and those judged to be usable for the entire Eel River drainage are estimated to be sufficient for 80,000 coho salmon redds.

It is estimated that enough steelhead trout spawning habitat is present to accommodate 100,000 spawning pairs, or twice that of the present average runs.

Water temperatures vary considerably between the lower and upper reaches. For 14 days, during July and August, the range was from 70° to 73° F.

near the mouth and from 78° to 88° F. in the upper reaches. During the winter, water temperatures range from 40° to 50° F.

Sport Fishing of Eel River. Eel River supports the second largest sport fishery of Northwestern California streams. Fishing for chinook salmon and steelhead trout occurs during fall and winter months and trout fishing during spring and summer months. The fishery for spring-run steelhead trout occurs only in the Middle Fork and in Van Duzen River.

Trout occur throughout the Eel River drainage but fishing pressure is concentrated in the headwater area. Posted land limits accessibility to many sections of the stream. Heaviest angling pressure occurs during the month of June in the upper stream sections between Van Arsdale and Scott Dams. During the summer, many tourists fish the stream adjacent to highways or government forest camps. Fishing effort is particularly intense along the accessible South Fork Eel River. Fishing declines throughout the basin during the late summer months as flow decreases.

The first catch of salmon is made in the lower river from boats in August. Bank fishermen follow the upstream movement of salmon and steelhead trout. Fishing pressure continues until discouraged by high, muddy flows. Most fishing for early-run steelhead trout is concentrated in the tidewater area. Coho salmon are occasionally caught on the South Fork and the main Eel River downstream from the South Fork confluence.

The late-run steelhead trout fishery nearly coincides with the November peak of the chinook salmon run in the lower river when catches commonly include both species. During the winter, the high turbid flow may greatly reduce or terminate fishing for many days. During the 1957-58 season, the high flow reduced fishing to 40 percent of the normal time spent under better flow conditions.

Van Duzen River receives only light to moderate fishing pressure during the anadromous fish runs. The South Fork Eel River receives high angler-use for chinook salmon and late-run steelhead trout. Anglers concentrate at numerous access points along the stream up to Benbow Dam. Fishing pressure is reduced upstream from Benbow Dam. Anglers concentrate along the lower 30 miles of Eel River and in the vicinity of the confluence of the Middle Fork Eel River, upstream. Most of the area above the confluence of the South Fork Eel is inaccessible.

Angler effort on the Middle Fork Eel River during the winter season is light and access points are few. Anglers concentrate near the stream mouth and along the middle reach in the vicinity of the Eel River Ranger Station.

The Eel River sport fishery provided an annual average of over 80,600 angler-days in 1956 and 1957. Trout fishing comprised 45,400 fishermen-days, salmon fishing 6,900 days, and steelhead trout about 28,300 days. Average catch per year was 68,400 trout, 3,500 salmon, and 13,700 steelhead trout. Thus the sport fishery catch represents about 16 percent of the chinook salmon run and 13 percent of the steelhead trout run.

Mattole River

Mattole River is located in the extreme southwest portion of the area under consideration. The North Fork, which joins the Mattole 5 miles above its mouth; Honeydew Creek, which joins the river at its mid-point; and Bear Creek, which is an upper tributary, are the principal tributaries.

Streamflow follows a pattern similar to rainfall, with a record high flow in December and January. Lowest streamflow occurs from July through October. During recent years, September flow in the Mattole River, below the North Fork confluence, has averaged about 55 second-feet with daily extremes severely limiting migration and the existence of fish life. When flow is low in the summer and fall, wave action frequently forms a sand bar across the mouth which closes the stream to direct contact with the ocean. This bar may remain intact for varying periods in the fall and block migration of anadromous fish to and from the ocean.

There are no significant water developments in this basin although several small tracts of irrigated land receive water from the Mattole River by means of pumps. Increased turbidity and reduced dry-season flow may have caused a reduction of freshwater habitat for anadromous fish. Accelerated ecological changes, caused primarily by recent logging activity on portions of the watershed, may have also caused changes in stream flow.

Anadromous Fishes of Mattole River. Mattole River salmon and steelhead trout population estimates were based on spawning gravel surveys and interviews with sportsmen and local residents.

Because of its relative inaccessibility, the Mattole did not provide a commercial fishery. Average chinook salmon runs presently number about 5,000 and coho salmon about 2,000. Steelhead trout are largely responsible for the present-day popularity of this stream. Annual runs of about 12,000 are estimated. The time of the migration runs of the Mattole River salmonoids is comparable to that of the Eel River.

Fish Habitat of Mattole River. The Mattole River is accessible to chinook salmon for about 45 miles. Coho salmon and steelhead trout ascend the river several miles above log jams and a restricted channel, which block chinook salmon migrants in the vicinity of Thorn.

In addition to the mainstem areas, several tributaries, including Honeydew Creek and Bear Creek, provide about 14 miles of stream suited for spawning chinook salmon. It is estimated that several times that amount is used by coho salmon and steelhead trout.

The gradient of the main stream and lower reaches of the main tributaries is low to moderate. The stream meanders extensively and channel division is prevalent in the lower several miles. Intensified logging in the Mattole River drainage began about 1952. Since that time, the amount of silt in the streambed has increased, and this accelerated siltation, especially in the lower portion, may be expected to continue.

Debris from logging operations has blocked many miles of formerly accessible spawning habitat in the tributaries.

It is estimated that this drainage can provide spawning habitat for over 7,900 pairs of chinook salmon. Usable gravel in this drainage probably would provide spawning space for not more than 10,000 pairs of coho salmon and a comparable number of steelhead trout.

Sport Fishing of Mattole River. The pattern of utilization of the Mattole River by sport fishermen is similar to that occurring on the Eel River. Prior to 1954, this stream had an exceptionally good winter steelhead trout fishery. The stream was turbid for periods of only a few days at a time until recent years.

Trout fishing in the Mattole River drainage is carried out largely by nonresident anglers. Most of the fishing is for juvenile steelhead trout in the lower reaches.

Although chinook salmon occasionally may be caught in the estuary area as early as October, most of the catch is made during November and December. Steelhead trout and, infrequently, coho salmon also are caught whenever water conditions are favorable. Before 1955, peak steelhead trout fishing activity occurred in January and February. Creel censuses for the 1956-57 and 1957-58 seasons showed negligible fishing effort in this drainage during those months because of the more prolonged turbid periods. There is little fishing for early-run steelhead trout.

It is estimated that the Mattole River sport fishery provided an annual average of 4,300 angler-days in the 1956 and 1957 seasons of which over 3,000 were for trout, 600 for salmon, and 700 for steelhead trout. The estimated catch was 400 salmon, 700 adult steelhead trout, and 8,000 juvenile steelhead trout. Anglers traveled an average of 172 miles to fish in this stream.

Smaller Streams.

Besides the six larger stream basins described in the preceding sections, there are several smaller ones which are important for their fish and wildlife resources. The principal smaller streams from north to south are Wilson Creek, lying north of the town of Klamath; Maple Creek, which flows into Big Lagoon; McDonald Creek, which flows into Stone Lagoon; Little River, which flows into the ocean near Crannell; Jacoby, Freshwater, and Salmon Creeks and Elk River, which flow into Humboldt Bay; and Bear River, which flows into the ocean at a pointabout midway between the mouths of the Mattole and Eel Rivers. All of these streams drain the western slopes of the Coast Range. They are subject to the climate of the coast including relatively large amounts of fog and high rainfall in the fall and winter. None of these st eams is outstanding but collectively they contribute significantly to the anadromous salmonoid populations of the area.

Anadromous Fishes of Smaller Streams. Most of these streams provide spawning habitat more suitable for steelhead trout and coho salmon than for chinook salmon. The estimated total number of fish for all of these streams includes 4,000 chinook salmon, 10,000 coho salmon, and 25,000 steelhead trout.

The most significant streams in this group include the Little, Elk, and Bear Rivers.

The fall chinook salmon of Little River once supported a small commercial fishery supplying Eureka's fresh fish market. Local Indian tribes were dependent on these fish for their food supply. Now, only a small number of chinook salmon spawn in the stream; although it is still an important coho salmon spawning stream. Steelhead trout and sea-run cutthroat trout enter the river to spawn in the winter and early spring. Until recently, large runs of salmon and steelhead trout were known to spawn in Elk River. Bear River accommodates an impressive run of steelhead trout. Although Bear River appears suitable for coho salmon, this species was not observed.

Fish Habitat of Smaller Streams. Eight miles of the Little River is accessible to salmon runs. Usable spawning riffles, composed largely of small gravel, are found generally in the middle reaches of the main stream and in tributaries that join it along that section. Bedrock outcroppings and an abundance of boulders on the riffles characterize most of the lower reaches. The gradient is moderate and the streambed is well defined along most of its lentth. This watershed was logged off about 30 years ago, but regrowth has stabilized it so that erosion is slight. However, log jams continue to form barriers to anadromous fish, especially in the upper reaches.

Available spawning area in the Little River is considered sufficient for over 2,400 pairs of chinook salmon or 9,000 pairs each of coho salmon or steelhead trout.

Bear River is accessible to steelhead trout for about 15 miles below a large log jam which forms a complete barrier. An over-abundance of fine elements in the spawning gravels lowers their value for spawning. The gradient is low and riffles near the mouth are broad and shallow. Considerable evidence of meander and channel diversion was observed in the lower reaches. Logging activity, renewed several years ago, has had an adverse effect on this small drainage. It is estimated that the available spawning area of Bear River could accommodate about 5,000 pairs of steelhead trout or possibly coho salmon. Spawning habitat appears unsuitable for chinook salmon.

Tributaries to Humboldt Bay provide spawning habitat for moderate-sized runs of steelhead trout and small runs of coho and chinook salmon. Watershed abuse has had a highly detrimental effect on the spawning habitat of these streams. Spawning habitat in many riffles has been destroyed by heavy depositions of silt. Log jams and other barriers have made considerable lengths of stream inaccessible to salmon and steelhead trout.

Tributaries to Big Lagoon, Stone Lagoon, and Lake Earl also provide spawning habitat for small runs of coho salmon and steelhead trout.

Most of these streams were not surveyed, but evidence indicates that habitat improvement may benefit the runs of salmon and steelhead trout.

Sport Fisheries of Smaller Streams. As a group, these streams are important to the sport fishery. Runs of salmon and steelhead trout support fisheries similar to those of the larger streams, but emphasis is placed on the trout fishery which consists of juvenile steelhead trout and cutthroat trout. The sport fishery associated with these smaller streams produced an annual average of over 4,300 angler-days during the 1956 and 1957 seasons and an estimated annual catch of 450 salmon, 700 steelhead trout, and 9,100 trout.

The Sport Fishery

Introduction

Inland streams and lakes of Northwestern California and adjacent estuarine and ocean waters provide a great variety of fishing for the sportsman. The outstanding fisheries are dependent upon salmon and steelhead trout. As juveniles in the fresh-water portion of their life cycle, steelhead trout are indistinguishable from resident trout but are considered to comprise a preponderance of the catch. Sea-run cutthroat trout are important in the more northerly streams of the area. Other anadromous fish of lesser importance to the sport fishery in the streams are sturgeons, shad, and eulachon. Pacific lampreys are also of importance to the Indians of Northwestern California as a food source and are thus subjected to considerable fishing pressure.

In the headwater portions of the streams, rainbow trout are the common game fish. Eastern brook trout predominate in the mountain lakes, but brown and rainbow trout are also present. Other species occasionally entering the sport catch in the Klamath River drainage are green sunfish, largemouth bass, yellow perch, and brown bullheads. Brown bullheads and green sunfish also occur in the Eel River drainage. Several other species, serving only as forage fish and not sought by fishermen, are black dace, other minnows, and suckers.

Ocean and surf or shoreline sport fisheries are growing attractions in this north coastal area but are still secondary in importance to the stream fisheries. Chinook and coho salmon are a major attraction and are frequently caught in or near the bays. Other species include lingcod, rockfish, and sole.

Inland Sport Fishing

Studies were made during 1956-1958 to determine the amount and distribution of fishing effort by stream and type of fishing in Northwestern California. Data also were obtained from the California Department of Fish and Game, the California Division of Beaches and Parks, and the U. S. Forest Service.

Results of these studies, covering all of the important streams of Northwestern California, are shown in table 6. The results showed that anglers traveled for considerable distance to fish in these north coastal streams (figure 3). On Smith and Klamath Rivers summer fishermen came from one-way distances averaging more than 300 miles. The Mad and Eel Rivers receive heavy fishing pressure from the densely populated local area. However, both streams are popular with California fishermen living at great distances.

Table 6. Average Angler-Day Use (effort) and Total Catch of Trout (1956; 1957), Salmon and Steelhead Trout (1956-1957; 1957-1958), Northwestern California Streams.

River	Salmon		Early-run Steelhead Trout (Aug.-Oct.)		Late-run Steelhead Trout (Nov.-Feb.)		Trout	
	Effort	Catch	Effort	Catch	Effort	Catch	Effort	Catch
SMITH	8,700	3,400	900	800	11,600	3,600	22,900	32,400
KLAMATH								
Lower (mouth upstream to Pecwan)	25,700	14,200	23,000	21,600	No Fishery		600	1,200
Middle (Pecwan to Salmon River confluence)	3,700	2,000	10,400	9,600	800	400	3,600	6,600
Upper (Salmon River to Copco Dam)	3,000	1,600	11,500	11,200	5,000	1,600	7,700	16,700
Trinity	5,000	2,600	8,000	7,100	5,300	1,700	19,700	42,500
Salmon	500	300	1,100	900	1,200	500	7,300	11,000
Scott	400	200	2,000	2,500	600	300	9,000	18,000
Shasta	400	200	500	600	---	---	9,000	20,000
Subtotal	39,700	21,100	56,500	53,500	12,900	4,500	51,400	104,000
REDWOOD CREEK	500	250	500	400	500	200	2,500	6,000
MAD								
Lower (mouth upstream to North Fork confluence)	1,000	200	300	300	2,500	800	400	1,000
Upper (North Fork confluence upstream)	No Fishery		No Fishery				3,400	11,400
Subtotal	1,000	200	300	300	2,500	800	3,800	12,400
EEL								
Lower (mouth upstream to South Fork Eel confluence)	5,000	2,500	4,800	4,200	12,600	4,300	5,900	10,400
Upper (South Fork Eel confluence to Scott Dam)	400	200	500	400	2,800	1,000	17,500	25,600
Van Duzen	200	100	200	300	500	200	7,400	10,700
South Fork Eel	1,000	500	1,000	800	4,000	1,400	11,600	17,400
North Fork Eel	100	50	100	50	100	50	1,500	2,000
Middle Fork Eel	200	150	300	300	1,400 1/	600	1,500	2,300
Subtotal	6,900	3,500	6,900	6,050	21,400	7,550	45,400	68,400

1/ Includes an estimated 650 angler-days from May 30-June 30.

Table 6. Average Angler-Day Use (effort) and Total Catch of Trout (1956; 1957), Salmon and Steelhead Trout (1956-1957; 1957-1958), Northwestern California Streams. (Continued)

River	Salmon Effort	Salmon Catch	Early-run Steelhead Trout (Aug.-Oct.) Effort	Early-run Steelhead Trout (Aug.-Oct.) Catch	Late-run Steelhead Trout (Nov.-Feb.) Effort	Late-run Steelhead Trout (Nov.-Feb.) Catch	Trout Effort	Trout Catch
OTHER SMALLER STREAMS (Little, Elk, Bear R., etc.)	900	450	300	300	300	400	2,800	9,100
MATTOLE	600	400	200	200	1,500	500	3,000	8,000
Total	58,300	29,300	65,600	61,550	51,100	17,750	131,800	240,300

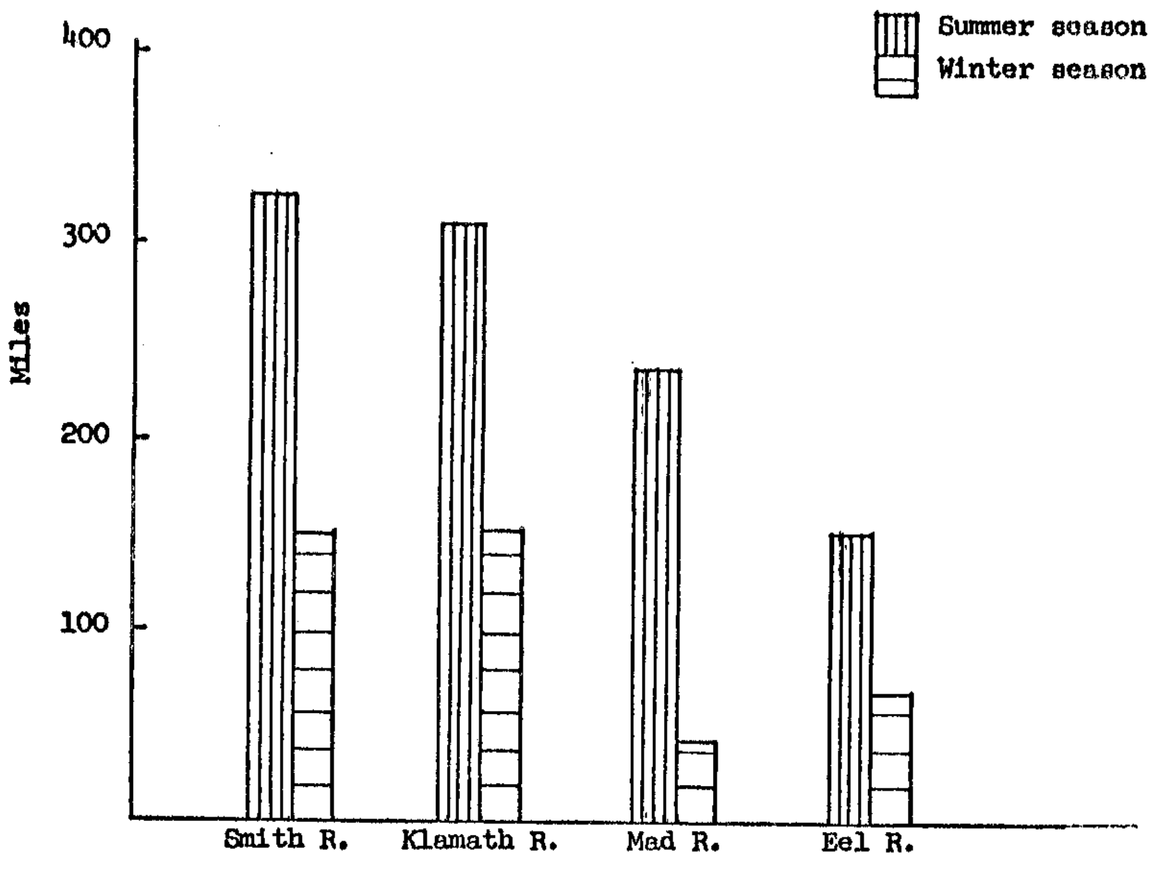


Fig. 3 One-way distances traveled by anglers to fish in major Northwestern California streams. (Based on 851 random angler-interviews in the summers of 1956 and 1957 and winters of 1956-57 and 1957-58.)

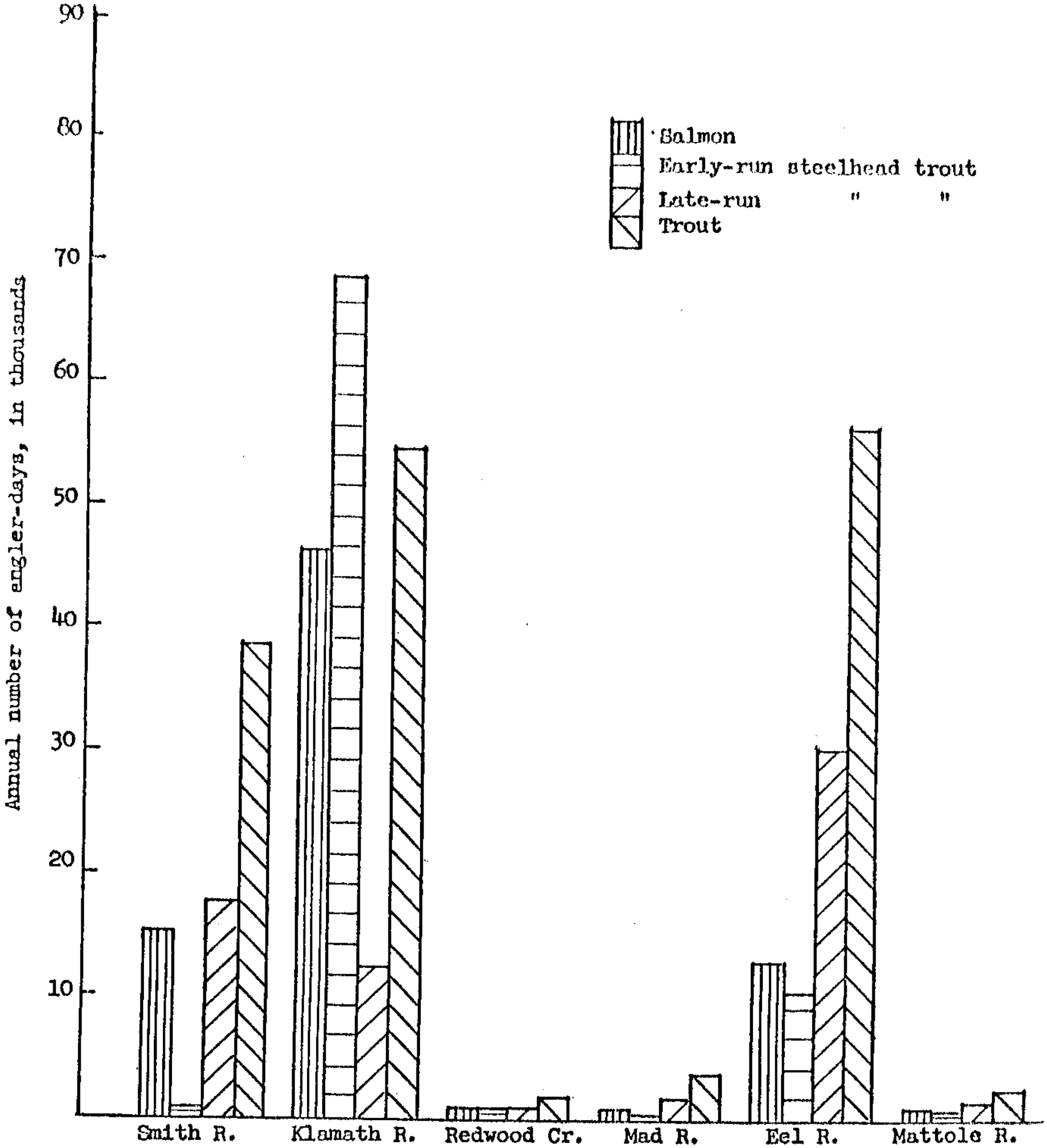


Fig. 4 The sport fishery effort in major Northwestern California drainages, summers of 1956 and 1957 and winters of 1956-57 and 1957-58.

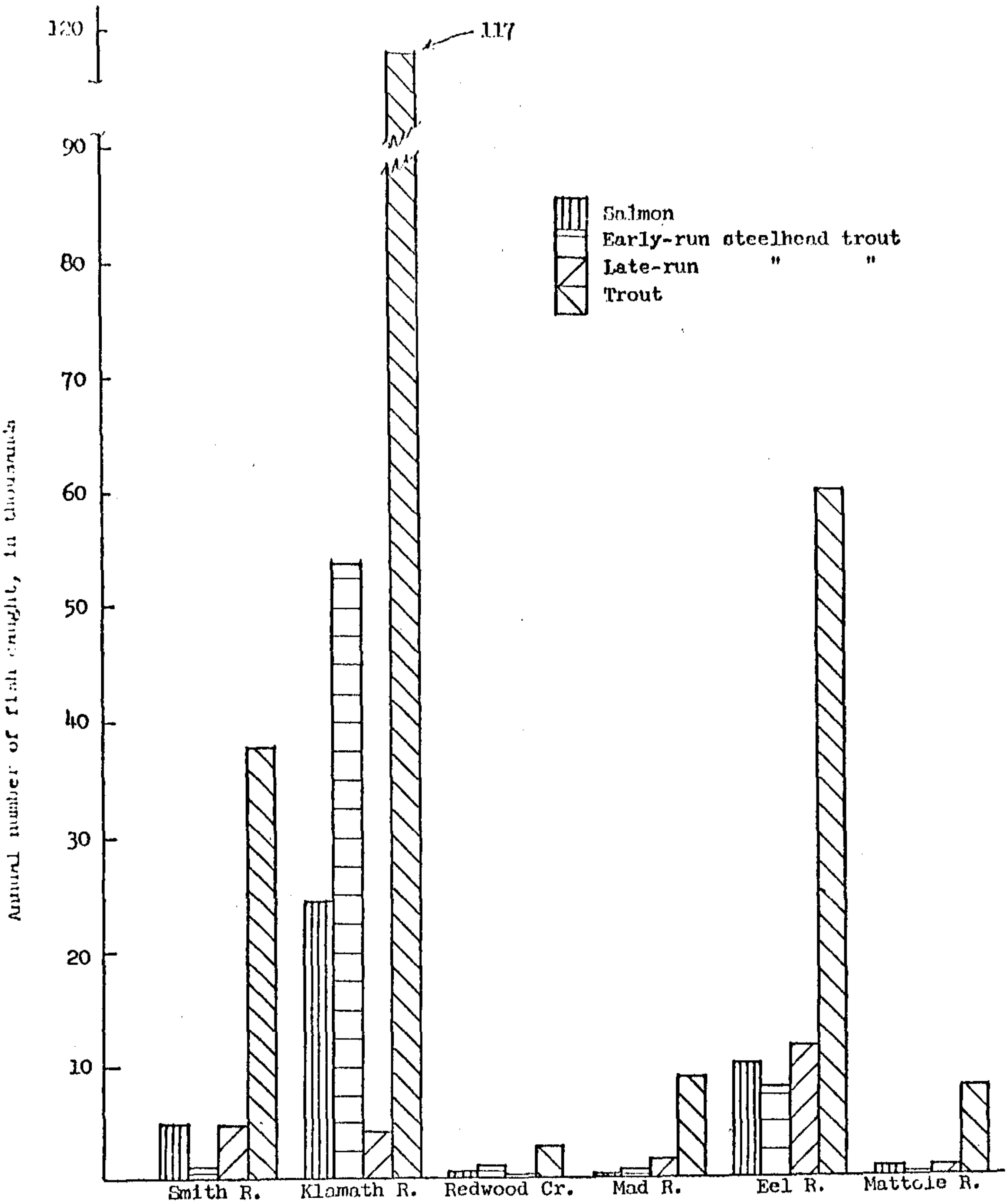


Fig. 5 The sport fishery catch in major Northwestern California drainages, summers of 1956 and 1957 and winters of 1956-57 and 1957-58.

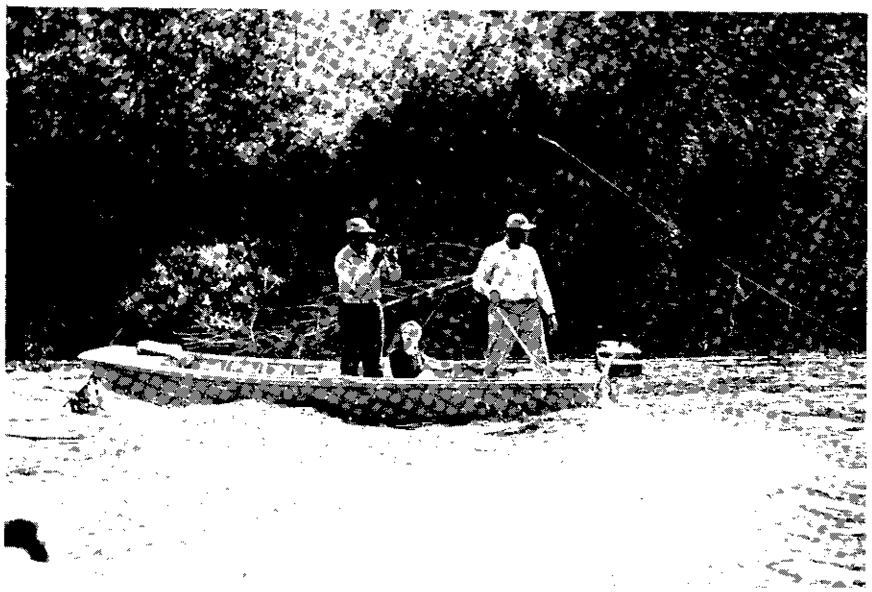


Fig. 6. Boats are commonly used by anglers when they fish for salmon and steelhead trout in the riffles and estuary of Klamath River.

Fig. 7. Salmon and steelhead fishing in Mattole River attract many fishermen from nearby and distant areas.

The principal inland types of fishing that attract fishermen to these streams and the relative catch by numbers are presented graphically in figures 4 and 5. Some of the most notable fisheries include late-run steelhead trout in the Smith River, the salmon and early-run steelhead trout in Klamath River, and the salmon and late-run steelhead trout in the Eel River.

The amount of fishing pressure on salmon and steelhead trout is dependent upon the time and intensity of spawning migrations of these ocean-run fish. During the chinook salmon runs, anglers concentrate in the estuary and riffle areas (figures 6 and 7). Especially noteworthy are the estuary salmon fisheries of the Smith, Klamath (figure 8), and Eel Rivers. The anglers follow the runs upstream as the fish move toward the spawning beds. Although sizable runs of coho salmon ascend the streams, relatively few of these fish are caught by anglers. The short duration of the run and the accompanying high, turbid flow result in light stream fishing pressure on coho salmon.

Accompanying the chinook run, and occasionally preceding it, is a run of relatively small steelhead trout. As these "half-pounders" enter the rivers in late summer and early fall, fishermen congregate at accessible points along the main streams. The fishery for this run in Klamath River is outstanding. Fishing for larger late-run steelhead trout develops as the fish enter the streams in increasing numbers during the winter. A high, roily flow limits fishing during the winter season.

Trout fishing in many of the streams exceeds the effort expended, in terms of fishing days, to catch salmon and steelhead trout. However, much of the summer trout fishing is incidental to the general recreational activity of vacationists and tourists. Salmon and steelhead trout fishing in fall and winter, on the other hand, is done by anglers who visit the area for the prime purpose of fishing.

Inland drainages provide more than 2,000 miles of main fishing streams and tributaries and several times this amount of smaller tributaries. About two-thirds of the main streams are reasonably accessible although occurring largely in mountainous and rough terrain. During the creel study, more than 300,000 fisherman-days were annually expended on these streams to catch 347,000 fish. Much of the fishing occurred in the most popular and readily accessible stream sections and estuaries. Sport fishermen harvested about 17 percent of the 1956 salmon run and about 7 percent of the 1956 steelhead trout run. In addition to adult steelhead trout that return from the ocean, 200,000 juvenile steelhead trout were harvested.

Fishing on mountain lakes and reservoirs also is important. Alpine lakes provide good trout fishing although the number of fishermen-days is small. Man-made reservoirs (Van Arsdale, Benbow, and Lake Pillsbury on Eel River) support moderate fishing for warm water species and trout.

A series of brackish water lagoons bordering the ocean support trout fishing primarily. Coho salmon and cutthroat and steelhead trout provide fishing in Big and Stone Lagoons, and Lake Earl. Sport fishing in lagoons is largely restricted to a period of several weeks following the opening of the fishing season near the end of May. However, it serves as a valuable complement to the stream and estuary fisheries.

An angler survey, conducted by California Department of Fish and Game in 1956, and additional studies by the Bureau of Sport Fisheries and Wildlife indicated that most of the river-caught salmon and the majority of the steelhead trout that are caught by sports fishermen in the Department's Region 1 are taken from the streams of the northwest coastal area. Region 1 includes the Sacramento River in Shasta and Tehama Counties as well as most of the northwestern California streams.

Income from recreational trade is important to the economy of the north coastal area. Fishermen expenditures are an important part of this recreational trade. Personnel of California Division of Beaches and Parks, interviewing campers and visitors in Northwestern California parks in 1957, found that 25 percent of those interviewed, fished in nearby streams during their visits. The Forest Service noted a 200 percent increase in the number of recreational visitors to the Six Rivers National Forest from 1953 to 1956. More than half of the visitors stated that their first purpose in visiting National Forests was fishing, principally in the streams within the forest boundaries.

Ocean and Coastline Sport Fishing

A variety of fish and shellfish are sought by sportsmen along the northern California coastline. Deep sea fishing, surf casting, clam digging, and skindiving are all increasing in popularity.

Of these fisheries, ocean trolling for chinook and coho salmon is the most important. This sport fishery extends along the entire northern California coast. Principal concentration points are in the vicinity of Humboldt Bay and Trinidad Head. Fewer anglers fish offshore from Crescent City and Shelter Cove.

Private small boats and licensed party boats are used for this sport fishing. Most anglers fish from private boats. Party-boat use has increased in recent years.

Fishing intensity and success in the ocean along the coast have varied greatly from season to season during recent years. The proportion of chinook salmon to coho salmon in the catch has also varied. In contrast with the sport fishery for other ocean-caught species in waters of Central and Northern California, the catch of salmon has shown a marked increase.

The total sport catch of chinook salmon in Northwestern California in 1956 is estimated to have exceeded 44,000 fish. Of this total, about 30,000 were caught in the streams and 14,000 in ocean waters. The estimated sport catch of coho salmon was 18,000 fish; about 16,000 were caught in the ocean and 2,000 in the streams.

Other sport fisheries along the coast are supported by deep-water species as well as those living in the shallow and intertidal areas. Many fish other than salmon are caught by boat fishermen while fishing for salmon in the ocean. Although salmon are of principal interest to the boat fishermen, such fish as lingcod, rockfish, hake, and sole are taken in large numbers.

Most fishing from the beach is done along the flat sandy stretches and from several rocky promontories for such species as surf smelts, sea-perch, kelp greenlings, rockfish, and lingcod. Sport fishing by net for surf smelts is concentrated at points along the shoreline where these fish congregate to spawn (figure 9).

Various kinds of shellfish are taken in several different habitats. Capers, soft-shell, and Washington clams abound in protected bays. Razor clams are found on sandy, flat beaches exposed to the pounding surf. Along rocky sections of the coast, abalone and scallops may be taken by wading or skindiving. Crabs are netted by sportsmen in the more protected waters. The value of the razor clam sport fishery is illustrated by a single day's count of over 2,000 clam diggers along a one-mile section of Clam Beach.

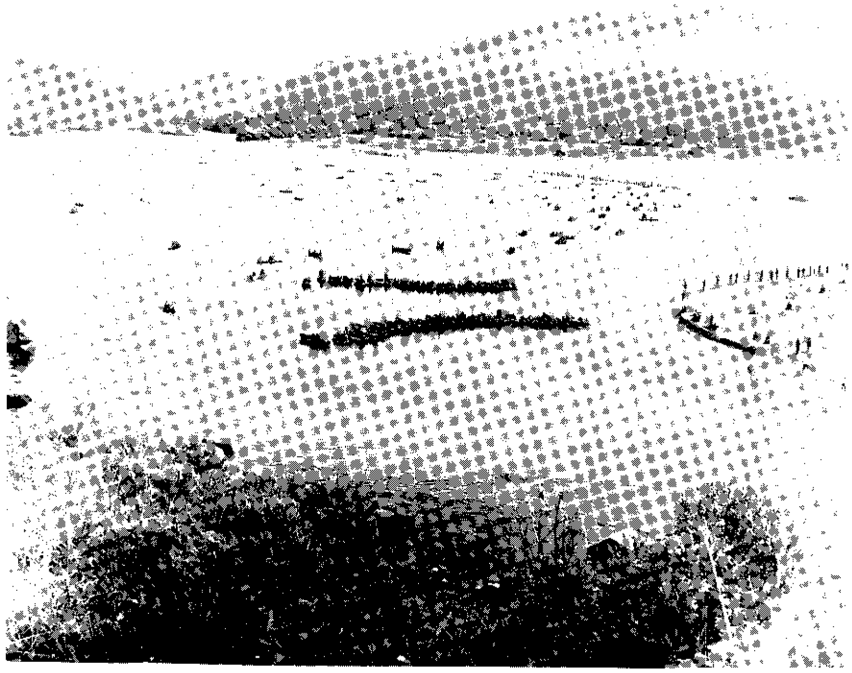


Fig. 8. Intensive fishing for salmon occurs in Klamath River Estuary during the annual spawning runs.

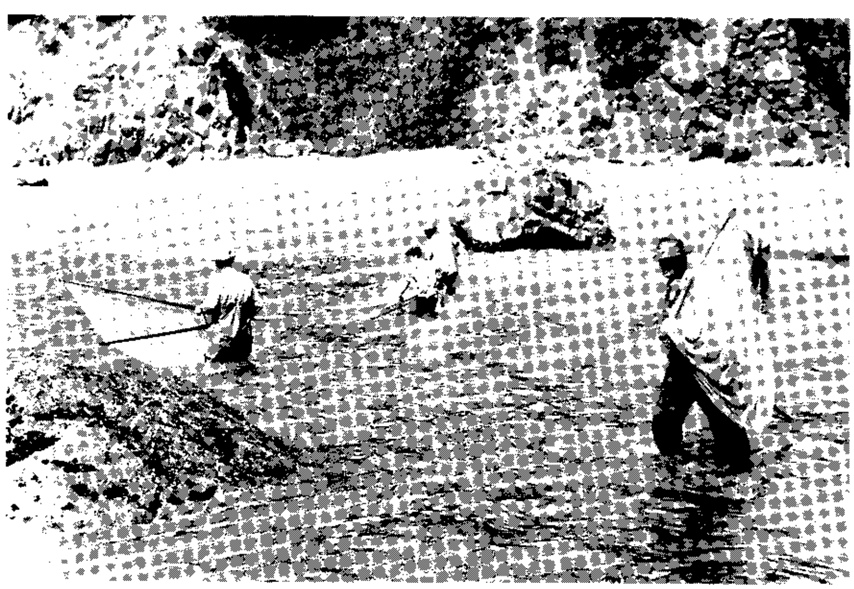


Fig. 9. Smelt fishing with "A" frame nets near Trinidad Head -- one of the many sport fishing activities which occurs along the coast.

The Commercial Fishery

Introduction

The commercial fishery is a basic industry of Northwestern California. The income received by the commercial fishing industry is exceeded only by that of the lumbering industry, the tourist and recreational trade, and agriculture. The ports of Northwestern California with their fishing fleet of approximately 500 vessels manned by 1,000 commercial fishermen represent a thriving and active industry (figure 10). Besides the direct value to the fisherman, more than a dozen plants are engaged in processing fishery products. In addition, construction and maintenance of fishing vessels, sales and service of fishing equipment, and dock facilities for fishermen represent sizable businesses in themselves.

Fishing Ports and Fish Landings

The five fishing ports receiving most of the fish landings of Northwestern California are Crescent City, Trinidad Head, Eureka, Fields Landing, and Shelter Cove. These ports, with the exception of Shelter Cove, have fish landing equipment with harbor facilities (figure 10). A variety of sport fishing facilities is also available at these various ports.

In the period 1935-1940 a significant shift of trawlers from San Francisco to the north coast occurred with greatly increased trawling in these ocean waters.

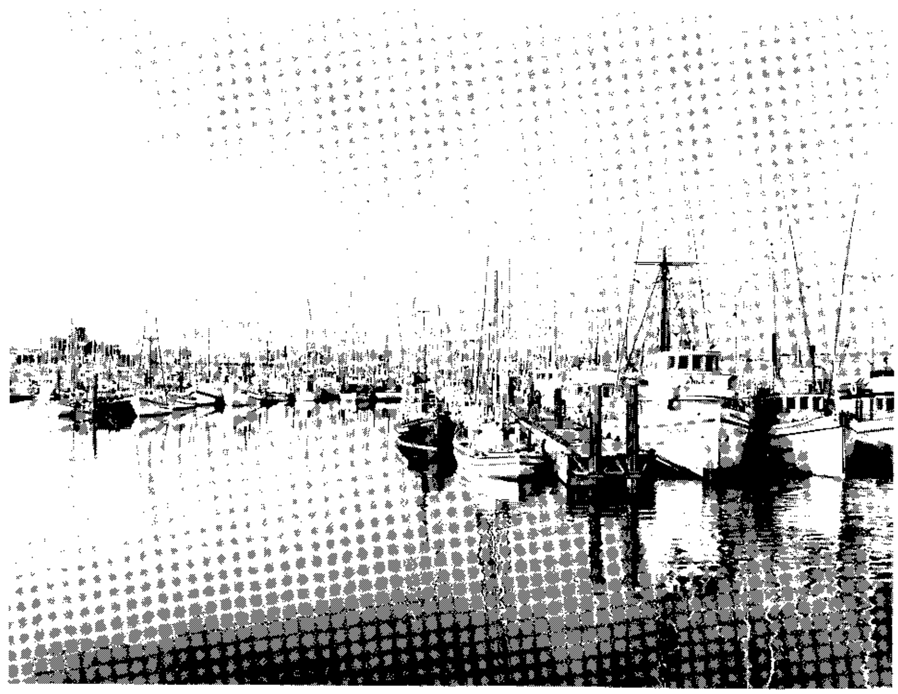


Fig. 10. This Eureka troll fishing fleet, Humboldt Bay, is indicative of the valuable commercial fishing industry of Northwestern California.

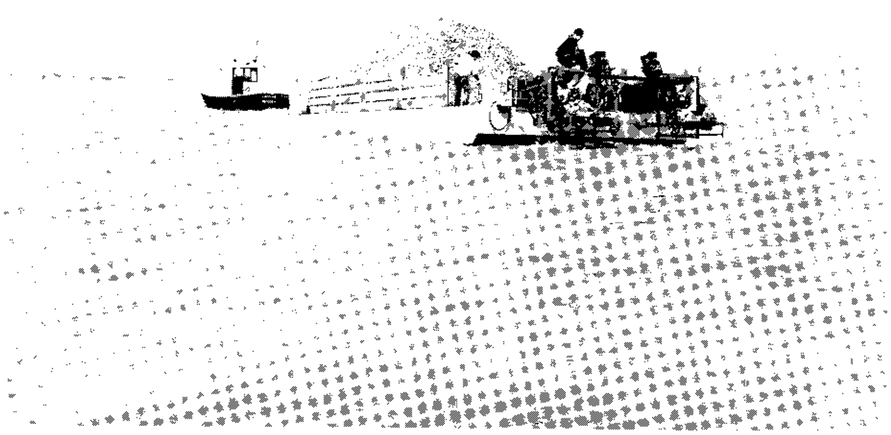


Fig. 11. The oyster fishery of Humboldt Bay is an important and growing industry of this coastal area.

Since 1955 the giant Pacific oyster, planted and cultured in Humboldt Bay, (figure 11) has risen to considerable commercial importance. Shrimp fishing is also of importance off Crescent City coast with landings at this port amounting to more than a half-million pounds in recent years.

Table 7 presents a summary of the annual average landings in these California ports for the period 1947 through 1956. During this period the annual landings averaged more than 25,000,000 pounds and had a value of almost $2,500,000 to the fisherman. Crab, salmon, sole, and albacore have had the highest values totalling more than $2,000,000 annually.

Table 7. Average Annual Fresh Fish and Shellfish Landed by Commercial Fishing Fleet for Period 1947-1956, Northwestern California Ports

Species	Crescent City Weight	Crescent City Value	Trinidad Head Weight	Trinidad Head Value
Crab	2,499,213	$336,445	613,062	$83,731
Sole 1/	453,080	26,684		
Salmon 2/	785,519	217,753	37,982	9,557
Albacore	82,608	14,586	2,705	512
Rockfish	81,285	3,444		
Sablefish				
Halibut 3/				
Lingcod	106,078	8,295		
All Other Species 4/	358,290	29,733	7,792	1,139
Total	4,366,073	$636,940	661,541	$94,939

Species	Eureka Weight	Eureka Value	Fields Landing Weight	Fields Landing Value
Crab	1,798,828	$ 234,850	843,319	$105,780
Sole	8,075,733	402,385	2,245,421	131,365
Salmon	1,113,600	320,488	91,231	24,298
Albacore	767,075	131,005	28,718	4,742
Rockfish	1,681,068	66,147	764,242	27,814
Sablefish	453,544	41,043	165,457	10,609
Halibut etc.	133,102	18,246	126,609	3,245
Lingcod	307,609	24,057	117,121	8,962
All Other Species	933,861	65,528	445,814	42,158
Total	15,264,420	$1,303,749	4,827,932	$358,973

Species	Shelter Cove Weight	Shelter Cove Value	Total by Species Weight	Total by Species Value
Crab			5,754,422	$ 760,806
Sole			10,774,234	560,434
Salmon	134,786	$33,220	2,163,118	605,316
Albacore	4,608	700	885,714	151,545
Rockfish			2,526,595	97,405
Sablefish			619,001	51,652
Halibut etc.			259,711	21,491
Lingcod	4,842	409	535,650	41,723
All Other Species	2,979	267	1,748,736	138,825
Total	147,215	$34,596	25,267,181	$2,429,197

1/ This includes the total for rex, petrale, English and Dover sole.
2/ See also table 8 for detailed landings covering 10-year period 1947-1956.
3/ This is a total for Pacific, arrowtooth halibut, and sand dab.
4/ Includes sporadic shark and skate fishery extending through 1952. Hake landings important since 1954.

The Ocean Salmon Fishery

The commercial salmon catch in the ocean off Northwestern California consists primarily of two species: chinook and coho salmon. Coho salmon landings in Northwestern California ports in 1952, the only year of available records, accounted for 48 percent of the total weight. Steelhead trout may not be legally landed in California ports.

Past reports show the river fisheries on the Eel, Klamath, Smith, and Mad Rivers have been of great importance. As early as 1857 the records show 2,000 barrels of cured salmon and 50,000 pounds of smoked salmon prepared from Eel River catches. In early years, a variety of gear was used on the rivers, including seines, gillnets, and traps. The Mad River was closed to commercial fishing in 1919, Eel River in 1922, and Klamath and Smith Rivers in 1933.

Commercial trolling for salmon had moved into the ocean waters of Northwestern California by 1916. During earlier years, total river catches exceeded that of the ocean but the troll fishery grew rapidly. The present-day salmon trolling boat (figure 10) usually has four poles and six lines with four hooks each. Most boats now use power gurdies which greatly facilitate the landings. Since 1919 annual landings have ranged from one to more than three million pounds (table 8). In 1956, the highest year of record, 3,695,000 pounds were landed. Salmon landings in ports of Northwestern California indicate the importance of the salmon industry in this area and also suggest the contributions these north coastal streams are making to the total ocean salmon catch.

Table 8. Commercial Salmon Landings, 1947-1956, Northwestern California Ports. 1/

Year	Crescent City Weight	Crescent City Value	Trinidad Head Weight	Trinidad Head Value	Eureka Weight	Eureka Value
1947	1,153,916	$ 245,207	95,515	$20,297	1,673,151	$ 355,545
1948	733,744	198,844	71,450	19,363	976,003	264,497
1949	465,499	110,510	37,436	8,887	902,352	214,218
1950	819,450	192,817	56,654	13,331	435,473	102,467
1951	412,494	107,125	22,340	5,918	703,705	182,752
1952	877,206	210,705	15,734	3,779	526,471	126,458
1953	380,522	92,793	26,172	6,375	689,042	167,851
1954	814,077	247,886	25,324	7,711	1,057,322	321,955
1955	985,831	342,227	29,201	9,906	1,772,344	619,322
1956	1,212,460	429,418			2,400,142	849,824
Total	7,855,199	$2,177,532	379,826	$95,567	11,136,005	$3,204,889
Average (10 yr.)	785,519	217,753	37,982	9,557	1,113,600	320,489

Year	Fields Landing Weight	Fields Landing Value	Shelter Cove Weight	Shelter Cove Value	Totals Weight	Totals Value
1947	172,170	$ 36,607	549,154	$116,695	3,643,906	$ 774,351
1948	203,190	55,064	364,083	98,666	2,348,470	636,434
1949	45,956	10,910	178,321	42,333	1,629,564	386,858
1950			42,891	10,092	1,354,468	318,707
1951	29,184	7,579	103,247	26,813	1,270,970	330,187
1952					1,419,411	340,942
1953	178,527	43,489			1,274,263	310,508
1954	210,089	63,972	27,886	8,491	2,134,698	650,015
1955	73,197	25,356			2,860,573	996,811
1956			82,273	29,115	3,694,875	1,308,357
Total	912,313	$242,977	1,347,855	$332,205	21,631,198	$6,053,170
Average (10 yr.)	91,231	24,298	134,786	33,220	2,163,118	605,317

1/ Extracted from California Department of Fish and Game Fish Bulletins.

Ocean Salmon from Streams of Northwestern California

The importance of the contribution of Northwestern California streams to the ocean salmon fishery has not been clearly determined. It is recognized that these streams contribute significantly not only to the salmon fishery of the California waters but also to the Oregon and Washington ocean fisheries. Efforts to determine the contribution of these streams have been made by tagging ocean fish and subsequently recapturing tagged fish in their native streams and by marking immature salmon in streams of their origin and noting their occurrence in the ocean catch. Both of these methods offer many difficulties statistically, including an assumption of random mixing and adequacy of tag returns either in the ocean or the stream.

Studies by the California Department of Fish and Game and by California Department of Water Resources are enlightening on some aspects of the problem. These studies show that chinook salmon move great distances from the coastal streams of their origin. One of the studies showed that most of the chinook salmon produced in the Sacramento River were caught in the commercial troll fisheries off the coast of Oregon and Washington. Only 7.3 percent of the total contribution of Sacramento River to the California commercial catch was made in Northwestern California coastal waters. The results of that study suggest that while Northwestern California streams may contribute to catches made in Oregon-Washington coastal waters they generally contribute to only relatively nearby waters. On the other hand, coastal streams of Oregon are known to contribute significantly to the coho salmon catch in the ocean off Northwestern California.

For purposes of this report, a reasonable estimate of the contributions of the Northwestern California streams can be made on the basis of the spawning escapement of both coho and chinook salmon. The use of a ratio of escapement to total catch is tempered by the known or estimated commercial and sport catch during recent years and by ratios used for other streams.

During recent years a spawning escapement of 56,000 coho salmon has been estimated for these north coastal streams (table 1). It is also estimated that twice as many fish contribute to the total commercial and sport catch. Of the total catch, about 2,000 coho salmon are taken in Northwestern California streams, and the remainder, 106,000, are taken in the ocean. The ocean sport catch of coho salmon off Northwestern California in recent years amounted to about 16,000 fish, and total commercial landings off the Eureka region have been about 137,000. These streams are credited with a contribution to the total ocean catch which equals about two-thirds of the catch of coho salmon in the Eureka offshore area.

The number of chinook salmon originiatng in Northwestern California streams is greater than that of coho salmon. Assuming a catch-to-spawning-escapement ratio of 2.5:1, the average annual catch attributable to these streams is 330,000. A catch-to-escapement ratio of 3:1 frequently has been assigned to the salmon of Sacramento River and other California streams. Even larger catch-to-escapement ratios have been recorded for individual tributaries of the Columbia River. About 7,000 chinook salmon have been caught annually in the ocean sport fishery and 27,000 in the stream sport fishery in recent years. The remaining 296,000 salmon, or approximately 3,582,000 pounds, are assigned to the commercial troll fishery. This estimate of the commercial catch of chinook salmon originating in California north coastal streams is equivalent to about 45 percent of the average annual chinook salmon landings of California over the past ten years.

WILDLIFE SECTION

Cover Types

The redwood belt in Northwestern California extends along the coast in a narrow strip about 35 miles wide ranging in elevation from sea level to 2,000 feet. In this belt summers are mild but foggy, and winters are wet. Redwoods are usually found in association with Douglas-fir, except on valley flats where stands are essentially pure. Western hemlock, western red cedar, madrone, California bay, grand fir,and red alder are found intermixed in the redwood forest. Some of the more common shrubs forming a low understory in the redwood association are California and red huckleberry, blue blossom, wax myrtle, salal, and thimbleberry. Sword fern, deer fern, redwood sorrel, and a vast array of shade-loving herbs are also components of this understory.

The Douglas-fir forest is located inland and at elevations above the redwood belt but below 4,500 feet. However, Douglas-fir is also common in places near the coast where it is in association with redwoods and tanbark oak. In some areas light mixtures of western hemlock, grand fir, or Sitka spruce are found. Hardwoods occuring in the Douglas-fir forest are madrone, California bay, red alder, and tanbark oak. Shrubs characteristic of the area are California huckleberry, manzanita, white thorn, tobacco bush, buck brush, deer brush, blue blossom, flowering currant, thimbleberry, and salmonberry.

Ponderosa pine forests are scattered at higher elevations in the eastern part of the area. Other conifers in this forest are Jeffrey, sugar, and western white pine and red and white fir. Shrubs of this forest area include manzanita, tobacco bush, buck brush, ceanothus, western serviceberry, California hazel, poison oak, and mountain-mahogany. White alders occur along streambeds. A variety of herbs and grasses are found, including bracken fern, lupine, hop clover, bur clover, yellow star-thistle, wild oat, and vetch.

The woodland-grass association is discontinuous. The woodland consists of stands of white oak and California black oak. The grass understory is composed mostly of California oatgrass, Pacific reed grass, and velvet grass. Characteristic shrubs of the woodland-grass area are buck brush, deer brush, coffeeberry, western mountain-mahogany, and various species of manzanita.

Chaparral occupies large areas in the southeastern part of Northwestern California and is also found in scattered small stands in other parts of the area. Shrubs of the chaparral community are mostly evergreen. Usually they are extensively branched, have a dwarfed habit of growth, and a large root system which accounts for their endurance during hot, dry summers. Chaparral is found in association with ponderosa pine, Douglas-fir, California black oak, and digger pine. The chaparral includes chamise, buck brush, western mountain-mahogany, scrub oak, and various species of manzanita.

Big Game

The Columbian black-tailed deer is found in large numbers in some areas of Northwestern California. Deer numbers north of the Klamath River in Del Norte County are low. Low soil fertility leading to an absence of proper nutrients in forage plants has been suggested as a possible explanation for the low population.

Deer herds along most of the coast use the same range all year. However, deer migration does occur in the headwaters of most of the drainages. It consists for the most part of a down-mountain drift when snow forces the animals out of higher elevations (plate III). Although migrations in the Trinity Alps are the most extensive, they are also widespread in the Marble, Scott Bar, and Trinity Mountains. Winter migration of deer in the Mattole River basin is practically non-existent. Winter migration in the Eel River occurs principally in the higher regions adjacent to Lake Pillsbury and the Middle Fork of the Eel.

In the dense stands of coniferous forest, especially redwood and Douglas-fir, populations of game animals are low. When the stands are opened by logging or fire, shrubs invade the area, provide more browse, and deer populations increase (figure 12).

A variety of plants are browsed by deer. Western mountain-mahogany, buck brush, and deer brush are heavily utilized. Other plants eaten in moderate amounts are chamise, blue oak, scrub oak, and black oak. Incense cedar and manzanita are eaten in smaller amounts. Grasses serve as green feed during late winter and early spring.

During late winter and early spring, large numbers of deer are lost due to infestations of stomach and intestinal worms. This condition usually occurs during years of heavy rainfall, when deer winter in grassy areas where grass constitutes a major portion of their diet.

National forest lands are generally accessible for hunting, though in some areas scarcity of roads exists. Much of the private lands are extensively posted against public hunting. About 25,000 acres of public domain have been withdrawn by the State for deer hunting and other recreational purposes in the Kings and Queens Peaks area of the Mattole River drainage. One large ranch, opened on permit basis in 1957 and 1958, provided considerable public hunting in the Mad River area. The average annual kill in Northwestern California from 1927-1957 was 6,521 deer (table 9).

Roosevelt elk are found in Humboldt, Del Norte, and Siskiyou Counties. They are established in two main areas: the Big Lagoon-Maple Creek area and the Prairie Creek-Gold Bluffs area. Small herds of elk are found in Del Norte County, in the vicinity of the Bald hills, and in Humboldt County in the vicinity of Freshwater Creek, Kneeland, and Elk River (plate III). The elk population in Humboldt and Del Norte Counties is estimated to be 1,000 to 1,500 animals. Elk hunting is not permitted at the present time.

These elk are non-migratory and occupy relatively small areas throughout the year. Their movements are geared to the abundance of food. Grasses, forbs, and ferns are the most important forage plants for these elk. Shrubs are utilized during the fall and winter in certain areas.

The black bear population in Trinity and Humboldt Counties is the largest in the state. Populations in the other counties are considerably smaller. In 1957, a total of 254 bears were killed in Northwestern California, most of these in Trinity, Siskiyou,and Humboldt Counties. Black bears may be taken at any time in Humboldt County. Mountain lions occur in moderate numbers in Humboldt, Trinity, Mendocino, and Siskiyou Counties.

Table 9. Deer Kill in Northwestern California. 1/

County	Yearly Average 1927-1952	1953	1954	1955	1956 2/	1957 3/
Del Norte	30	33	46	55	63	57
Humboldt	1,255	2,323	3,055	3,408	3,393	3,631
Trinity	911	1,220	1,242	1,242	1,811	1,633
Lake	281	429	508	496	406	317
Mendocino	1,173	2,187	2,616	2,294	2,025	1,924
Siskiyou	571	556	807	844	1,130	879
Glenn	323	303	344	390	425	405
Total	4,544	7,051	8,618	8,729	9,253	8,846

1/ Corrected kill presented for Lake, Mendocino, Siskiyou, and Glenn Counties since only a portion of these counties fall within Northwestern California.

2/ 1956 Regular Deer Season Report, California Department of Fish and Game.

3/ 1957 Regular Deer Season Report, California Department of Fish and Game.

Fig. 12. Deer and upland game find abundant food and cover in this mixed forest of the Eel River drainage.

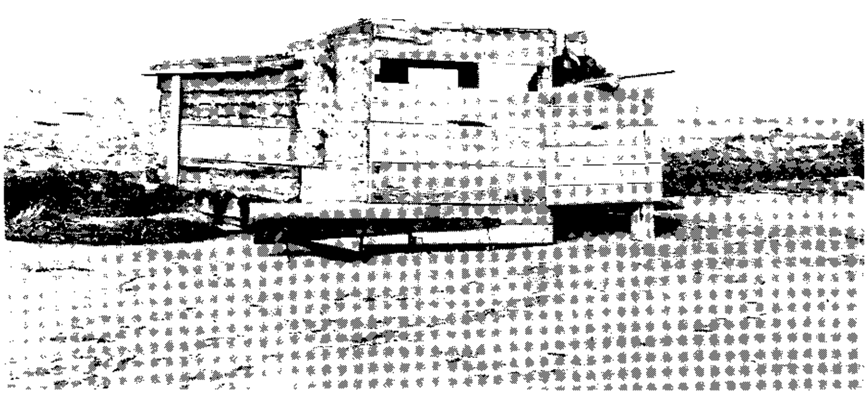


Fig. 13. The wood frame blind is commonly used when hunting black brants and ducks. Pictured area is on South Spit, Humboldt Bay.

Upland Game

Blue and ruffed grouse are found in low density throughout the area. Blue grouse inhabit Douglas-fir forests in all counties of the area. Ruffed grouse are found at lower elevations in Del Norte, Humboldt, western Siskiyou, and western Trinity Counties. This species inhabits forests composed of Douglas-fir, western red cedar, red alder, madrone, and tanbark oak. Ruffed and blue grouse are hunted for only two days in Del Norte, Humboldt, Siskiyou, and Trinity Counties.

California and mountain quails are common to the area. California quails are widespread in their distribution, preferring brushy stream bottoms and cut-over areas. Mountain quails are distributed from the upper part of the California quail range to the higher mountainous areas of the Smith, Eel, Klamath, Salmon, and Trinity River drainages, preferring the oak-pine country.

The California quail is hunted more than the mountain quail. The rugged country inhabited by the mountain quail and its unwillingness to take to the wing are largely responsible for the low hunting pressure. Mendocino and Humboldt Counties are good quail producing areas, but hunting pressure is limited because of extensive posting on private lands.

Small populations of ring-necked pheasants inhabit the Loleta-Ferndale and Arcata bottoms, and Scott and Round Valleys. Scott and Round Valleys consist principally of irrigated grain and alfalfa fields. Pheasants were abundant in Humboldt County thirty years ago when grain was the major crop. However, grain has been replaced by permanent pasture, and pheasants have become scarce. Pheasants have been planted by the California Department of Fish and Game in selected areas from time to time to provide hunting.

Band-tailed pigeons are found throughout the area. During their southward migration, band-tailed pigeons are numerous on the Kneeland Prairie, lower Eel, and upper South Fork Eel, with concentrations along the Trinity River near Hoopa, Helena, and Junction City and the Klamath River near Orleans. Heavy concentrations also occur in the lower Mattole River drainage. They inhabit the ponderosa pine and oak association of the mountains. In Northern California the highest pigeon kill occurs in Humboldt County, where about 5,000 birds are harvested annually.

Mourning doves occur throughout the region in woodland-grassland areas, except at the higher elevations. They concentrate in the Round Valley-Covelo area and the Klamath-Scott area. Doves are subjected to light hunting pressure in Northwestern California.

Gray squirrels inhabit the Douglas-fir and pine belt areas and were quite abundant many years ago. Gray squirrel populations encountered a low point in the thirties and are now apparently increasing. At the present time, hunting pressure is light.

Snowshoe hares are found in western Siskiyou and Trinity Counties and inhabit the higher mountains along streams in the timbered regions of the red fir forest. Brush rabbits are found throughout most of the coastal forest belt and brushy areas. Hunting pressure for rabbits in this area is light.

Fur Animals

Northwestern California supports a variety of fur animals. Minks, river otters, and beavers are the commercially important fur animals of the area. Ring-tailed cats, gray foxes, coyotes, muskrats, and bobcats are seldom harvested because of poor demand for their pelts. Pine martens and fishers are found in small numbers in the higher mountains. Both species are protected in California. Raccoons, weasels, badgers, spotted skunks, and striped skunks are also found in the area.

The number of licensed fur trappers is small; their number is largely determined by the market demand for fur. Most trapping is done on a part-time basis for sport by individuals who wish to augment their regular incomes.

Waterfowl

Concentrations of migrating waterfowl are found along the coast in the winter. Humboldt Bay is the most important resting area in the north coast area. Small concentrations are found in Lake Earl, Big Lagoon, and Stone Lagoon and in even fewer numbers along the rivers and streams.

Humboldt Bay and adjacent areas provide one of the most important wintering grounds for black brants (table 10). The bay is important because it supports a stand of approximately 3,000 acres of eelgrass, so vital in the brant's diet. Probably no other waterfowl species is so closely associated with one food. In years when eelgrass does not thrive, brants will feed in pasture lands and salt marshes near the bay.

Brants arrive in the bay in October and some remain in the area until they start their northward migration. The greatest concentrations occur in March and April with the influx of migrants from southern wintering areas, although the migration northward from the bay begins in late January or early February.

Brants are eagerly hunted by local sportsmen. In South Humboldt Bay, wooden framed blinds (figure 13), built especially for brant hunting, line the western shore. According to banding data, more brants are taken in Humboldt Bay than in any other area. It has been reported that 3,200 brants were killed or crippled in Humboldt Bay in 1959.

Table 10. Winter Counts 1/ of Black Brants, Humboldt Bay.

Year	Number	Year	Number	Year	Number
1932	29,415	1942	48,000	1951	36,000
1933	5,000	1943	18,000	1952	25,000
1934	18,860	1944	2,500	1953	28,000
1935	115,000	1945	16,000	1954	7,500
1936	50,000	1946	No data	1955	11,870
1937	22,500	1947	25,000	1956	19,010
1938	45,000	1948	27,120	1957	18,800
1939	29,000	1949	27,505	1958	11,300
1940	56,375	1950	32,500	1959	4,850
1941	50,000				

1/ 1932-1941 are February inventories by California Department of Fish and Game. (Moffet 1943.) 1942-1959 are January inventories by the U. S. Fish and Wildlife Service.

The principal migrant surface ducks visiting the area are American widgeons, pintails, and mallards. The more abundant diving ducks are scaups, scoters, and ruddys. Other species occurring are gadwalls, green-winged teals, shovelers, wood ducks, redheads, canvasbacks, ring-necks, goldeneyes, buffleheads, and mergansers. Canada geese and whistling swans are occasional visitors. Coots and Wilson's snipe also winter in the area. Large numbers of shorebirds inhabit the tidelands of Humboldt Bay and coastal shoreline.

A number of western Canada geese spend the winter on Castle Island, a small, rocky, wooded island one mile off the coast near Crescent City. In 1955 it was estimated that 80 of these geese were on the island. Castle Island appears to be the southern extent of their winter range.

Mallards are the most common summer resident. They nest along sloughs of the bays and rivers. A small number of cinnamon teals and wood ducks nest in the area during the summer.

A number of years ago, migrant waterfowl depended heavily on grain planted in the bottom lands which are now utilized for pasture. The birds now depend to a great extent on natural foods including pondweeds, bulrushes, pasture grasses, salt grass, and eelgrass. The presently small acreage in grain provides summer food for a few local birds.

Most waterfowl hunting is done in Humboldt Bay and adjacent areas. The two principal methods of hunting are sculling and hunting from blinds. In sculling, a specially designed boat with a low silhouette is used.

The sculler lies on his back in the boat and propels it with a single oar that extends through a hole in the stern. The sculler approaches the birds downwind and attempts to flush them into position for an overhead shot. In the second method, decoys are placed in the water in front of a blind and the hunter attempts to lure the birds within shooting range. Wooden-frame blinds, located on the beach, stilt blinds, and floating blinds are used.

Other Wildlife

Several species of whales were economically important until recent years. A whaling station was once operated at Fields Landing on Humboldt Bay; however, scarcity of whales in offshore waters forced cessation of this activity.

Northern sea lions and harbor seals reproduce in the coastal waters. Alaska fur seals and gray whales annually migrate along the coast en route to their breeding grounds, the Alaska fur seals going to the Pribilof Islands in the Bering Sea and the gray whales to the waters of lower Baja California. Other aquatic mammals occasionally appear along the coast but are rarely seen close to shore as are the gray whales and Northern sea lions.

Castle Island and other islands along the coast are inhabited or visited by harbor seals, Northern sea lions, and several species of birds including puffins, gulls, auklets, murres, and murrelets. They provide considerable interest, since they can be observed from the harbors and coastline roads.

Exploding human populations, conflicting philosophies on the use of land and water, improved roads and means of transportation, and many other pressures of modern living have brought about a multiplicity of problems to fish and wildlife managers throughout the country. These areas of concern are equally if not more pronounced in Northwestern California. This section of the report presents measures needed for the preservation and enhancement of fish and wildlife resources in order to meet hunting and fishing demands in Northwestern California. Solutions to the problems and needs are obvious in certain instances; no measures are readily apparent to reverse downward trends in fish and wildlife populations in other situations. The list of problems and needs is not intended to present priority categories, but merely to show where emphasis should be placed in any program affecting fish and wildlife resources.

a. Preservation and enhancement of fish and wildlife in water development planning. This subject will be treated in greater detail in the section on Fish and Wildlife in Relation to Water Development Planning.

b. Control of Pollution in estuarine areas and streams. Plans for industrial development in the Humboldt Bay area alone include paper pulp mills, an atomic power plant, hydroelectric plants, and numerous other industries that present hazards to water quality throughout the area. Strict control should be assured to prevent damage to the estuarine nursery grounds for many forms of important fish and sea foods as well as certain waterfowl and fur animals. Streams which provide migration routes for anadromous fish and habitat for resident species should be kept free from industrial and municipal pollutants.

c. Establishment of a management area for the protection and improvement of habitat conditions for the black brant. There is paramount need for setting aside a portion of Humboldt Bay to develop feeding and resting habitat for the black brant. Concentrations as great as 25 percent of the entire Pacific Flyway population frequent the Humboldt Bay area during the winter migration. Eelgrass beds along this section of the coast provide food that is essential to the diet of the black brant.

d. Control of sedimentation and blocking streams. Removal of gravel for industrial use, mining activities, highway construction, lumbering, and many other human activities contribute to stream deterioration. Frequently, gravel removal is directly responsible for muddy and roiled water conditions that cause loss of fish spawn. Log jams created by careless lumbering practices present barriers to migrating fish. Use of stream beds as a source of highway fill or for actual road location destroys fish habitat. Mining activities often disturb stream beds, destroy food-producing and fish spawning habitat, and release certain pollutants in the stream. All these activities need close coordination with fish and wildlife planning.

e. Maintenance of desirable streamflow. The flow in Northwestern California streams is inherently low during the summer and fall and is high during the winter and spring due to the rainfall pattern of the region. The characteristic low flow has been greatly accentuated in many streams by diversions or by watershed practices that accelerate runoff during periods of high water conditions. Water storage in headwater areas is needed to supplement natural flow. Logging practices which denude steep slopes of their vegetation should be modified and provision should be made to leave protective cover over highly-erodable areas. Clearing to provide agricultural land should follow a designed pattern to prevent excessive removal of all vegetative cover over extensive areas.

f. Improvement of access for hunting and fishing. Private land in the region is extensively posted, and, as a result, hunting and fishing are prohibited in large areas which are actually accessible by roads. Access to the large National Forest areas is likewise frequently blocked by posted private holdings. Improvement of access is generally needed to equalize hunting and fishing pressure which can be expected to show steady increases in future years.

PLANS FOR WATER DEVELOPMENT

Northwestern California comprises 8 percent of the total area of California and about 37 percent of the water resources originate there. As the demand for water increases in the highly populated portions of the Central Valley and Southern California, plans for export of excess water from Northwestern California are becoming more apparent. Demand for water by local communities and industries has also increased. Floods are common in these north coastal streams during the winter periods of heavy rains. In 1955, winter floods occurred throughout Northwestern California causing great damage to agricultural lands and property. Various plans for water development to meet the many needs are underway by the State of California, the Federal Government, and local groups.

Three major water development projects and a few minor ones are already in use or under construction. These include Copco power dams, far upstream on the Klamath River, and Pillsbury storage reservoir and Scott Dam on the upper Eel River which provide for interbasin diversion to the Russian River for hydroelectric and conservation purposes. Trinity Dam and Lewiston Diversion Dam, under construction by the Bureau of Reclamation will develop Trinity River water for export to Sacramento River through a system of tunnels to supply water for Central Valley Project. Power development will also be a major purpose. Other smaller reservoirs, providing storage for local use, are Dwinnell Reservoir on the Shasta River and Sweasey Reservoir on the Mad River.

The California Water Plan presented in 1957, has become recognized by the California legislature as a guide for water development in the state. It presents a master plan for the control, distribution, and use of water for the present and future needs in all areas of the State. The plan is intended to supplement existing water developments and to provide for coordination of all planning entities. It provides a broad and flexible framework for development in an orderly sequence throughout the State. It allows for the development of individual projects to meet various needs and anticipates alterations and improvements in project plans. It clearly suggests that developments should be fitted into the framework of the plan. It further describes the California Aqueduct System, a program including interbasin transfer facilities and water development projects to meet local requirements.

In outlining features for local development, California is divided into hydrographic areas, one of which is the North Coastal Area. This covers the coastal drainages from the Oregon-California state line, inclusive of the Mattole River, whereas the Water Plan area includes also the Noyo, Navarro, Garcia, and Russian Rivers lying in the south of the Mattole River. The State Water Plan discusses development features for these north coastal streams and, although differing considerably in detail from other plans, has great similarity in the objective of local storage and water transport.

The U. S. Army Corps of Engineers is studying the feasibility of flood control projects for various streams of Northwestern California and for harbor improvement.

The Humboldt Bay Municipal Water District is moving forward with the development of Ruth Dam on the Mad River and the distribution of water to new industries and towns of the Humboldt Bay area.

These numerous projects will all effect fish and wildlife resources but are not discussed in this report. This chapter gives emphasis to the effect on fish and wildlife of tentative water development projects by the Bureau of Reclamation.

The Bureau of Reclamation has developed plans similar to the California Water Plan to meet local water needs and to transport water outside Northwestern California. Projects proposed for initial construction (plate I), in probable order of development, would be the Upper Eel River, Middle Fork Eel River, and Upper Trinity and Adjacent Streams.

Ultimate development would include the Lower Eel River and Klamath River Extension.

The Upper Eel River project would include a dam 475 feet high at the English Ridge site on the Eel River which would impound 1,490,000 acre-feet of water. About 370,000 acre-feet would be diverted annually from the reservoir into a short tunnel through the ridge to the East Fork of the Russian River. Water diverted to the Russian River would be used for irrigation of lands in Mendocino, Marin, Lake, Napa, Solano, and Yolo Counties, and the remaining unused water would then be diverted through Clear Lake and Cache or Putah Creeks to Sacramento River.

A second project would include a system of storage reservoirs and diversions from the Middle Fork Eel River to Stony Creek, a tributary of Sacramento River. A 428-foot dam is considered for the Middle Fork Eel at the Etsel-Short site. A second dam on Short Creek would prevent water from overflowing a saddle between Short Creek and the Middle Fork Eel River. A dam at the Jarbow Ridge site, a short distance downstream from Etsel-Short damsite, would impound Middle Fork streamflow and divert it through a proposed tunnel to Grindstone Creek. The diverted water would be stored in proposed reservoirs at the Stony Creek site on Stony Creek and at the Newville site on the North Fork of Stony Creek. Power installations would be operated by release from these two reservoirs and at the proposed Black Butte Reservoir farther downstream. Engineering data for these several reservoirs are summarized in table 11.

Table 11. Reservoir Data, Middle Fork Eel River - Stony Creek Project.

Item	Etsel-Short	Jarbow Ridge	Stony Creek	New-ville	Black Butte 1/
	Reservoirs				
Height of dam	428	162	260	250	125
Full Pool:					
Elevation (MSL)	1,703	1,237	850	830	510
Capacity (1,000 acre-feet)	1,425		1,125	1,045	375
Area (acres)	9,500	1,000	13,700	9,900	7,100
Minimum pool:					
Elevation (MSL)	1,350	1,153	775	760	467
Area (acres)	300	300	7,900	5,600	3,900
Fluctuation (feet)	353	84	75	70	43

1/ Under construction by the Army Corps of Engineers.

It is tentatively planned by the Bureau of Reclamation that Etsel-Short and English Ridge Reservoirs would be operated to provide a flow of 60 second-feet during late fall and at least 30 second-feet at other times in the Eel River at Dos Rios, ten miles downstream from the Jarbow damsite.

The proposed Branscomb Dam and Reservoir on the South Fork of the Eel River, six miles below Branscomb, is being considered for conservation purposes. Improvement of fish habitat in the stream below the dam is also under consideration. This dam would impound enough water to provide a streamflow of 150 second-feet and a minimum recreation pool. Part of the streamflow would be used to meet future irrigation and industrial needs in the Lower Eel-Van Duzen area.

Another transbasin diversion proposal is included in the Upper Trinity and Adjacent Streams project, which would involve not only Trinity River but also Mad and Van Duzen Rivers. This entire development would consist of a total of eight reservoirs on streams of Northwestern California. The project would annually transport to Sacramento River Valley about two million acre-feet of water. By a system of tunnels and pump lifts, water would be made available to Helena Reservoir for transport through the Trinity Mountains to storage reservoirs for uses in the Central Valley. Helena, Burnt Ranch, and Ironside Mountain Dams would impound water at successive points downstream from Lewiston Diversion Dam, presently under construction. A tunnel through the Trinity Mountains at an upstream point on Helena Reservoir would transport waters to Clear Creek, a tributary of Sacramento River. Dinsmore Dam on the Van Duzen River, Pilot Ridge Dam on the Mad River, and Eltapom Dam on the South Fork Trinity River would provide additional storage for eventual transport by way of Helena Reservoir to the Sacramento River (plate I).

Ruth Dam, to be located on the Mad River upstream from Pilot Ridge Dam, in combination with the Essex Diversion, is being planned by the Humboldt Bay Municipal Water District. Impounded waters would be used for municipal and industrial purposes in the Eureka area. In the current planning of the Bureau of Reclamation, Butler Valley Dam would be constructed on the Mad River downstream from Maple Creek. The resulting impoundment would supply water to areas previously planned for irrigation by waters impounded by Ruth Dam and would also serve presently irrigated lands. Ruth Reservoir could then receive emphasis for recreational use in addition to providing another source of water during extremely dry years. Releases to maintain stream flow and to meet downstream demand for municipal and irrigation needs would have to be made from the dams on the Van Duzen, Mad, and South Fork Trinity Rivers.

The lower Eel River project would probably be constructed in the distant future. It would consist of three reservoirs on the lower Eel River: Indian Springs, Willow Creek, and Sequoia. Water from Indian Springs Reservoir, the uppermost of these reservoirs, would be delivered to Stony Creek by gravity tunnel, following the same general course as the water derived from Jarbow and Etsel-Short Reservoirs.

Klamath River Extension project would eventually include a series of four large reservoirs on Klamath River: Red Cap Creek, Happy Camp, Hamburg, and Ah Pah. Water collected in these reservoirs could be diverted through the divide to Ironside Mountain Reservoir on the Trinity River and then lifted by pumps to the proposed Helena Reservoir for diversion by a tunnel to the Sacramento River as described above for the Upper Trinity project (plate I).

Table 12. Reservoir Data, Upper Trinity and Adjacent Streams Project. 1/

Item	Reservoirs						
	Dinsmore	Ruth	Pilot Ridge	Eltapom	Ironside Mountain	Burnt Ranch	Helena
Maximum Pool:							
Elevation (MSL)	2,635	2,697	2,543	1,565	1,100	1,345	1,837
Area (acres)	3,300	2,200	3,700	5,600	1,700	3,700	16,000
Capacity (1,000 acre-feet)	465	126	480	1,000	180	600	2,831
Minimum Pool:							
Elevation (MSL)	2,522	2,600	2,345	1,355	1,000	1,300	1,657
Area (acres)	1,900	500	800	2,300	700	3,100	6,900
Capacity (1,000 acre-feet)	165	14	86	200	65	440	836
Fluctuation in pool (feet)	113	97	198	210	100	45	180
Height of dam (feet)	305	172	483	377	460	475	558
Streambed elevation (MSL)	2,340	2,535	2,070	1,200	650	880	1,285
Yield (1,000 acre-feet)	192	72	252	521	327	160	642

1/ Data supplied by Bureau of Reclamation June 1959.

Discussion, Fish and Wildlife Aspects

All of these developments would have significant and far-reaching effects upon fish and wildlife resources. Spawinng runs of salmon and steelhead trout would be seriously affected by most of the projects. Wildlife habitat in the reservoir areas would be adversely affected but would generally be benefited in the irrigation lands. The implied uses of water for industrial development suggest that secondary problems of first importance to fish and wildlife would arise.

Under the supposition that these major projects will be constructed, detailed consideration will have to be given to alleviate their effects on fish and wildlife. English Ridge Dam on the main Eel River and Etsel-Short and Jarbow Dams on the Middle Fork Eel would block important spawning runs of salmon and steelhead trout. Branscomb Dam would block a large portion of the coho salmon runs from their spawning areas. It would inundate the most valuable coho salmon spawning area in the Eel River. All of these dams would result in significant losses of deer winter range and inundate established migration routes in this important basin. Measures to alleviate project effects on habitat need to be carefully considered to arrive at reservoir operation and features of greatest advantage to fish and wildlife.

The lower Trinity development contemplates a series of three dams in addition to the Lewiston and Trinity Dams presently under construction. This newly proposed development would inundate most of the remaining spawning areas on the Trinity. The Eltapom Dam on the South Fork Trinity River would block most of the spawning habitat in this important tributary.

Construction of all proposed dams on both the Klamath and Trinity Rivers would virtually eliminate existing spawning areas utilized by anadromous fish in this drainage should passage facilities prove infeasible. Spawning habitat improvement downstream from the proposed Klamath River dam-sites would offer only slight compensation for loss of spawning area. The drastic losses of spawning area would necessitate hatchery propagation, use of articicial spawning channels, and intensification of use of the remaining accessible stream sections to maintain salmon and steelhead trout runs. Without due consideration for restitution, the loss of spawning area in the Klamath River drainage is expected to severely reduce the salmon and steelhead trout populations of Northwestern California.

Dams proposed for the Trinity River would result in a continuous chain of reservoirs for a large portion of the river. These reservoirs would result in inundation of important deer winter range. Winter concentrations in this area are several times greater than those of the summer. During heavy winter snows, the deer migrate down the slopes to lower elevations for winter browse. Deer migrate from the north-facing slopes toward the river and thence to the south-facing slopes. These routes would be blocked by reservoirs which would usually be held at high levels during winter migration periods. Eltapom would have similar effects upon deer habitat and migration routes in the South Fork Trinity.

Reservoirs would eliminate a moderate amount of upland-game habitat but would improve conditions for waterfowl. On newly irrigated lands, conditions would be improved for certain upland game species. Slight benefit would be expected for fur animals although some species would be more favored than others.

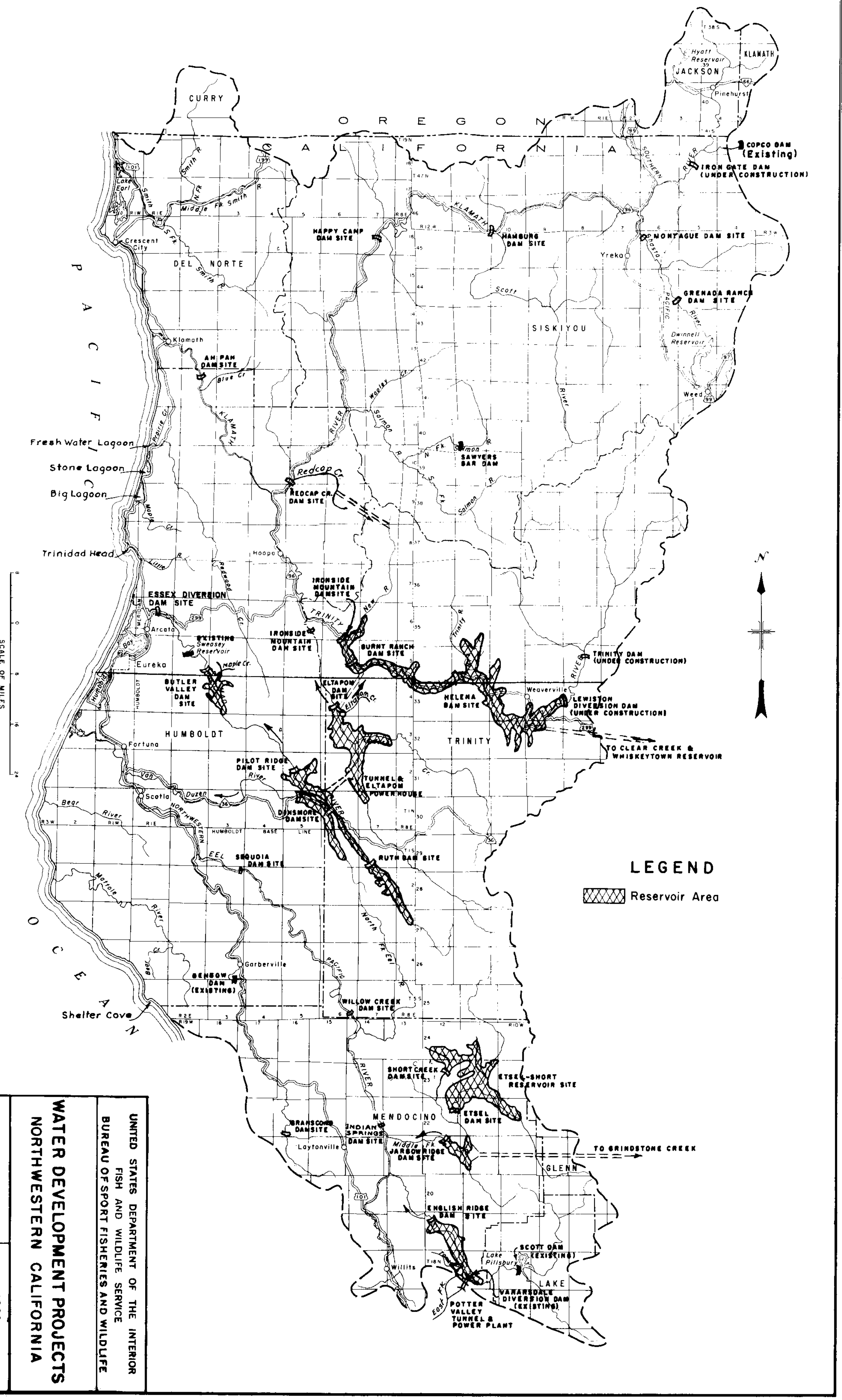
Construction of a storage dam near Ruth and a diversion dam at Essex has been planned by the Humboldt Bay Municipal Water District for municipal and industrial use. The Ruth site is well above the limit of salmon and steelhead trout migration, but the water to be stored will improve stream habitat through increased flow and will provide a reservoir trout fishery. At the Essex Diversion, satisfactory facilities and flow releases would be necessary for fish passage.

Water development plans of the Bureau of Reclamation include Pilot Ridge Dam which would provide storage for transport of water to Trinity River impoundments and the proposed Butler Valley Dam which would be developed to store water for local use. The Butler Valley Dam on the Mad River would reduce spawning habitat for anadromous fish. Spawning habitat used by many steelhead trout and coho salmon would be lost. Loss to chinook salmon would be small since few chinook salmon spawn above the damsite. Pilot Ridge Dam would not affect habitat presently used by anadromous fish.

Pilot Ridge and Butler Valley Reservoirs would inundate important deer winter range and disturb winter migration routes. Some upland-game and fur-animal habitat would be lost in the reservoir areas. Improved upland-game habitat would be created on irrigated lands and fur-animal habitat along streams below the dams would be improved. Because of their location near Humboldt Bay and river mouths, Butler Valley and Pilot Ridge Reservoirs would receive considerable usage by resident waterfowl as resting areas.

Proposals are not included in the Bureau of Reclamation's plans for transport of water from the Smith River, Redwood Creek, Mattole River, and other smaller drainages. However, to meet local municipal and irrigation needs, plans contemplate use of water derived from wells and stream diversions. Dependent upon the extent of stream diversions, time of year, and point of diversions, these local developments would have varying adverse effects on stream and streamside habitat for both fish and wildlife.

PLATES

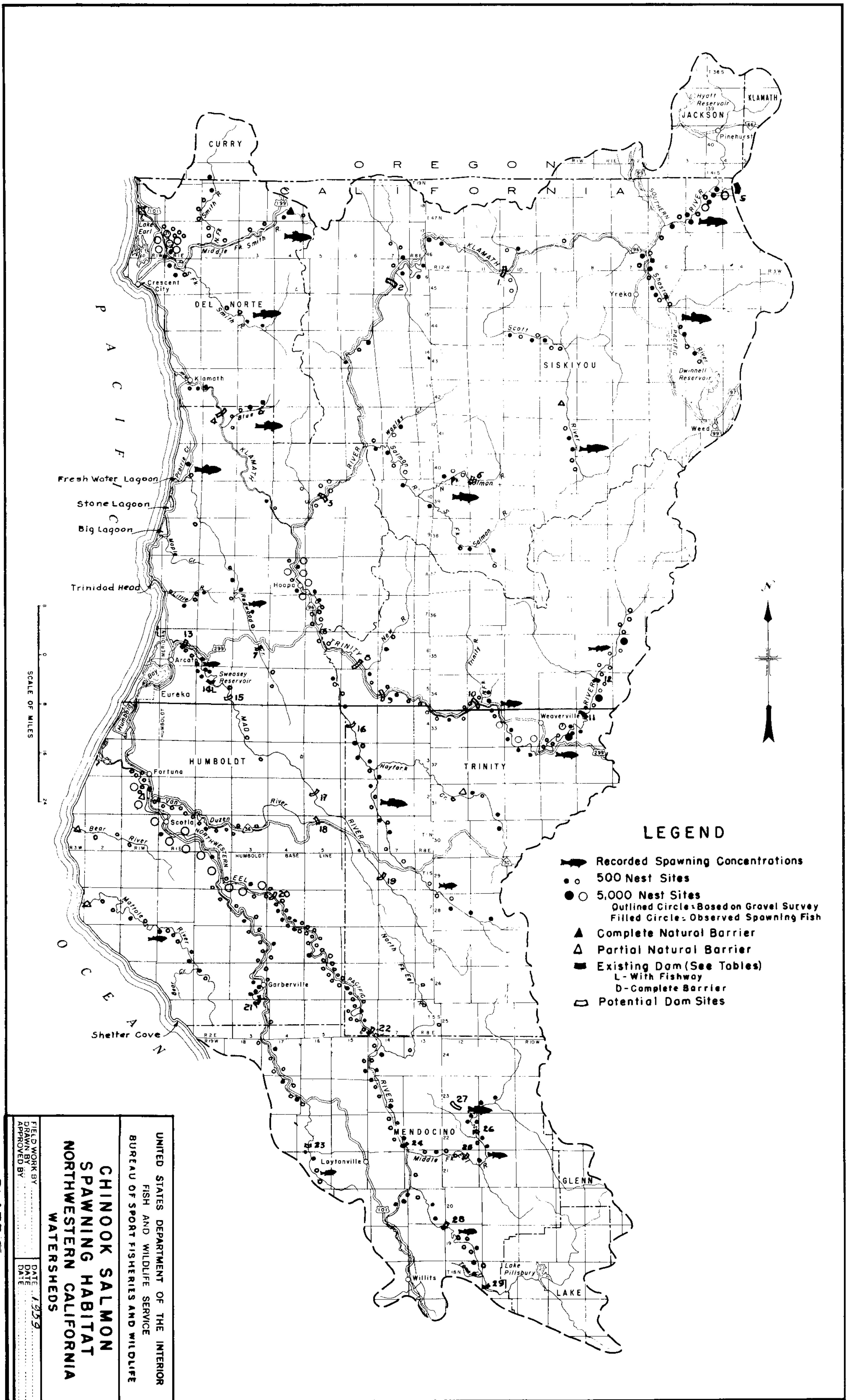


UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

WATER DEVELOPMENT PROJECTS
NORTHWESTERN CALIFORNIA

1960

PLATE I

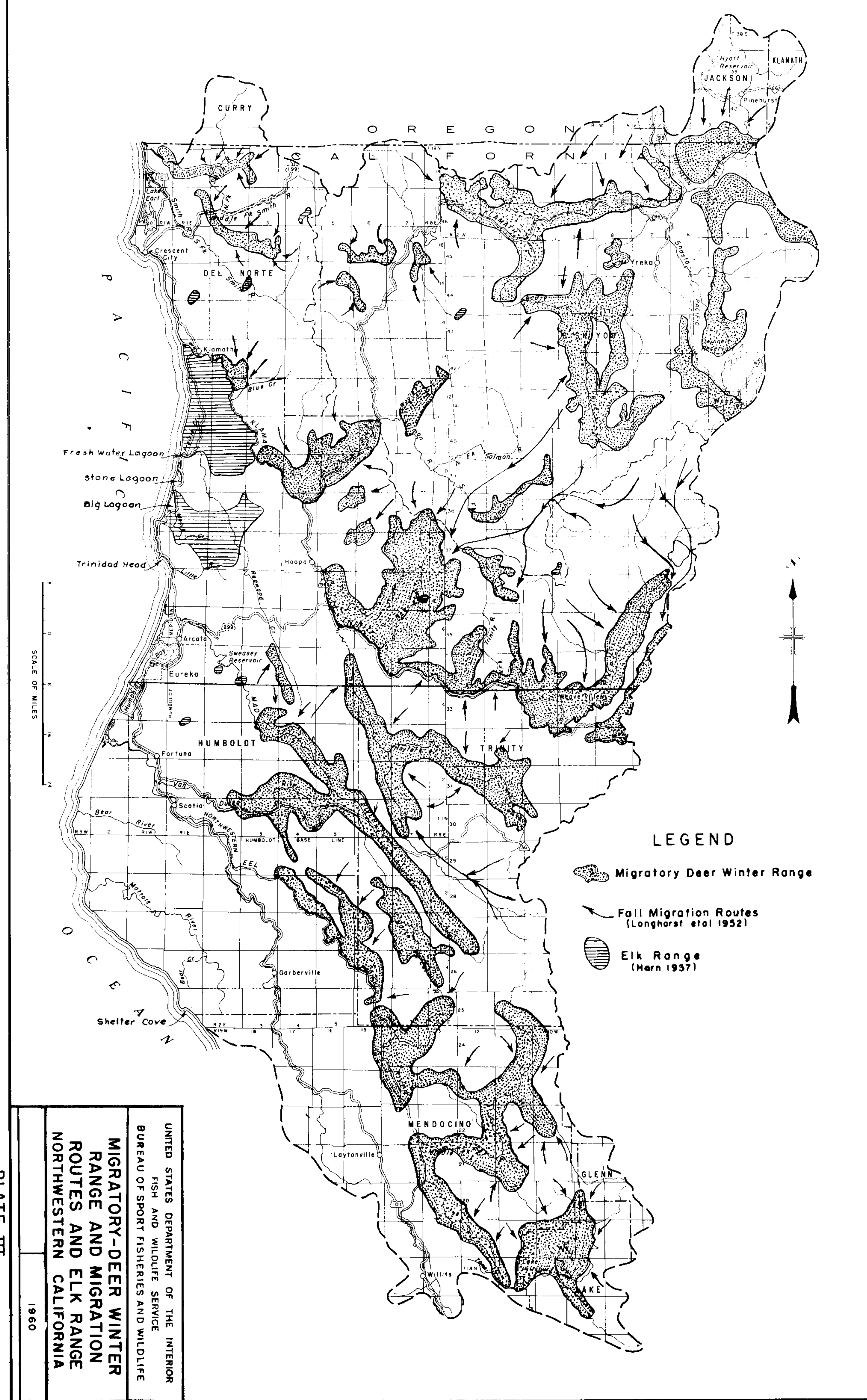


UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

CHINOOK SALMON SPAWNING HABITAT NORTHWESTERN CALIFORNIA WATERSHEDS

FIELD WORK BY	DATE ....
DRAWN BY	DATE 1959
APPROVED BY	DATE ....

PLATE II



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

MIGRATORY-DEER WINTER RANGE AND MIGRATION ROUTES AND ELK RANGE NORTHWESTERN CALIFORNIA

1960

PLATE III

APPENDED MATERIAL

(Letter of Concurrence California Department of Fish and Game)

EDMUND G. BROWN
GOVERNOR

W. T. SHANNON
DIRECTOR

STATE OF CALIFORNIA
Department of Fish and Game

722 Capitol Avenue
Sacramento 14

September 19, 1960

Harry M. Goodwin, Chief
Division of Technical Services
U. S. Fish and Wildlife Service
P. O. Box 3737
Portland 8, Oregon

Dear Mr. Goodwin:

Your letter of September 12, 1960 requesting concurrence in the report entitled "A Survey of Fish and Wildlife Resources of Northwestern California" is hereby acknowledged.

We have discussed several of the more important comments regarding this report made in our earlier letter to you with River Basins personnel here in your Sacramento office.

With the exception of two minor suggestions made to them we concur in the report. May we also suggest that Plate II be retained since it provides immediate observation of the spawning areas used by chinook salmon in one easily available source. We have reviewed the plate with some care and find that it reflects counts made by this Department during the 1955-59 period.

Again we wish to express our appreciation for the opportunity to review the report.

Sincerely,

Director

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6
UNITED STATES GOVERNMENT

Memorandum

TO : Quinault Indian Reservation Files

DATE: April 27, 1973

FROM : Fishery Management Biologist

SUBJECT: Queets River Steelhead Catch

On February 12, 1973, I visited the Quinault Enterprise at Taholah, and obtained the attached data from Dean Reed. He took the figures from the fish record books and gave them to me.

Justine James, an independent fish buyer, told me that Richard Stritmater of Hoquiam, Washington, buys about 25% of the Queets River steelhead. These steelhead numbers are not included in the attached Enterprise figures. Justine said that Stritmater records these steelhead as Hoh- and Quileute River caught fish.

Walt Ambrogetti

Queets River Steelhead Catch

(figures from Quinault Enterprise)

1973	Date	No. Fish	Pounds
	January	1,596	18,781
	February	1,064	13,073
1972	January	1,588	14,847
	February	1,624	15,999
	March	2,862	28,089
	April	714	7,336
	October	124	1,618
	November	520	6,459
	December	2,234	25,475
1971	*		
	10/18	10	115
	10/20	4	34
	10/21	6	61
	10/23	4	32
	10/25	7	94
	10/27	7	72
	11/1	11	147
	11/4	16	174
	11/6	47	432
	11/8	51	517
	11/11	36	366
	11/12	24	212
	11/16	69	689
	11/18	49	435
	11/22	92	826
	11/26	112	1,167
	11/30	199	1,768
	12/3	123	1,124
	12/6	264	2,168
	12/9	133	1,186
	12/13	234	2,007
	12/16	178	1,632
	12/20	381	3,432
	12/22	169	1,460
	12/27	270	2,369
	12/30	80	664
	TOTALS	2,576	23,183

* No records kept for early 1971 catch

Heckman deposition
Exhibit 9

GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Quileute Indian Reservation Files

DATE: February 30, 1972

FROM : Fisheries Management Biologist

SUBJECT: Quillayute River Steelhead Catch

In preparation for a temporary Restraining Order on the Quillayute River in January 1972, it was necessary to obtain the 1971 Quileute steelhead catch data.

Two fish buyers for the tribe were contacted and they are the only buyers for steelhead caught in the Quillayute River. Leo Williams and Redge Ward are the Tribal buyers.

On January 15, 1972, I visited Leo Williams and requested that he furnish me with his steelhead catch data for 1971. Leo mailed the steelhead data to me and I received the information on February 11 (see attached sheet).

I phoned Redge Ward on January 22 and he gave me the following steelhead catch information:

Steelhead

Year	Period	Pounds
1970	Jan. to Dec.	*63,000
1971	Jan. to Dec.	*64,000

* 1/3 of these fish are from the Hoh River.

Walt Ambrogetti

WA:de

Attachment

2-9-72

Dear Sir:
I'm sending you the poundage you asked for. Sorry, I didn't send it in any sooner.

~~#~~ 107,767#

Leo Williams

about 12,000 is Troll fish

107,767
12,000
95,767

Leo Williams

Hickman Deposition
Exhibit 10

UNITED STATES GOVERNMENT

Memorandum

TO : Quileute Indian Reservation Files

DATE: Jan. 14, 1972

FROM : Fisheries Management Biologist
Tumwater, Washington

SUBJECT: Quileute Indian Fishery Problems

On January 11, 1972, I met with Ken Payne, Chairman of the Quileute Tribal Council, Chris Penn and Butch Edwards all tribal fishermen, to discuss the steelhead gill net fisheries problems on the Quillayute River. After the meeting I accompanied Mr. Penn on a tour of the river.

Nets have recently been confiscated by the enforcement officer for the Department of Game and the tribal fishermen are upset over this issue.

The following information from the tribal members was collected:

Tribal personnel advised me that the Department of Fisheries permits Indian gill net fishing for salmon on the Quillayute River upstream to a point located approximately 200 yards below the confluence of the Soleduck River. On November 30th of each year the Department of Fisheries relinquishes their regulatory control of the river to the Department of Game. The Department of Game regulations prohibit gill net fishing in the Quillayute River upstream from the Olympic National Park boundary. This results in the tribe loosing approximately 2 river miles of fishing area for steelhead. The tribe claims that there are only two eddys in this restricted area acceptable for fishing. The best areas are those above the park.

There are twenty fishermen in the tribe who fish consistantly. These fishermen average 5 days per week of fishing. Ten other fishermen only fish periodically.

There are approximately 30 steelhead nets presently being used by tribal fishermen. Most nets average 30-33 fathoms in length and cost about $100 dollars each. This price does not include the individuals labor for hanging or constructing the nets. Most fishermen only have one net for taking steelhead so when a net is confiscated they must do without until a new one is purchased. This takes at least five days if the fisherman has the money available.

The tribe advised me that the nets are always set from the bank and do not extend further than one fifth the distance across the river. My observation indicated this to be true on my boat trip through the area.

The average catch per night per fisherman is 5 steelhead. The fish average 8 pounds each and at the current price of sixty cents a pound, the fisherman averages $24 dollars a night. These figures are estimates and exact figures will be obtained later from the fish buyers.

The tribe told me that in the last couple of years a total of 23 nets have been confiscated for alleged fishing violations. The tribe further informed me that this year, to date, 3 nets have been confiscated.

The tribe said that occasionally they observed Mr. Aggergarrd and one of his partners (WDG enforcement officers) on the river with gill nets in his boat. Upon checking their netting sites they have found their nets gone and could only assume that the nets were confiscated. In most cases however, they were not informed by the state that their nets had been taken.

The tribe stated that Mr. Aggergarrd admits picking up three nets this year. He claims that one net was directly below the Soleduck bridge, which is above both the park and Dept. of Fisheries regulation boundaries. The tribe stated that this was not one of their nets. The tribe said that the area under the bridge is not a practical fishing site. The current in this area beneath the bridge is too swift for a gill net. They said that this net may have been placed there by a sportman or some else to make the tribe look bad. I observed the river under the Soleduck bridge while on my boat tour. I noted that the rapids in this area make it an unlikely spot to set a gill net.

When confronted by Mr. Payne, Mr. Aggergarrd admitted he had confiscated 2 nets this year on the north side of the lower part of a new river channel which is immediately above the park boundary (see attached map). The other net missing was set from the south bank at the lower junction of the old and new river channels. Mr. Aggergarrd was observed on the river and later the net was gone.

The tribe stated that in all cases the officers confiscated the nets only after the fishermen had gone. The tribe said that on occasion the officers have seen the fishermen at their nets but said nothing to them. The nets are always picked up after the fishermen depart. Mr. Aggergarrd claimed he couldn't tell whether the nets he was picking up were Indian or non-Indian nets. I suggested to Mr. Payne that it might be a good idea to have identification labels on the nets. The tribe agreeded that this was a good idea and that they would use name tags in the future.

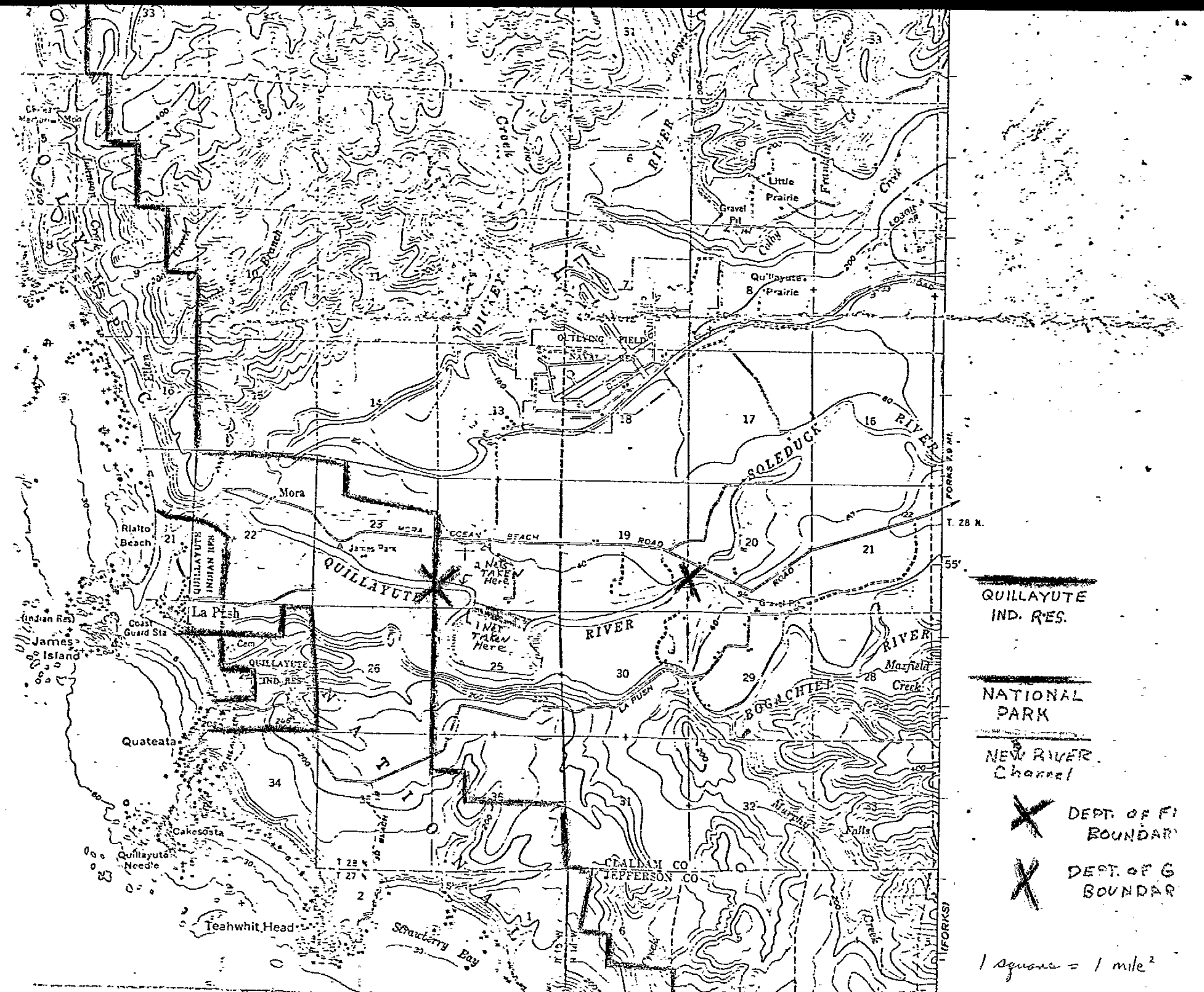
No arrests of tribal fishermen have been made so far this year; however, one arrest was made of Butch Edwards three years ago. He was fishing just below the mouth of the Soleduck River when his nets were taken. Butch told Mr. Aggergarrd that he was on his ancestral fishing grounds, and was released(apparently by the Judge) pending the decision of the U.S. vs. Washington State Court Case. He signed a waiver and got his nets back. When the Game Dept officer returned Edwards nets he also brought other tribal nets, previously confiscated to LaPush, Washington. Fifteen minutes was alloted by the officer for the fishermen to pickup their nets. The only person able to get his nets back because of the short time limit was Butch.

One complaint lodged by a tribal member was that the state is allowing a sport fishing guide service on the Quillayute River. The guides are required to purchase a $75 dollar permit. The state has told the tribe that twenty one guides operate on the river, however the tribe claims there are twice this number. He said that newspaper reports indicate an average catch of one fish per fisherman-day for this area. In past years, He has counted as many as 110 boats floating down the river in one day.

During the river trip I took pictures of the boundaries indicated and where nets were confiscated.

Walter J. Ambrogetti

cc
Mr. Dysart
R.O. Fishery Services



QUILLAYUTE IND. RES.
NATIONAL PARK
NEW RIVER Channel
DEPT. OF FI BOUNDAR
DEPT. OF G BOUNDAR
1 square = 1 mile²
SOLEDUCK RIVER
QUILLAYUTE
RIVER
BOGACHIEL RIVER
DICKEY
Mora
La Push
Rialto Beach
Coast Guard Sta
James Island
Quateata
Cakesosta
Quillayute Needle
Teahwhit Head
Strawberry Bay
OUTLYING FIELD NAVAL RES.
Quillayute Prairie
Little Prairie
Gravel Pit
MORA OCEAN BEACH ROAD
LA PUSH
NETS TAKEN Here
NET TAKEN Here
QUILLAYUTE IND. RES.
QUILLAYUTE INDIAN RES
CLALLAM CO
JEFFERSON CO
Murphy Falls
Maxfield Creek
T. 28 N.
T 28
T 27
FORKS

UNITED STATES GOVERNMENT

Memorandum

BUREAU OF SPORT FISHERIES AND WILDLIFE
P.O. BOX 3737 PORTLAND, OREGON 97208

MAY 03 1973

TO : Program Manager, NW Fisheries Program
Tumwater, Washington

DATE: May 1, 1973

Heckman Deposition
Exhibit 11

FROM : Assistant Regional Supervisor
Division of Fish Hatcheries

SUBJECT: Capital and O&M Costs, Quinault National Fish Hatchery

As you requested, I have listed below the subject costs.

Capital Cost

Through FY 1972	$1,859,000	
FY 1973	673,400	(appropriated)
Total	$2,532,900	

O&M Cost

FY 1969	$ 51,500
FY 1970	87,300
FY 1971	80,500
FY 1972	93,800
FY 1973	105,700
Total	$418,800

John Miller
for Paul W. Handy

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

Heckman Deposition
Exhibit 12

UNITED STATES GOVERNMENT

Memorandum

TO : Quinault Indian Reservation Files

DATE: May 2, 1973

FROM : Fisheries Management Biologist

SUBJECT: Quinault Spawning Ground Counts

Attached are the sockeye spawning ground counts for the Quinault Drainage for the years 1971, 1972 and 1973.

Walt Ambrogetti

Walt Ambrogetti

WA:de

Attachment

Sockeye spawning index area counts in
Big Creek from 1971 through 1973

Big Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1971	10/21	1.0	29	29			
1971	11/8	1.0	530	530			
1971	11/16	1.2	331*	276			
1971	12/21	1.2	148**	123			
1971	12/27	0.8	291	363			
1972	11/17	1.3	1,513	1,164			
1972	11/21	1.3	2,876	2,212			
1972	12/5	1.3	2,777	2,136			
1972	12/29	1.3	320	246			
1973	1/5	1.3	440	339			
1973	1/11	1.3	631	485			
1973	1/19	1.3	202	155			
1973	2/1	1.3	247	190			
1973	2/15	1.3	39	30			

* Poor Visibility
** High Water

Sockeye spawning index area counts in Inner Creek from 1971 through 1973

Inner Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1971	11/21	2.0	223	111			
1971	11/9	1.0	51*	51			
1971	11/10	1.0	306	306			
1971	11/15	2.7	1,150	427			
1971	12/21	2.0	579	289			
1971	12/28	1.2	304	253			
1972	11/21	2.25	374	166			
1972	12/5	2.25	496	220			
1972	12/29	2.25	1,412	628			
1973	1/5	2.25	1,309	582			
1973	1/18	2.25	951	423			
1973	2/1	2.25	1,345	598			
1973	2/15	2.25	1,825	811			

* Poor Visibility

Sockeye spawning index area counts in
Alder Creek from 1971 through 1973

Alder Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
1971	11/2	0.6	162	270			
1971	11/10	0.6	589	982			
1971	11/16	0.6	584	973			
1971	12/21	0.6	592	987			
1971	12/28	0.6	589	982			
1972	11/21	0.6	445	742			
1972	12/5	0.6	790	1,317			
1972	12/29	0.6	1,505	2,508			
1973	1/5	0.6	876	1,460			
1973	1/11	0.6	858	1,430			
1973	1/18	0.6	395	658			
1973	2/1	0.6	195	325			
1973	2/15	0.6	166	276			

Sockeye spawning index area counts in
Fletcher Creek, Culvert Creek, Hager Creek
from 1971 through 1973

Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
Fletcher							
1971	11/28	0.8	157	183			
1971	12/28	0.8	26	32			
1972	11/21	0.8	193	241			
1972	12/5	0.8	251	314			
1973	1/5	0.8	46	57			
1973	1/18	0.8	10	12			
1973	2/1	0.8	5	62			
1973	2/15	0.8	12	15			
Culvert							
1971	12/7	1.2	458	382			
1971	12/27	1.2	160	133			
1972	11/17	1.2	22	18			
1972	11/21	1.2	30	25			
1972	12/5	1.2	148	123			
1973	1/5	1.2	580	483			
1973	1/19	1.2	166	138			
1973	2/1	1.2	118	98			
1973	2/15	1.2	62	51			
Hager							
1971	12/7	0.1	33	330			
1971	12/27	0.1	58	580			
1973	1/5	0.1	54	540			

Sockeye spawning index area counts in
Kestner Creek, Canoe Creek, Zigler Creek
from 1971 through 1973

Creek	Date	Distance	Count	Fish/mi.	Peak	Est. of run	Remarks
Kestner							
1971	12/7	1.0	9	9			
1973	2/15	0.1	1	10			
Canoe							
1973	2/15	1.2	0	0			
Zigler							
1971	11/16	0.7	16	22			

GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Quinault Indian Reservation Files

DATE: May 3, 1973

FROM : Fisheries Management Biologist

SUBJECT: Quinault Spawning Ground Counts

Attached are the spawning ground counts for miscellaneous fish counted on the Quinault Sockeye Index Areas. Data represents counts for the years 1971, 1972 and 1973.

Walt Ambrogetti

WA: cp

Attachment

Chinook-Coho Counts
1972-1973

Stream	Date	Distance in miles	Total Count Chinook	Total Count Coho	Chinook Alive	Chinook Dead	Coho Alive	Coho Dead	Chinook Fish/Mile	Coho Fish/Mile
Big Creek	11/17/72	1.3	7	0	7	0	0	0	5.3	0
	11/21/72	1.3	19	0	15	4	0	0	14.6	0
	12/5/72	1.3	2	0	1	1	0	0	1.5	0
	*+12/29/72	1.3	0	0	0	0	0	0	0	0
	*+ 1/5/73	1.3	0	1	0	0	0	1	0	0.7
	1/11/73	1.3	0	2	0	0	0	2	0	1.5
	1/19/73	1.3	0	2	0	0	0	2	0	1.5
	2/1/73	1.3	0	5	0	0	0	5	0	3.8
	2/15/73	1.3	0	4	0	0	0	4	0	3
Inner-Merriman Creek	11/21/72	2.25	0	0	0	0	0	0	0	0
	12/5/72	2.25	0	0	0	0	0	0	0	0
	12/29/72	2.25	0	80	0	0	78	2	0	35.5
	1/5/73	2.25	0	35	0	0	30	5	0	15.5
	1/18/73	2.25	0	42	0	0	33	9	0	18.6
	2/1/73	2.25	0	25	0	0	1	24	0	11.1
	2/15/73	2.25	0	30	0	0	0	30	0	13.3
Alder Creek	11/21/72	.6	0	3	0	0	2	1	0	5.0
	12/5/72	.6	0	0	0	0	0	0	0	0
	12/29/72	.6	0	32	0	0	32	0	0	53.3
	1/5/73	.6	0	22	0	0	19	3	0	36.6
	1/11/73	.6	0	1	0	0	0	1	0	1.6
	1/18/73	.6	0	0	0	0	0	0	0	0
	2/1/73	.6	0	3	0	0	0	3	0	5.0
	2/15/73	.6	0	1	0	0	0	1	0	1.6
Fletcher Creek	11/21/72	.8	0	0	0	0	0	0	0	0
*Walt saw 20	12/5/72*	.8	0	0	0	0	0	0	0	0
spring Chinook	1/5/73	.8	0	43	0	0	39	4	0	53.7
8"-10" long	1/18/73	.8	0	21	0	0	19	2	0	26.2
	2/1/73	.8	0	11	0	0	2	9	0	13.7
	2/15/73	.8	0	2	0	0	2	0	0	2.5
Culvert Creek	11/17/72	1.2	2	0	1	1	0	0	1.6	0
	11/21/72	1.2	1	0	0	1	0	0	0.8	0
	12/5/72	1.2	1	0	0	1	0	0	0.8	0
	1/5/73	1.2	0	62	0	0	53	9	0	51.6
	1/19/73	1.2	0	48	0	0	30	18	0	40.0
	2/1/73	1.2	0	14	0	0	4	10	0	11.6
	2/15/73	1.2	0	5	0	0	0	5	0	4.1
Kestner Creek	2/15/73	0.1	0	2	0	0	0	2	0	20
Canoe Creek	2/15/73	1.2	0	4	0	0	0	4	0	3.3
Graves Creek	11/21/72	0.5	0	0	0	0	0	0	0	0