BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

In the Matter of the Request of	)	
	)	
PACIFIC POWER & LIGHT	)	
(dba PACIFICORP	)	UE-170
	)	
For a General Rate Increase in the	)	
Company's Oregon Annual Revenues	)	
(Klamath Rate Case Portion of this Proceeding	)	

Direct Testimony of

James V. McCarthy

On Behalf of

Oregon Natural Resources Council, Pacific Coast Federation of Fishermen's Associations, and WaterWatch of Oregon

January 17, 2006

Q: PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A: My name is James V. McCarthy; my business address is Oregon Natural Resources Council, P.O. Box 151, Ashland, Oregon, 97520.

Q: WHAT IS YOUR OCCUPATION AND BY WHOM ARE YOU EMPLOYED?

A: I have been employed as a salaried employee by Oregon Natural Resources Council (ONRC) as a Policy Analyst since 2002. In addition, over the same period I have worked as a self-employed public policy and communications consultant, employed by a variety of conservation organization clients such as Defenders of Wildlife, Earthjustice, the Klamath Basin Coalition, and The Larch Company.

Q: WOULD YOU PLEASE STATE YOUR EDUCATION BACKGROUND AND PROFESSIONAL EXPERIENCE?

A: I received a Bachelor of Arts degree from Princeton University in 1996. Since 2001, I have researched and written on various issues relating to the environment, economy, and public policy in the Klamath River Basin for published reports and articles, in addition to speaking at various public forums on these subjects. I have also resided in or within less than an hour’s drive of the Klamath Basin since 2001. My professional contacts and personal experiences range throughout the breadth of interest groups and communities involved in the current resource debate the Klamath Basin, from irrigator homesteaders in the Klamath Project to salmon trollers in Newport, Oregon. Before coming to the Klamath Basin, I worked as a teacher, writer, and editor in California.

Q: ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

A: I am testifying on behalf of ONRC, a non-profit conservation group with approximately 6,500 members in Oregon, on behalf of WaterWatch of Oregon (WaterWatch), a non-profit water policy watchdog group, and on behalf of the Pacific Coast Federation of Fishermen’s Associations (PCFFA), a non-profit coastwide trade association for the commercial fishing industry. All three organizations and many of their members have been working for many years on Klamath Basin restoration and water policy issues. PCFFA's members in particular have been dramatically affected by lack of biologically suitable flows in the Klamath River below Iron Gate Dam, which in turn have caused widespread salmon mortality among both juvenile and adult migrating salmon. The resulting serious depletion of Klamath salmon stocks has significantly disrupted Pacific coastal salmon fisheries and had devastating impacts on the livelihoods of PCFFA's many commercial fishermen members. Continued degradation of the Klamath Basin's natural resources associated with wasteful water use by irrigation in the Upper Klamath Basin has also had significant impacts on the members and staff of ONRC and WaterWatch who hunt, hike, fish, boat, view wildlife, and recreate on a regular basis within the Klamath Basin. Collectively these organizations will be referred to as "ONRC et al." when referred to in this testimony.

Q: WHAT SUBJECTS DO YOU INTEND TO ADDRESS IN THIS TESTIMONY?

A: I have been asked to review PacifiCorp's proposal to move Klamath Basin irrigators from their present highly subsidized electrical power rates under their current special contracts – rates which have only decreased since 1917 – to the standard Agricultural Pumping Service Tariff, Schedule 41 (the "standard tariff"), which is the rate paid by every other similar Oregon agricultural operation obtaining its power from PacifiCorp.

In particular I have been asked to describe the differences between what Klamath irrigators pay under their current special contract rates with what every other non-Klamath Oregon irrigator typically pays under PacifiCorp's Schedule 41. This is relevant to whether the current, highly-subsidized and below cost power rates currently enjoyed by the Klamath Basin irrigators are "just and reasonable," and if not, then what a "just and reasonable" power rate would be.

Q: DO YOU HAVE ANY SPECIAL EXPERTISE IN THE AREA OF KLAMATH IRRIGATION POWER RATES, AND IF SO, WHAT IS THAT SPECIAL EXPERTISE?

A: Over the course of my work in Klamath Basin conservation and public policy, I have done considerable research on the current Klamath Basin below-cost power rates, including writing a major report on these rates titled “Ratepayer Rip-Off: Electric Power Subsidies in the Klamath Irrigation Project” as a consultant for ONRC and The Larch Company. This report was published by ONRC in 2002 and has since been used as a reference by the media, policy makers, other researchers, and the public.

Q: ARE YOU SPONSORING ANY EXHIBIT IN CONNECTION WITH YOUR TESTIMONY?

A: Yes. I am sponsoring Exhibits ONRC et al./### and ONRC et al./###.al. Exhibits 101 through 106, inclusive. These exhibits were prepared either by me or under my supervision and direction. A copy of each Exhibit is attached to this testimony.

Q: WOULD YOU PLEASE SUMMARIZE YOUR FINDINGS AND CONCLUSIONS?

A: The main points of my testimony can be summarized as follows:

1. The rates paid by the Klamath irrigators under their current special contracts are roughly an order of magnitude below the power rates routinely paid by every other non-Klamath irrigator or agricultural producer customer of PacifiCorp in Oregon.

2. PacifiCorp provides the subsidized power rates under the current contracts at a substantial loss. Other PacifiCorp customers must pay PacifiCorp’s costs of providing this subsidized power.

3. Highly subsidized power rates allow Klamath agricultural producers to compete unfairly against non-subsidized producers throughout the rest of Oregon.

4. There is evidence that the Klamath agricultural economy is not dependent on their current power rates and there is reasonable basis to expect that the

Klamath Basin will have time to adapt to having to pay the same electrical rates as every other PacifiCorp-served farming area in Oregon.

5. There is evidence that agricultural irrigation diversions in the Klamath Basin affect imperiled fish species and moving Klamath irrigators to standard tariffs could reduce irrigation diversions and increase efficient irrigation water use.

I will take each of these points sequentially below. For simplicity, throughout my testimony I have expressed power rate prices in cents rather than in "mills" (i.e., 1/10th cents).

COMPARISON OF STANDARD AGRICULTURAL RATES TARIFF TO CURRENT SUBSIDIZED KLAMATH TARIFFS

Q: WHEN WAS THE LAST TIME THE FARMERS WITHIN THE KLAMATH IRRIGATION PROJECT HAD A POWER RATE INCREASE?

A: The farmers of the Klamath Irrigation Project (KIP) have not had a power rate increase since 1917, i.e., not for 89 years. The electric power costs for irrigators in the KIP and surrounding Upper Klamath River Basin—for moving water through canals, bringing well water to the surface, pressurizing sprinkler systems, and draining flooded fields—represent a small fraction of the power costs their fellow farmers elsewhere in Oregon must pay to raise the same types of crops for the same markets. This subsidy is perhaps the largest of its kind in the United States, but benefits fewer than 2,600 irrigators. It also benefits an unknown but substantial number of off-Project customers, some of whom are not engaged in commercial farming in any sense of the word, including at least one exclusive and expensive country club and golf course (Reames Golf and Country Club of Klamath Falls, Oregon).

Q: WHAT DOES THIS KLAMATH POWER SUBSIDY CONSIST OF, AND HOW IS IT STRUCTURED?

A: This unique subsidy was made possible through a longstanding contractual arrangement between PacifiCorp and the U.S. Bureau of Reclamation (USBR). In 1917, a predecessor of PacifiCorp (Copco, the California and Oregon Power Company)[1] and the USBR entered into a fifty-year contract concerning the construction and operation of the Link River Dam (LRD) at the outlet of Upper Klamath Lake near Klamath Falls, Oregon.[2] Before the first fifteen years of the contract passed, the USBR and the KIP irrigators had used the leverage of the contract and the power of the federal government to extract further allowances from the utility; namely free powerline extensions for all users, regardless of size, and an exemption from standard "delivery" or "minimum" fees. Thus, by 1931, the Klamath Basin irrigators' special subsidy plan had evolved into a three-part form as follows:

(1) rock-bottom electrical rates;
(2) exemption from standard pump fees;[3] and
(3) free powerline extensions.

Copco and the USBR renewed the Link River contract in 1956,[4] thereby insuring PacifiCorp customers would continue to pay for these three guarantees to this day. Oddly, the power rates agreed to in the 1956 contact were actually reduced for Klamath Irrigation Project (KIP) irrigators compared to the 1917 contract rates, as set forth in Table I below, which depicts the subsidized power rates by irrigation class.

Table I
Electrical Subsidy Comparison
1917 versus 1956 Contracts

Subsidy	1917 Contract	1956 Contract (Current)
Klamath Irrigation Project (KIP) Energy Charge (except Tule Lake)	0.7¢/kWh	0.6¢/kWh

[1] Over the decades, Copco became Pacific Power and Light, then Pacific Power, then PacifiCorp, now a subsidiary of Scottish Power.
[2] Contract I1r-406, USBR files.
[3] Standard pump fees have evolved considerably since 1931, and now have various layers and names in California and Oregon rate schedules. For clarity, these fees are referred to as "standard" fees, or by their place in the billing cycle, as "monthly and annual" fees.
[4] Contract No. 14-06-200-5075, USBR files.

Tulelake Irrigation District Energy Charge	0.5¢/kWh (11:01 p.m. to 5:59 p.m.) 0.7¢/kWh (6 p.m. to 11 p.m.)	0.3¢/kWh off-peak (8 p.m. to 8 a.m. weekdays, all day weekends and holidays) 0.5¢/kWh on-peak (8 a.m. to 8 p.m. weekdays)
Oregon's Non-KIP Upper Klamath River Basin Energy Charge	Not included under contract	0.7¢/kWh
Exemption from Standard Pump Fees	Only on pumps 100 hp and above	All pumps
Free Powerline Extensions (KIP only)	Only on pumps 100 hp and above	All pumps

Q: CAN YOU EXPLAIN MORE ABOUT THE THREE-PART SUBSIDY RECEIVED BY THE KLAMATH IRRIGATORS, INCLUDING WHO GETS WHAT?

A: These three types of subsidies also vary depending on whether the customer is on the Klamath Irrigation Project (KIP) or off-Project. A related 1956 agreement created a new irrigation subsidy zone in Oregon, known as the "Upper Klamath River Basin" (UKRB), essentially the southern three-quarters of Klamath County outside the Klamath Irrigation Project (KIP), where non-KIP irrigators receive the low electrical rates and an exemption from standard pumping fees, but do not enjoy free powerline extensions. The UKRB subsidy zone is exclusive to Oregon. At the time of the contract renewal, California Public Utility Commission rejected a similar proposal for non-KIP irrigators on the California side of the Upper Klamath River Basin.

In more detail, the three parts of this subsidy are as follows:

Part 1: Extremely Low Electrical Rates: The special power rates—originally between 0.5¢ and 0.7¢ per kilowatt-hour (kWh)—are the long-term subsidy that made possible expansion of irrigation onto even poor-quality and marginal lands in the Klamath Basin. As seen from Table I, the 1956 contract provided an even lower KIP power rate schedule, between 0.3¢ and 0.6¢ per kWh, than its 1917 predecessor. Meanwhile, irrigators in Oregon's UKRB received a special rate of 0.7¢ per kWh. These rates remain in effect for the duration of the contracts. The current cost of this central component of the Klamath Basin subsidy is approximately $6.2 million annually, paid for by other PacifiCorp ratepayers, though the amount varies from year to year by usage.

Part 2: Exemption from Standard Pumping Fees: The second component of the subsidy allows KIP irrigators in both Oregon and California, as well as Oregon's UKRB irrigators, to avoid standard pump fees. Oregon farmers outside of the Klamath Basin pay monthly and annual charges, calculated by pump size and peak demand. These fees are in addition to any consumption charges, and can range from $190 a year for a 10 horsepower (hp) pump to $13,000 a year for a pump of 750 hp. A highly conservative estimate for the current subsidy value of the pumping fee exemption alone, for the roughly 2,600 agricultural pumping service customers in the Klamath Basin, is $2.6 million annually.

Part 3: Free Powerline Extensions: The third component of the contract subsidy has provided Klamath Irrigation Project (KIP) irrigators with free powerline extensions since 1917. Typically, power customers must pay the cost of extending power from the nearest existing pole to any new end use. Such service extensions can cost tens of thousands of dollars per extension. Through the Link River Dam contracts, the USBR and PacifiCorp have passed the cost of electrifying the pumping system of the entire Klamath Irrigation Project onto other PacifiCorp customers. The estimated cost of this exclusive KIP subsidy is roughly $1.1 million annually. Non-KIP irrigators within Oregon's UKRB do not benefit from this aspect of the Klamath Basin subsidy.

Q: WHAT WOULD PACIFICORP'S "STANDARD AGRICULTURAL RATE" BE FOR NON-KLAMATH IRRIGATORS UNDER SCHEDULE 41 AND OTHER APPLICABLE SCHEDULES?

A: PacifiCorp has calculated a cost of 7.291¢/kWh in its Motion for Summary Disposition (filed 3/31/05) in UE-171 (see chart on page 5 of that pleading), applying a combined rate from Schedule 41 and Schedule 200, which also applies under many assumptions. This includes averages for line transmission costs and other factors which vary from user to user and which are unknown to me from their materials.

Q: HOW DO THE KLAMATH CONTRACT RATES COMPARE TO THE PACIFICORP STANDARD AGRICULTURAL RATE?

A: Using similar assumptions, and based on information supplied by PacifiCorp, I have prepared Chart 2 (which is also EXHIBIT 102), which graphically shows the comparison between the PacifiCorp standard agricultural tariff and what the current Klamath Project and off-Projects rates are under the present contract.

It is plain that the current Klamath Project and off-Project rates are grossly disproportionate by comparison to the PacifiCorp standard agricultural rate.

COST OF KLAMATH SUBSIDIES TO PACIFICORP AND OTHER CUSTOMERS

Q: WHAT IS THE GENERAL ECONOMIC IMPACT ON PACIFICORP CUSTOMERS OF MAINTAINING THESE THREE TYPES OF KLAMATH ELECTRIC POWER SUBSIDIES?

A: PacifiCorp provides power to the Klamath Basin irrigators who take advantage of these subsidies at a considerable financial loss. Adding the total annual costs of these three types of losses together gives numbers for the annual ratepayer burden as follows: approximately $6.2 million/year (low rates) plus $2.6 million (pumping fee exemption) plus $1.1 million/year (free powerline extensions) equals approximately $9.9 million/year in economic burden on PacifiCorp ratepayers from this subsidy.

All these factors all vary slightly year-by-year, depending on the total Klamath customer base receiving this subsidy and total electrical use each year, but as costs of providing each of these services continue to increase (with inflation as well as increasing generation and delivery costs), this economic burden has tended to increase. I should note that not all of these costs are incurred in Oregon as a small number of KIP customers irrigate lands just across the border into California, where the standard agricultural tariff is slightly different. However, since PacifiCorp supplies power to both sides of the border, and spreads the costs over their ratebase as a whole, this factor will be set aside at this point and addressed later in my testimony.

Table II shows Klamath annual triple subsidy costs to PacifiCorp ratepayers over a five-year period:

Table II
Total Klamath Subsidy Recipients and Triple Subsidy Cost 1997-2001[5]

Year	Average Number of Recipients	Total Triple Subsidy Cost
1997	2,573	$10,485,222
1998	2,554	$8,584,111
1999	2,567	$10,541,471
2000	2,562	$10,475,260
2001	2,605	$9,668,216
Average	2,572	$9,950,856

Roughly speaking, therefore, the economic cost to other PacifiCorp ratepayers from these special Klamath subsidies is approximately $10 million each year.

Breaking this burden down for Oregon Project and non-Project irrigators by class of subsidy for these same years yields Table III as follows:

[5] Data derived from PacifiCorp's 1997 to 2001 FERC Form 1 documents, "Sales of Electricity by Rate Schedules," p. 304. Available at http://www.ferc.gov.

Table III
Oregon's Klamath Irrigation Project and Non-KIP Power Subsidy Recipients, Power Consumption, and Total Triple Subsidy Cost
1997-2001[6]

Year	Average Number of Recipients	Consumption (kWh)	Energy Charge Subsidy Cost	Standard Fee Subsidy Cost (Estimate)[7]	Powerline Extension Subsidy Cost (Estimate)[8]	Total Triple Subsidy Cost
1997	1,977	102,326,000	$5,299,450	$1,977,000	$896,000	$8,172,450
1998	1,968	77,341,000	$3,704,488	$1,968,000	$896,000	$6,568,488
1999	1,979	107,477,000	$5,144,689	$1,979,000	$896,000	$8,019,689
2000	1,986	109,437,582	$5,232,285	$1,986,000	$896,000	$8,114,285
2001	1,999	99,699,702	$4,787,496	$1,999,000	$896,000	$7,682,496
Ave.	1,982	99,256,257	$4,833,682	$1,982,000	$896,000	$7,711,482

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[6] Data derived from PacifiCorp's 1997 to 2001 FERC Form 1 documents, "Sales of Electricity by Rate Schedules," p. 304. Available at http://www.ferc.gov.

[7] All other Oregon farmers pay standard annual and monthly charges, calculated by pump size and load, in addition to any consumption charges. These fees defray the utility's cost of maintaining enough power in the grid to run all the pumps connected to the system, even if all the pumps never run concurrently. The utility would otherwise sell this reserve power. Fees can range from approximately $190 per year for a 10 horsepower (hp) pump, to $1,400 per year for a 65 hp pump, to over $13,000 per year for a 750 hp pump.[7] One 80-acre field of potatoes will typically use two 40 hp pumps working in tandem, while one 65 hp pump is not unusual for 80 acres of alfalfa, the most common crop in the Basin. Pumps from 150 hp to 750 hp are generally used for wells or district pumping plants. Given the range of pump power in the Klamath Basin, an exact calculation of this aspect of the subsidy is impossible. By using a conservative annual fee average of $1,000 per pump, multiplied by the roughly 2,600 agricultural pumping customers in the Klamath Basin, the estimated annual cost of the fee exemption reaches $2,600,000. This estimate relies on one highly conservative assumption: the total pump horsepower necessary to irrigate the subsidy area, a region containing hundreds of thousands of acres, is the equivalent of each Klamath subsidy recipient possessing one pump in the 60 hp range. Considering the massive scale and duration of the Klamath subsidy has greatly reduced the cost of developing and using pumps in the Basin over the last 85 years, this should be considered an absolute minimum estimate. This cost is passed onto PacifiCorp's other ratepayers and shareholders.

[8] The irrigators in the KIP also receive the benefit of free powerline extensions (the construction of power poles, lines, transformers, etc., to serve any new pump installation), paid for by PacifiCorp's other ratepayers and shareholders. Klamath Basin irrigators outside of the KIP do not receive this subsidy. According to company representatives, the cost for a single line extension may range from $4,000 to $100,000. Using a highly conservative average of $20,000 per line extension, if each of the 1,400 customers within the KIP received only one free line extension within the last 25 years, the annual cost of this subsidy for PacifiCorp ratepayers would be roughly $28 million, or $1,120,000 per year since 1977. The free line extension subsidy has existed in the KIP for 85 years.

Q: WHAT ARE THE SPECIFIC ECONOMIC BURDENS ON PACIFICORP'S NON-KLAMATH CUSTOMERS RELATED TO THIS SUBSIDY?

A: Through 2005, the annual $10 million public burden of the Klamath power subsidy passed to ratepayers in six states, with each state paying a percentage of the whole. Oregon ratepayers cover the lion's share of this cost, absorbing 36.73% annually, while Utah ratepayers come in second at 30.57%. California's PacifiCorp customers absorb the least cost at 2.35%. Washington, Wyoming, and Idaho also contribute 10.97%, 15.01% and 4.37%, respectively. I have prepared Chart 1 (which is also EXHIBIT 101) to illustrate each state's portion of the burden. In other words, PacifiCorp customers in each of those six states, including other agricultural producers, are forced to pay a little more each month for electrical power in order to maintain these large subsidies for only about 2,600 irrigators in one small area. This subsidy operates as a net economic drag – in effect as a hidden tax – on the productivity and economic vitality of all six states.

Q: WHAT IS THE SPECIFIC ECONOMIC BURDEN ON PACIFICORP'S OTHER OREGON CUSTOMERS RELATED TO THIS SUBSIDY?

A: Using the figures explained above, I have calculated that Oregon's non-Klamath PacifiCorp ratepayers have paid approximately $36 million over the last decade to subsidize irrigation pumping in the Klamath Basin. It is my understanding that for Oregon customers, this hidden tax has represented roughly 1% of their monthly utility bill costs. However, in 2006, a new six-state utility cost sharing agreement comes into effect, and Oregon's share of the subsidy burden will jump from the previous 36% burden to a 50% burden or more. Thus, Oregon's economy stands to shoulder even more of the economic drag caused by the Klamath power subsidy if it is continued.

Q: DO HIGHLY SUBSIDIZED TARIFFS IN THE KLAMATH ALLOW KLAMATH AGRICULTURAL PRODUCERS TO COMPETE UNFAIRLY AGAINST NON-SUBSIDIZED PRODUCERS THROUGHOUT THE REST OF OREGON?

A: Yes. Because of this power subsidy, irrigators in the Klamath Basin often enjoy an $75 to $300 per acre crop cost advantage over their producer neighbors in adjacent valleys, allowing Klamath irrigators to compete unfairly against similarly situated producers throughout Oregon. At the same time, many other producers in Oregon must pay more in their power bills to support the Klamath subsidy, adding insult to this economic injury. Table IV depicts the estimated costs of direct irrigation to various crops with and without the Klamath power subsidies.

Table IV
Direct Irrigation Pumping Costs Per Crop
Klamath Schedule versus Standard Agricultural Rates*

Crop	Subsidized Electric Power Costs in $/Acre/Year	Estimated Normal Electric Power Costs in $/Acre/Year
Onions	$10-12	$160-192
Potatoes	$10-12	$160-192
Alfalfa	$15-20	$240-320
Wheat	$15	$240
Barley	$5	$80

* The figures above represent rough estimates including pump fees and do not consider irrigation district fees.

Q: IS THERE EVIDENCE INDICATING THAT THE KLAMATH AGRICULTURAL ECONOMY WOULD BE ABLE TO ADAPT TO HAVING TO PAY THE SAME TARIFF AS OTHER IRRIGATORS IN OREGON?

A: Yes. When I first began researching this issue in 2002, I was concerned about the lack of planning for the looming transition from subsidized to standard tariffs in the Klamath Basin. Since then, the Oregon State University (OSU) Extension Service published the July 2004 report by agricultural economist William K. Jaeger, titled “Energy Pricing and Irrigated Agriculture in the Upper Klamath Basin.” The OSU report studied the possible impacts of the tariff transition on the Klamath agricultural economy and found that, “…most of the irrigated lands of the Upper Klamath Basin (and in particular those lands within the Klamath

Reclamation Project) are highly productive and would continue to be profitable to irrigate under energy prices and fees currently paid by farmers in other parts of Oregon and northern California. Indeed, the viability of agriculture in the region does not depend on the current low energy prices, although these prices provide significant benefits to landowners and owner-operators in the region." I have attached a copy of this report as EXHIBIT 103.

In addition, the Oregon Legislature passed Senate Bill 81 into law in mid-2005. With SB 81 now guaranteeing a seven-year, gradual transition period from subsidy tariffs to standard tariff, it is reasonable to expect that the local agricultural economy will have time to adapt and will continue to thrive under a normal tariff.

Q: DOES THE OSU REPORT INDICATE WHETHER MOVING KLAMATH IRRIGATION TO THE STANDARD TARIFF WOULD IMPACT WATER USE IN THE KLAMATH BASIN?

A: Yes. The attached OSU report (EXHIBIT 103) estimates that if Klamath irrigation moves to standard tariff, decreased irrigation diversions and more efficient use of irrigation water could be expected.

Q: ARE YOU AWARE OF ANY FISH SPECIES LISTED UNDER THE FEDERAL ENDANGERED SPECIES ACT AFFECTED BY AGRICULTURAL IRRIGATION PRACTICES IN THE KLAMATH BASIN?

A. Yes, several species of fish residing in the Klamath Basin are now considered "threatened" or "endangered" under the federal Endangered Species Act. Water diversions, depletion of natural flows and reduced stream flows have all been identified by the federal government as some of the causes for decline of federally ESA listed coho in the "Final Rules for the Southern Oregon/Northern California Coast Coho," EXHIBIT 104 (with relevant passages indicated on the Exhibit) (63 *Federal Register* 24588 (May 6, 1997)). Instream flow diversion has also been cited as a cause of decline for the ESA-listed Shortnose and Lost River suckers that inhabit the upper Klamath Basin, see EXHIBIT 105 (with relevant passages indicated on the Exhibit) (53 *Federal Register* 27139 (July 18, 1988)).

Q: ARE YOU AWARE OF ANY EVIDENCE INDICATING THAT LOW FLOWS IN THE KLAMATH RIVER HAVE CAUSED HARM TO FISH?

A. Yes, the California Department of Fish and Game prepared a report that links atypically low flows in the lower Klamath River to a massive fish-kill of adult salmon that occurred in the fall of 2002, resulting in an estimated 35,000 to 80,000 dead adult salmon (EXHIBIT 106).

Q: DO THESE REPORTS AND ENDANGERED SPECIES ACT LISTINGS CONTRADICT THE ARGUMENTS THAT THE KLAMATH OFF-PROJECT WATER USERS HAVE MADE REGARDING THE IMPACT OF AGRICULTURE ON FLOWS IN THE KLAMATH BASIN?

A. Yes. KOPWU has argued in the related proceeding UE-171 that the existence of irrigated agriculture somehow results in an increased amount of water going down the Klamath River. See, for example, UE-171 KOPWU Response to PacifiCorp's Motion for Summary Disposition at 52. This argument by KOPWU appears to be inconsistent with the well-known fact that fish in the Klamath Basin suffer from low stream flows today as compared to the past, as reported in EXHIBITS 104-106.

END OF TESTIMONY

INDEX TO MCCARTHY TESTIMONY EXHIBITS:

ONRC et al. Exhibit 101: Chart 1: Percentages of $10 Million Annual Klamath Power Subsidy Cost Burden by State.

ONRC et al. Exhibit 102: Chart 2: PacifiCorp Standard Irrigation Tariff Rate (for 25 kw, 5,200 kWh) vs. Current Klamath Project and Off-Project Subsidized Rates

ONRC et al. Exhibit 103: William K. Jaeger, *Energy Pricing and Irrigated Agriculture in the Upper Klamath Basin,* (Report EM 8846-E, July 2004), Oregon State University Extension Service, Supplemental Brief #3 to *Water Allocation in the Klamath Reclamation Project* (2002).

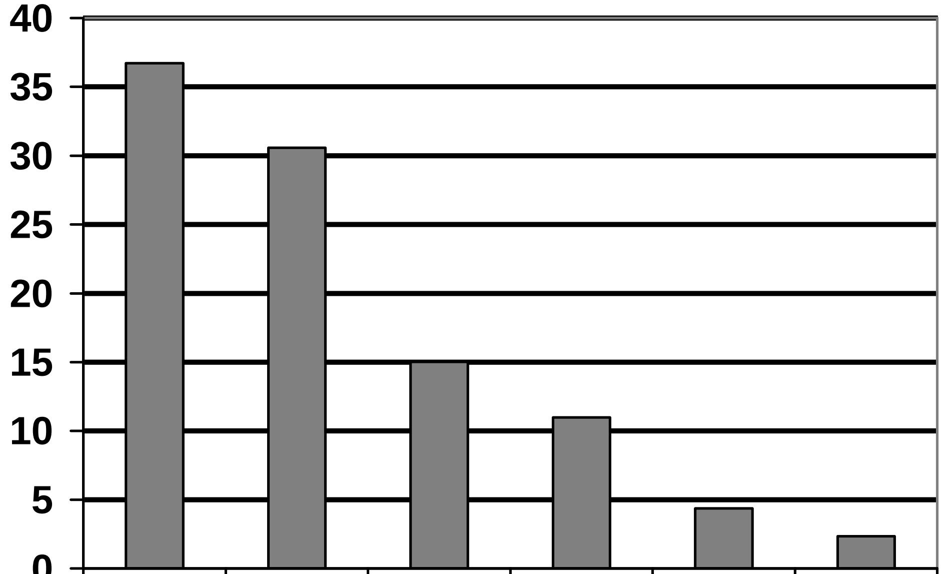
ONRC *et al.* Exhibit 104: 62 *Federal Register* 24588 (May 6, 1997), Endangered and Threatened Species; Threatened Status for Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon, Final Rule. Available on the web at: www.nwr.noaa.gov/Publications/FRNotices/1997/upload/62FR24588.pdf.

ONRC *et al.* Exhibit 105: 53 *Federal Register* 27130 (July 18, 1988), Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Shortnose Sucker and Lost River Sucker, Final Rule. (5 pages).

ONRC *et al.* Exhibit 106: Excerpts from: *September 2002 Klamath River Fish-Kill: Final Analysis of Contributing Factors and Impacts* (July 2004), California Department of Fish and Game, Northern California-North Coast Region, The Resources Agency, State of California.

ONRC et al./EXHIBIT 101

Chart 1: Percentage of $10 Million Annual Klamath Power Subsidy Cost Burden by State

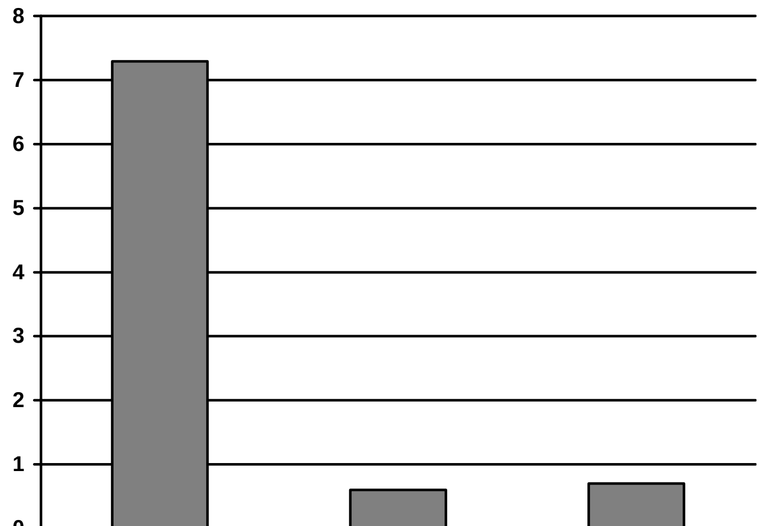


	Oregon	Utah	Wyoming	Washington	Idaho	California
% Burden	36.73	30.57	15.01	10.97	4.37	2.35

(Source: Oregon Public Utilities Commission)

ONRC et al./EXHIBIT 102

Chart 2: PacifiCorp Standard Oregon Irrigation Tariff Rate vs. Current Klamath Project and Off-Project Subsidized Rates



	PacifiCorp Standard Rate	Klamath On-Project (USBR)	Klamath Off-Project
Ave. Cents/kWh	7.291	0.6	0.7

(Source: PacifiCorp calculated rate from UE-171, Motion for Summary Disposition, Chart on pg. 5)

ONRC *et al.*/103
McCarthy/1
EM 8846-E
July 2004

Water Allocation in the Klamath Reclamation Project

Brief # 3

Energy Pricing and Irrigated Agriculture in the Upper Klamath Basin

W.K. Jaeger

The conflict over water allocation in the Upper Klamath Basin encompasses many important, complex, and difficult questions. One aspect of the situation, energy pricing, has come under increased scrutiny in connection with relicensing of the Klamath River hydropower operations, which is scheduled to take effect in 2006.

At issue are the prices that Upper Klamath Basin irrigators pay for energy under a 1956, 50-year contract with the energy provider and hydropower operator—now PacifiCorp. Under the terms of that long-term contract, irrigators within the Klamath Reclamation Project pay about one-tenth the price paid by other Oregon and California farmers served by PacifiCorp and one-fifth to one-eighth the price charged by other power companies serving farmers in Oregon. In addition, Project farmers do not pay standby fees of $15 to $19 per horsepower of pumping capacity, and they are not charged for line extensions to new pumping sites.

Oregon farmers outside the Project but within the Upper Klamath Basin enjoy low energy rates (87 percent lower than rates for other farmers served by PacifiCorp) and an exemption from standby fees, but not free line extensions.

The origins of these contractual arrangements date back to 1917, when PacifiCorp's predecessor, Copco, negotiated a contract with the U.S. Bureau of Reclamation for construction and operation of Link River Dam at the outlet of Upper Klamath Lake. In exchange for the rights to operate hydropower facilities on the Klamath River, Copco agreed to build the Link River Dam but convey the dam's ownership to the Bureau of Reclamation. The terms of the agreement included providing energy to irrigators at a long-term "contract rate" that currently is one-tenth of the rate charged to other PacifiCorp irrigators.

In light of the conflicts over limited Klamath Basin water supplies for agricultural, environmental, tribal, recreational, and commercial and sport fishing uses, questions have arisen about the effects of these low energy prices on agriculture in the region and, in particular, about the impact that higher energy pricing would have on the viability and scale of irrigation. Key questions include:

- Would irrigated agriculture continue to be economically viable at higher energy prices?
- How would the elimination of these contract power rates alter the demand for irrigation water?
- Might the elimination of low power prices alleviate water conflicts?

The present analysis does not attempt to address questions about the justification for the current, contracted energy prices. Differential pricing and contracts of this nature are common in both the private and public sectors, as with rent-controlled apartments, airline ticket pricing, and differences in power rates, for example, between residential and industrial customers. Moreover, electric utilities are regulated private companies, whose pricing rules must be approved by government, and dozens of different pricing schedules apply to different classes of customers.

Nevertheless, the relicensing of PacifiCorp's hydropower operations, and any renewal of power rate agreements for Klamath irrigators, will take place within the current legal, political, and social setting—one that differs greatly from the situation 50 years ago. The elimination of the current low energy price arrangement is only one of a number of possible outcomes from the current relicensing process (Klamath Water Users Association, personal communication, April 28, 2004).

In the Oregon State University–University of California report on Klamath water allocation,[1] only brief mention was made of the effects of energy pricing on farm profitability. A rough calculation of the average differentials in power cost per acre between Project irrigators and non-Klamath irrigators suggested that the difference was not large relative to the net income generated for the Project overall (OSU–UC report, p. 378). This brief discusses this issue in greater detail.

Per-acre energy costs without low energy prices

In order to assess the impact of changes in energy prices on farm profitability, we need to compare the current contract energy rates per irrigated acre with those charged to other Oregon and California irrigators. Current power rates for irrigators on the Oregon portion of the Project (including delivery and other components) are 0.6¢/kWh (kilowatt hour); comparable rates for nearby non-Project irrigators are 0.75¢/kWh. For other irrigators in Oregon, the PacifiCorp rate is 5.696¢/kWh; for other irrigators in California, it is 6.318¢/kWh (http://www.pacificorp.com/Navigation/Navigation4428.html).[2]

Oregon irrigators served by some other power companies pay lower rates than PacifiCorp's non-Klamath customers. For example, Umatilla Electric Cooperative charges irrigators in Umatilla, Morrow, and Union counties 4.17 to 4.70¢/kWh, and Idaho Power in Ontario charges 3.06¢/kWh (http://www.idahopower.com/aboutus/regulatoryinfo/tariffPdf. asp?id=75&.pdf).

Given the wide range of crops, soils, pumps, irrigation types, and lift requirements, it is difficult to evaluate the effect of current contract power rates on a particular irrigated plot in the region. However, there are several approaches to estimating how a change in energy price will affect typical irrigation costs, and hence the economics of farming generally.

First, we can use data on total energy consumption and total acres irrigated to compute the average cost per acre under current and alternative pricing. Second, we can look at similar irrigated areas in locations where standard energy charges apply. Third, we can estimate the energy required for a given pumping system to pump an acre-foot of water, and then apply that requirement to the volume of water needed for each crop rotation to find the total energy requirement and cost.

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[1]Braunworth, Jr., W.S., Welch, T., and Hathaway, R. eds. *Water Allocation in the Klamath Reclamation Project, 2001: An Assessment of Natural Resource, Economic, Social, and Institutional Issues with a Focus on the Upper Klamath Basin,* SR 1037 (Oregon State University and the University of California, 2002).

[2]Under a contract between the Tulelake Irrigation District and the U.S. Fish and Wildlife Department, excess water is pumped from Tule Lake to Lower Klamath Lake through a 6,600-foot tunnel in Sheepy Ridge. This process provides flood control to the basin, and is the primary source of water for the Lower Klamath National Wildlife Refuge. The pumping cost is about $50,000 annually at the special off-peak drainage power rate of 0.2¢/kWh. Since this pumping activity differs from irrigating privately cultivated lands and serves a public purpose that benefits the entire basin in direct and indirect ways (including the national wildlife refuges), any change in the power rates or cost allocation for this activity may be negotiated separately from any proposed changes in the power rates paid by individual irrigators. As a result of this unique situation, we do not evaluate how changes in energy prices might affect the costs of this activity.

Estimates based on energy consumption data

The first component of energy cost is direct payment for energy. Under current pricing schedules, Upper Klamath Basin irrigators paid PacifiCorp $880,000 in 2000 (McCarthy 2002), a year with slightly higher than average energy consumption. These energy costs are concentrated among the sprinkler-irrigated lands (between 175,000 and 200,000 acres), where energy use is highest. (For the approximately 250,000 flood-irrigated acres, energy costs may be zero or negligible.)

If we assume this $880,000 energy bill (which includes costs incurred by centralized pumping stations such as those operated by irrigation districts), this cost represents an average of between $4.50 and $5 per acre. Some farmers pay only an annual minimum based on their pump's horsepower (e.g., $6 per horsepower for the first 5 years for pumps less than 90 horsepower, $3 per horsepower after that). For some irrigators, this payment could amount to $256, or $3 to $6 per acre, depending on the acreage irrigated (Lynn Long, Klamath Water Users Association, personal communication).

Given exemptions from standby fees and line extension charges, the above figures represent the total payments for energy by farmers. Thus, a 900 percent increase in power rates from a starting point of $4 to $5 per acre suggests per-acre energy costs of $40 to $50 for sprinkler irrigation. Of course, costs for individual farms vary by crop, crop rotation, and technology.

The average annual regional energy consumption from 1997 to 2001 was 127 million kWh (McCarthy 2002). At the Oregon standard agricultural price of 5.696¢/kWh, this energy would cost irrigators $7.22 million (compared with less than $1 million at current rates), or an average of $36 to $41 per acre for 175,000 to 200,000 sprinkler-irrigated acres. This figure represents an increase of $32 to $36 per acre compared to current pricing. Increases for water-intensive crops such as alfalfa would be higher. Increased energy costs for the region as a whole would amount to more than $6 million per year.

The second component of energy pricing is the standby fee, or "standard fee," which is based on the horsepower of each farmer's pumping capacity. The current rate for irrigators in Oregon outside the Klamath Basin is $9/kW, or about $6.75/horsepower. If applied to the Klamath Basin, these annual charges could average an additional $3 to $5 per acre per year, depending on the pump size and number of acres irrigated.

The third component of energy pricing involves line extensions. If paying the full cost of line extensions, farmers likely would request line extensions only if the financial benefits were greater than the cost (which could be quite high for some operators).

The continued viability of agriculture in the region is unlikely to be driven by the cost of line extensions. Indeed, requests for line extensions might decline dramatically or stop altogether. Therefore, we will set aside the question of line extensions under future pricing schedules and focus on the direct costs of energy and pumping capacity.

Taken together, standard energy charges and standby fees for Oregon are estimated at $35 to $50 per acre for pressurized sprinkler irrigation, compared to only $3 to $6 per acre in the Upper Klamath Basin under the current pricing schedule.[3]

However, in order to accurately estimate how the elimination of current contract energy pricing would affect per-acre energy costs, we must consider how the price increase would affect energy use. With a possible 900 percent increase in the price of energy, we expect farmers to consume less energy per acre. With the imposition of an annual standby charge based on pumping capacity, farmers also are likely to consider ways to minimize these charges. Finally, if farmers are

[3]For a small but significant number of acres (perhaps 2,000 acres), diesel or propane pumps are used rather than electric pumps (Lynn Long, personal communication). These pumps are easily moved, but are more expensive to operate.

charged the full cost of line extensions, requests for line extensions certainly would decline. Indeed, there might even be a reduction in the number of pumping sites since the higher energy charges and standby fees might induce some farmers to switch from sprinklers back to flood irrigation (although water quality requirements on return flows imposed under the Clean Water Act may inhibit switching to flood irrigation (Greg Williams and Eldwin Sorensen, Northwest Farm Credit Services, personal communication, April 2004).

All of these factors suggest that the actual cost increases would be less than the above estimates, which do not take account of the ways farmers can be expected to economize on energy as it gets more expensive. The responsiveness of farmers' energy consumption to energy price (what economists call the "price elasticity of demand") has been estimated in a number of economic studies (see, for example, Conners, Glyer, and Adams 2003), indicating that a reduction in energy consumption can be expected. Thus, the above estimates of increased costs should be viewed as "upper bounds" reflecting a situation where farmers do not reduce their energy consumption as the cost of energy rises.

Estimates based on energy costs in other areas

In other parts of Oregon (e.g., along the Deschutes River in Jefferson County and in northeast Oregon), irrigators pay between five and nine times as much for energy as farmers in the Klamath Reclamation Project and from four to nearly eight times as much as Klamath irrigators outside the Project.

Information on irrigation energy costs throughout Oregon also is found in the crop enterprise budgets produced by the Oregon State University Extension Service (http://oregonstate.edu/Dept/EconInfo/ent_budget/). For alfalfa grown in central Oregon (Jefferson, Crook, and Deschutes counties) and eastern Oregon (Baker, Wallowa, and Union counties) using surface water for irrigation, pumping costs have been estimated at $25 per acre (see EM 8606, EM 8604).

In the case of potatoes and mint grown in north-central and eastern Oregon using groundwater (EM 8460, EM 8602), pumping costs are estimated at $60 per acre due to the lift involved. (Some potatoes in the Hermiston area are irrigated with water lifted 500 to 600 feet from the Columbia River.) These figures from other parts of Oregon provide estimates of irrigation pumping costs that are both higher and lower than the range of estimates for the Upper Klamath Basin.

Estimates based on an engineering approach

We also can take a more technical approach to estimating irrigation energy costs, based on the energy requirements for a given pumping system per acre-foot of water and on the water application levels for each crop and representative crop rotation.[4] Most of the pumping cost is associated with pressurizing water into sprinkler systems at between 45 and 70 psi (pounds per square inch). Flood irrigation frequently involves little pumping and very low pumping costs. Water applications range from 20 to 36 acre-inches for crops grown in the Upper Klamath Basin.

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[4]Pumping cost, c, is computed as $c = p * E$, where E is the energy consumed in kWh, and p is the price per kWh of energy. E is computed as $E = t * kw$, where t is the time in hours and kw is kilowatts per unit time. The rate of energy consumption is $kw = q * tdh/3{,}960$, where q is the pumping rate in gallons per minute and tdh is the "total dynamic head." Total dynamic head, tdh, is the sum of lift, head loss, and the pressure at the pump in psi multiplied by 2.306. The hours of pumping, t, necessary to apply the required acre-inches of water, d, is computed as $(d * 27{,}180)/(q * 60)$. Combining these formulas gives us $c = p * (27{,}180 * d * tdh)/(60 * 3{,}960)$. Lift and head loss are assumed to sum to 15 feet. Motor and pump efficiency is assumed to be a combined 0.7. Assumptions are based on typical values for the technologies used in the region. (Sources: Marshall English, professor and Extension irrigation specialist, Bioresource Engineering Department, Oregon State University; Lynn Long, Chair of the Power Committee, Klamath Water Users Association; Kerns Irrigation; Klamath County Soil and Water Conservation District; Thompson Pumping).

Under current pricing in the Klamath Project, these formulas generate electricity cost estimates of between $3 and $6.25 per acre for crops grown on Class II and III soils. For a given piece of land following a typical crop rotation, however, the average annual electricity cost ranges from $4 to $5 per acre. The range narrows because potatoes—the crop with the highest energy costs—are typically grown only 2 years out of 10.

If the price of energy were increased from 0.6¢ to 5.693¢/kWh, the costs for representative crop rotations on these lands would increase to an estimated $38 to $45 per acre per year. This represents an increase of $34 to $40. Crop-specific costs run from $28.50 for cereals to $60 for potatoes. Alfalfa and pasture costs are estimated at $44 per acre per year. Although some pasture occurs in rotation with higher value crops, most pasture is grown on Class IV and V soils and is flood irrigated; thus, electricity costs most often are negligible, although in some cases drainage pumps are used to remove excess water from these lands.

To summarize, two of the three approaches to estimating potential energy costs suggest that costs to Upper Klamath Basin farmers who sprinkler irrigate would be in the range of $38 to $50 per acre per year under power rates currently charged by PacifiCorp to non-Klamath irrigators, compared to $3 to $6 under current contract rates.[5] The other approach, which looks at per-acre energy costs in other parts of Oregon, finds examples that are both higher and lower than this $38 to $50 range.

Although these estimates do not take full account of the ways that farmers are likely to reduce energy consumption if it becomes much more expensive, they are remarkably close to estimates from the U.S. Department of Agriculture's Economic Research Service. Based on comprehensive national data collection and analysis, the USDA/ERS estimates irrigation energy costs in the western U.S. for electric pumping to average $44 per acre (U.S. Department of Agriculture).

Farm profits without low energy prices

How would energy costs based on standard prices affect farmers' costs and profitability in the Upper Klamath Basin? At one level, we can compare energy costs to the total cost of production (fixed and variable costs), which varies from $200 per acre for Class V lands (primarily pasture) to an average (over a 10-year rotation) of more than $600 per acre for Class II lands where row crops typically are grown in rotation with alfalfa.

Based on standard statewide rates, energy costs would represent between 6.3 and 22.5 percent of total per-acre costs. Under current contract rates, energy costs amount to less than 1 percent of production costs on average.

Of greater interest, however, is the impact that higher energy costs would have on farm profits, and hence on the viability of farming. "Farm profit" refers to the difference between total revenue and total cost, where all costs are taken into account, including inputs, water, labor, district charges, returns for the farm operator, and land.

One way to estimate changes in farm profitability is to estimate expected changes in land rental rates or land prices. The reason is that, except where other nonagricultural uses of land compete with farming, the cost of land is determined primarily by farm profitability. Both rental rates and land values can be expected to reflect the profitability of farming (revenue in excess of all costs) and of the return to landowners who allow others to farm their land.[6]

Variations in rental rates (or, equivalently, an annualized measure of land values) for

[5] For comparison purposes, Idaho farmers growing similar crop rotations (potatoes, alfalfa, grains) incur costs of $30 to $45 per acre (Bob Smead, account manager for irrigation at PacifiCorp, personal communication, September 19, 2003).

[6] Land values will diverge from this relationship if nonagricultural demands for land (e.g., recreational or residential uses) compete with agricultural uses. Otherwise, land rental rates and land prices (expressed on an "annualized" basis) should be consistent.

different land classes reflect this fact. Class II and III farmlands in the Klamath Reclamation Project rent for between $75 and $130 per acre over a typical crop rotation, depending on the soil class and productivity (Klamath County Tax Assessor 2001). When used for highly profitable row crops, rents for these lands can range from $200 to $300 (Braunworth et al. 2002). Also consider the land rental rates in the Project versus those for Jefferson County, Oregon ($60 to $90 per acre, also averaged over a multiyear crop rotation). The disparity in rates between the two areas reflects differences in farm profitability due to cropping patterns, soils, climate, and energy costs.

Farmers generally are willing to rent a given piece of land at a given price only if they expect that, after paying all other costs, their profits will cover the rental price. If farmers cannot break even at a given land rental rate, market pressures will cause the land rental rate to adjust downward.[7]

As a result, we cannot assume that land rental costs would remain constant in the face of changing crop prices or input costs. This conclusion is supported by many detailed economic studies and economic theory: changes in farm costs or revenues tend, eventually, to end up being capitalized into land prices and rental rates.

If the costs of farming were to increase by $40 per acre in the Klamath Project due to higher energy costs (a central estimate based on both the energy consumption data and the engineering estimates above), farmers would be reluctant to pay current land rental rates. Landowners, of course, would prefer not to reduce rental rates, but if farmers could not break even at the current rates, pressure would build for lower rental rates (in cases where the renter pays the power costs). These downward pressures on rental rates (or farm profitability) would also lower land prices and thus reduce the value of landowners' assets. In cases where landowners pay for power, the rental rate may not decline, but the impact on landowners' incomes and land prices is likely to be the same.

To estimate how higher energy prices would affect the land rental rates (or annualized land values) for irrigated land in the Upper Klamath Basin, we subtract the estimated annual energy cost increases (for sprinkler irrigation) from the current estimates of land values/rental rates for each location and soil class. These adjusted annual land values are presented in Table 1 (page 7).[8]

Profits on Class II and Class III lands

With these changes in power charges, rental rates (or annualized land values) for sprinkler-irrigated Class II lands in the main Project areas (including most of the Upper and Lower Lost River Valley areas) are estimated to decline to between $74 and $104 per acre per year, with one exception. Estimates are lower for the "West of 97 to Keno" area, where rental rates were lower initially. In the case of Class III lands, adjusted rental rates range from $23 to $62 per acre, again with one exception.

These results suggest that the profits accruing to landowners using sprinkler irrigation would decline significantly with a change in energy pricing, but farming would not become unprofitable in the Project or on most non-Project lands in the Upper Basin. We estimate that the loss of current contract energy pricing

[7]Land sale prices will tend to reflect these same relationships, with the price of land representing the discounted present value of expected future annual profits (whether from rental income or own-use). In some areas, however, demand for "lifestyle" or "hobby" farms may cause land prices to diverge from values that reflect only farm profits.

[8]These reductions in land values and landowner income would have some additional "ripple effects" on the regional economy due to reduced spending by landowners. Property tax revenues in Klamath County also would be adversely affected by declining land prices. Bear in mind, however, that immediately after the 2001 irrigation curtailment, land prices declined significantly compared to the pre-2001 levels used in the current analysis. Since then, however, land values (reflected in land rental rates) have increased above their pre-2001 levels (Don Ringold, Klamath County Tax Assessors Office, personal communication, June 2004). These changes seem to reflect both increased certainty about water deliveries to farmlands and recent opportunities to lease or sell water to publicly-funded water transfer and water banking programs.

Table 1. Estimated land rental values with elimination of current low energy prices (for sprinkler-irrigated lands only).[a, b]

	Net revenue per acre if sprinkler irrigated (by soil class)				Total irrigated acres	Sprinkler-irrigated acres	Non-Project acres	Sprinker pasture/hay acres
	Class II	Class III	Class IV	Class V				
Upper Klamath Lake and above	—	—	—	—	179,000	58,000	173,000	57,000
Fort Klamath Valley	—	2	-13	-28				
Modoc Point to Chiloquin	38	2	-13	-28				
Sprague River Valley	—	8	-7	-34				
North Country	—	-7	-7	-37				
Upper Lost River Valley	—	—	—	—	84,000	50,000	44,000	46,000
Langell Valley	74	35	-7	-30				
Bonanza-Dairy	74	35	-7	-30				
Poe Valley	98	26	2	-28				
Swan Lake Valley	74	35	-7	-30				
Lower Lost River Valley and other Project lands	—	—	—	—	184,000	85,000	32,000	50,000
Merrill-Malin area	98	23	2	-28				
Midland-Henley-Olene	98	26	2	-28				
Lower Klamath Lake	98	56	2	-40				
Malin Irrigation District	104	62	8	-34				
Shasta View District	104	29	8	-34				
West of 97 to Keno	38	2	-13	-28				
Tule Lake	98	50	8	—				
Total acres	**51,000**	**161,000**	**183,000**	**30,000**	**447,000**	**193,000**	**249,000**	**153,000**

[a]Expected energy cost increases have been subtracted from the recent rental rate estimates for each class and location for irrigated lands (net of the value corresponding to nonirrigated land). Sprinkler irrigation is assumed for purposes of these estimations, even though only about 43 percent of irrigated lands are sprinkler irrigated based on the above data.

[b]Class IV and V lands are dominated by pasture and hay production, and they include both flood and sprinkler irrigation.

would raise costs by an average of $40 per sprinkler-irrigated acre in the Project and that these costs likely would be absorbed by landowners. (Cost increases outside the Project are assumed to be slightly less given the higher current non-Project energy prices.)

These estimated rental rates are similar to the range reported for Jefferson County ($60 to $90 per acre), where energy prices are much higher than the prices paid in the Upper Klamath Basin (Jefferson County Assessor, 2003). The Jefferson County land rental rates highlight the fact that higher energy prices have not kept farmers in other parts of Oregon from irrigating highly productive farmlands.[9]

Profits on Class IV and Class V lands

In the case of Class IV and V lands, sprinkler-based irrigated agriculture may become unprofitable in most cases when power costs increase by $40 per acre. Table 1 indicates that all areas where Class IV and V lands are sprinkler irrigated are vulnerable to a loss of profitability. Many of these lands are concentrated in the Sprague River area, the Swan Lake Valley, and Langell Valley. The Class IV and V lands currently under sprinkler irrigation amount to about 153,000 acres based on data from the Natural Resources Conservation Service (Terry Nelson, personal communication). Approximately 65,000 of those acres are outside the Project.[10]

The number of farm acres in these areas that might face a loss of profitability would depend on irrigation lift requirements, the need to use sprinkler irrigation (e.g., where sloped or uneven fields could not be flood irrigated effectively), and restrictions from the Clean Water Act for switching to flood irrigation. Some farms may be able to convert to controlled flood irrigation; others may not. Conversion to flood irrigation may be impeded by uneven ground. A significant portion of these lands are currently irrigated with groundwater. Recent attention to this issue suggests that increased reliance on groundwater may have contributed to a decline in groundwater levels (Milstein, 2004).

If some portion of these Class IV and Class V sprinkler-irrigated lands became unprofitable to irrigate, consumptive use of water for irrigation would decline. For example, one-fifth (30,000 acres) of these Class IV and V sprinkler-irrigated lands represent about 7 percent of the total irrigated acres in the Upper Basin but only about 3.5 percent of the net income from irrigated agriculture. The consumptive use on these 30,000 acres of pasture and hay is about 75,000 acre-feet, or about one-quarter of the irrigation reductions imposed in 2001.[11]

Potential changes in agricultural practices

In addition to reductions in land prices and rental rates, some changes in agricultural practices could be expected if current contract energy prices were eliminated. The proportion of lands planted to water- and energy-intensive crops likely would decline relative to non-water-intensive and non-energy-intensive crops. The shift toward high-pressure sprinkler irrigation likely would slow, whereas the introduction of energy-conserving technologies likely would accelerate. Indeed, some irrigators in the Klamath area already have shifted or made plans to switch to low-pressure nozzles, smaller pumps, or variable-frequency drives.

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[9]The short-run financial effects of a large increase in energy prices will vary among farm enterprises, depending on the timing, advanced notice, and suddenness of any changes in energy prices.

[10]In a few instances, the incentives to irrigate may not be based solely on demands for commercial agriculture, but are related to residential or "lifestyle farm" demand. In these cases, an increase in energy prices may not affect irrigation in the same way.

[11]In some wetland areas with subsurface water, however, cessation of irrigation may not reduce the "consumptive use" of water since native vegetation potentially could consume water at rates similar to cultivated crops such as irrigated pasture. However, many of the acres vulnerable to a loss of profitability seem to be higher elevation lands, where slopes and uneven ground make flood irrigation impossible, rather than low-lying wetlands.

A shift from sprinkler irrigation to flood irrigation might be an option in areas where "laser leveling" can ensure uniform applications for high-value crops. However, Clean Water Act requirements may limit this option. Note that a decline in the use of high-pressure sprinklers is not expected to significantly lower overall irrigation efficiency or increase water diversions since the aggregate irrigation efficiency for the Project already is greater than 95 percent (and indeed these remaining return flows contribute to wildlife habitat in the refuges.)

An opposing trend, however, is underway in the region in response to a special authorization in the 2002 Farm Bill, which has allocated $50 million of public funds to the Upper Klamath Basin to promote irrigation efficiency (primarily adoption of sprinkler technologies, but also including some laser-leveling for controlled flood irrigation). These funds typically finance three-quarters of the cost of sprinkler technologies purchased by eligible farmers in the area, thereby increasing the prevalence of energy-intensive sprinklers.

While these changes are unlikely to "free up" additional water because of the already-high aggregate irrigation efficiency in the Project (mentioned above), any future increase in energy prices would add significant production costs for those farmers who take advantage of this program. Thus, continued use of the newly acquired equipment may be discouraged.

Conclusions

Overall, the analysis above indicates that most of the irrigated lands in the Upper Klamath Basin (and in particular those lands within the Klamath Reclamation Project) are highly productive and would continue to be profitable to irrigate under energy prices and fees currently paid by farmers in other parts of Oregon or northern California. Indeed, the viability of agriculture in the region does not depend on the current low energy prices, although these prices provide significant financial benefits to landowners and owner-operators in the region.

If energy prices were to increase to rates comparable to rates paid by PacifiCorp's irrigation customers outside the Klamath area, we estimate the returns to landowners would decrease by about $40 per acre per year on those acres that are, and would continue to be, sprinkler irrigated. Farmers could be expected to conserve energy in a number of ways, such as using low-pressure sprinklers, more energy-efficient pumps, and laser-leveling to increase the efficiency of controlled flood irrigation.

The analysis suggests that some of the 193,000 acres that currently are sprinkler irrigated might become unprofitable if energy prices rise, and that the lands most vulnerable are among the 213,000 acres of Class IV and Class V lands, although the exact number and their location would be difficult to predict. Two-thirds of the sprinkler-irrigated pasture and hay acres are located outside the Project, and these acres represent consumptive use of about 250,000 acre-feet of water.

A loss of profitability on some of these lands could lead to a reduction in irrigation diversions. Water bank or water transfer opportunities might become more attractive for some irrigators who might face significantly higher pumping costs. Depending on how future water shortages are addressed, use of a water bank or other transfer mechanism has the potential to facilitate lower cost solutions to the region's water conflicts, thereby reducing potential harm to the region's overall agricultural economy.

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National Oceanic and Atmospheric Administration

50 CFR Part 227

[Docket No. 950407093-6298-03; I.D. 012595A]

Endangered and Threatened Species; Threatened Status for Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of Coho Salmon

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: The NMFS is issuing a final determination that the Southern Oregon/Northern California Coast Evolutionarily Significant Unit (ESU) of coho salmon (*Oncorhynchus kisutch*) is a "species" under the Endangered Species Act (ESA) of 1973, as amended, and is being listed as threatened. Coho salmon populations are very depressed in this ESU, currently numbering less than 10,000 naturally-produced adults. The threats to this ESU are numerous and varied. Several human-caused factors, including habitat degradation, harvest, and artificial propagation, exacerbate the adverse effects of natural environmental variability brought about by drought, floods, and poor ocean conditions. NMFS has determined that existing regulatory mechanisms are either inadequate or not implemented well enough to conserve this ESU. While conservation efforts are underway for some populations in this ESU, they are not considered sufficient to change the likelihood that the ESU as a whole will become endangered in the foreseeable future. NMFS will issue shortly protective regulations under section 4(d) of the ESA, which will apply section 9(a) prohibitions to this ESU, with certain exceptions. NMFS does not expect those regulations to become effective before July 1, 1997.

NMFS has further determined that the Oregon Coast ESU does not warrant listing at this time. Accordingly, NMFS will consider the Oregon Coast coho salmon ESU to be a candidate species in 3 years (or earlier if warranted by new information).

EFFECTIVE DATE: June 5, 1997.

ADDRESSES: Garth Griffin, NMFS, Northwest Region, Protected Species Program, 525 N.E. Oregon St., Suite 500, Portland, OR 97232-2737; Craig Wingert, NMFS, Southwest Region, Protected Species Management Division, 501 W. Ocean Blvd., Suite 4200, Long Beach, CA 90802-4213; or Joe Blum, NMFS, Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD 20910.

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SUPPLEMENTARY INFORMATION:

Species Background

The coho salmon (*Oncorhynchus kisutch*) is an anadromous salmonid species that was historically distributed throughout the North Pacific Ocean from central California to Point Hope, AK, through the Aleutian Islands, and from the Anadyr River, Russia, south to Hokkaido, Japan. Historically, this species probably inhabited most coastal streams in Washington, Oregon, and northern and central California. Some populations, now extinct, are believed to have migrated hundreds of miles inland to spawn in tributaries of the upper Columbia River in Washington and the Snake River in Idaho.

Coho salmon on the west coast of the contiguous United States and much of British Columbia generally exhibit a relatively simple 3-year life cycle. Adults typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. The run and spawning times vary between and within populations. Depending on river temperatures, eggs incubate in "redds" (gravel nests excavated by spawning females) for 1.5 to 4 months before hatching as "alevins" (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles or "fry" and begin actively feeding. Juveniles rear in fresh water for up to 15 months, then migrate to the ocean as "smolts" in the spring. Coho salmon typically spend 2 growing seasons in the ocean before returning to their natal stream to spawn as 3 year-olds. Some precocious males, called "jacks," return to spawn after only 6 months at sea.

During this century, indigenous, naturally-reproducing populations of coho salmon have been extirpated in nearly all Columbia River tributaries and they are in decline in numerous coastal streams throughout Washington, Oregon, and California. NMFS" coho salmon status review identified six distinct population segments (i.e., ESUs) in Washington, Oregon, and California and noted that natural runs in all ESUs are substantially below historical levels (Weitkamp, et al. 1995). At least 33 populations have been identified by state agencies and conservation groups as being at moderate or high risk of extinction. In general, the impacts on West Coast coho salmon stocks decrease geographically from south to north, with the central California stocks being in the worst condition.

This **Federal Register** document focuses on listing determinations for two coho salmon ESUs—the Southern Oregon/Northern California Coast ESU and the Oregon Coast ESU—both of which were proposed as threatened species under the ESA on July 25, 1995 (60 FR 38011). The Southern Oregon/Northern California Coast ESU is composed of populations between Punta Gorda (CA) and Cape Blanco (OR). In the 1940s, estimated abundance of coho salmon in this ESU ranged from 150,000 to 400,000 naturally spawning fish. Today, coho populations in this ESU are very depressed, currently numbering approximately 10,000 naturally produced adults. Populations in the California portion of this ESU could be less than 6 percent of their abundance during the 1940s (CDFG, 1994), while Oregon populations have exhibited a similar but slightly less severe decline (ODFW, 1995); however, it is important to note that population abundance in the Rogue River Basin has increased substantially over the last 3 years (NMFS, 1997a). The bulk of current coho salmon production in this ESU consists of stocks from the Rogue River, Klamath River, Trinity River, and Eel River basins. Smaller basins known to support coho salmon include the Elk River in Oregon, and the Smith and Mad Rivers and Redwood Creek in California.

The Oregon Coast ESU is composed of populations between Cape Blanco and the Columbia River. More than one million coho salmon are believed to have returned to Oregon coastal rivers in the early 1900s (Lichatowich, 1989), the bulk of them originating in this ESU. Current production is estimated to be less than 10 percent of historical levels. Spawning in this ESU is distributed over a relatively large number of basins, both large and small, with the bulk of the production being skewed to the southern portion of its range. There, the coastal lake systems (e.g., the Tenmile, Tahkenitch, and Siltcoos basins) and the Coos and Coquille Rivers have been particularly productive for coho salmon.

Previous Federal ESA Actions Related to Coho Salmon

The history of petitions received regarding coho salmon is summarized in the proposed rule published on July 25, 1995 (60 FR 38011). The most comprehensive petition was submitted by the Pacific Rivers Council and 22 co-petitioners on October 20, 1993. In response to that petition, NMFS assessed the best available scientific and commercial data, including technical information from Pacific Salmon Biological and Technical Committees (PSBTCs) in Washington, Oregon, and California. The PSBTCs consisted of scientists with technical expertise relevant to coho salmon. They were drawn from Federal, state, and local resource agencies, Indian tribes, industries, professional societies, and public interest groups. NMFS also established a Biological Review Team (BRT), composed of staff from its Northwest Fisheries Science Center and Southwest Regional Office, which conducted a coastwide status review for coho salmon (Weitkamp et al., 1995).

Based on the results of the BRT report, and after considering other information and existing conservation measures, NMFS published a proposed listing determination (60 FR 38011, July 25, 1995) that identified six ESUs of coho salmon ranging from southern British Columbia to central California. The Olympic Peninsula ESU was found not to warrant listing and the Oregon Coast ESU, Southern Oregon/Northern California Coast ESU, and Central California Coast ESU were proposed for listing as threatened species. The Puget Sound/Strait of Georgia ESU and the lower Columbia River/southwest Washington Coast ESU were identified as candidates for listing. NMFS is now in the process of completing status reviews for these latter two ESUs; results and findings for both will be announced in an upcoming **Federal Register** notice.

On October 31, 1996, NMFS published a final rule listing the Central California Coast ESU as a threatened species (61 FR 56138). Concurrently, NMFS announced that a 6-month extension was warranted for the Oregon Coast and Southern Oregon/Northern California Coast ESUs (61 FR 56211) due to the fact that there was substantial disagreement regarding the sufficiency and accuracy of the available data relevant to the listing determination (pursuant to section 4(b)(6)(B)(i) of the ESA). The NMFS has now completed a review of additional data pertaining to these two ESUs and has updated its west coast coho salmon status review (NMFS, 1997a).

Summary of Comments Regarding the Oregon Coast and Southern Oregon/ Northern California Coast ESUs

The NMFS held six public hearings in California, Oregon, and Washington to solicit comments on the proposed listing determination for west coast coho salmon. Sixty-three individuals presented testimony at the hearings. During the 90-day public comment period, NMFS received 174 written comments on the proposed rule from state, Federal, and local government agencies, Indian tribes, non-governmental organizations, the scientific community, and other individuals. In accordance with agency policy (59 FR 34270, July 1, 1994), NMFS also requested a scientific peer review of the proposed rule, receiving responses from two of the seven reviewers. A summary of major public comments pertaining to the Oregon and Northern California coho salmon ESUs (including issues raised by peer reviewers) is presented below, grouped by issue categories.

Issue 1: Sufficiency and Accuracy of Scientific Information and Analyses

Comment: Many individuals urged NMFS to use the best available scientific information in reaching a final determination regarding the risk of extinction that the coho salmon ESUs face. Comments received from a peer reviewer, as well as from scientists representing state fish and wildlife agencies, tribes, and the private sector, disputed the sufficiency and accuracy of data that NMFS employed in its proposed rule to list west coast coho salmon. In particular, they questioned the data relating to the ESUs in Oregon and California. The primary areas of disagreement concerned data relevant to risk assessment and NMFS' evaluation of existing protective measures.

Response: The ESA requires that listing determinations be made on the basis of a population's status which is determined by using the best available scientific and commercial data, with subsequent consideration being given to state and foreign efforts to protect the species. In response to the comments summarized above, NMFS published a document (61 FR 56211, October 31, 1996) extending the final listing determination deadline for the Oregon Coast and Southern Oregon/Northern California Coast ESUs for 6 months to solicit, collect, and analyze additional data. During this period, NMFS met with fisheries co-managers and received new and updated information on coho salmon in British Columbia, Washington, Oregon, and California. This was deemed critical to assessing the current status of coho salmon ESUs. This new information, more fully described in a report from the NMFS BRT (NMFS, 1997a), generally consists of updates of existing data series, new data series, and new analyses of various factors. NMFS also received analyses and conservation measures associated with the OCSRI (OCSRI, 1996 and 1997). The OCSRI components relating to hatchery and harvest measures were assessed by the BRT (NMFS, 1997a), while remaining measures were assessed by the NMFS Habitat program (NMFS, 1997b).

NMFS believes that information contained in the agency's 1995 west coast coho salmon status review (Weitkamp *et al.*, 1995), together with more recent information collected by NMFS scientists and information provided to NMFS by other sources since the proposed listing determination was published, represent the best scientific information presently available for coho salmon populations on the Oregon and California coast. NMFS believes that this information is sufficient and accurate, and, in accordance with the ESA, finds it both mandatory and appropriate to make a listing determination at this time. If substantial new scientific information indicates a change in the status of either coho salmon ESU, NMFS will reconsider the present listing determinations.

Comment: Some commenters felt that NMFS should establish explicit listing criteria common to all coho salmon ESUs, and noted that such criteria would lead to different conclusions regarding extinction risk.

Response: At this time, there is no accepted methodology nor explicit listing criteria for determining the likelihood of extinction for Pacific salmon. In November 1996, NMFS' Northwest and Southwest Fisheries Science Centers sponsored a symposium/workshop on "Assessing Extinction Risk for West Coast Salmon" (Seattle, November 13–15, 1996). The objective of the workshop was to evaluate scientific methods for assessing various factors contributing to extinction risk for Pacific salmon populations. A preliminary summary of key recommendations was considered by the BRT during the coho salmon status review. Most of these recommendations require long-term development of improved methods, and thus, could not be substantially applied in this review.

In recent months, NMFS has also evaluated three different population simulation models for coho salmon developed by members of the OCSRI Science Team. The preliminary results of these viability models provide a wide range of results, with one model suggesting that most Oregon coastal stocks cannot sustain themselves at the ocean survival rates that have been observed in the last 5 years (even in the absence of harvest) and another suggesting that stocks are highly resilient and would be at significant risk of extinction only if habitat degradation continues into the future (more detailed evaluations of these models are presented in NMFS' status review update (NMFS, 1997a)). While these models have potential heuristic value, NMFS is presently reluctant to employ them to forecast extinction risk for coho salmon. Instead, NMFS has relied on its traditional assessment method, which employs a variety of information types to evaluate the level of risk faced by an ESU. These include: (1) Absolute numbers of fish and their spatial and temporal distribution; (2) current abundance in relation to historical abundance and carrying capacity of the habitat; (3) trends in abundance, based on indices such as dam or redd counts or on estimates of spawner-recruit ratios; (4) natural and human-influenced factors that cause variability in survival and abundance; (5) possible threats to genetic integrity (e.g., fisheries and interactions between hatchery and natural fish); and (6) recent events (e.g., a drought or a change in management) that have predictable short-term effects on the ESU's abundance. These considerations and the approaches to evaluating them are described in more detail in Weitkamp et al. (1995) and have been used by NMFS in other salmon status reviews. At this time, NMFS believes that an integrated assessment using these types of information is both desirable and appropriate for determining whether a Pacific salmon species is likely to become endangered or extinct.

Issue 2: Description and Status of the Southern Oregon/Northern California Coast and Oregon Coast Coho Salmon ESUs

Comment: A few commenters disputed NMFS' conclusions regarding the geographic boundaries for these ESUs; those who did, believed that NMFS should reduce the size/number of populations that constitute ESUs. One commenter believed that the Umpqua River basin (in the Oregon Coast ESU) should be considered a separate ESU and that listing was not warranted.

Response: The NMFS has published a policy describing how it would apply the ESA definition of a "species" to anadromous salmonid species (56 FR 58612, November 20, 1991). More recently, NMFS and the U.S. Fish and Wildlife Service (FWS) published a joint policy, consistent with NMFS' policy, regarding the definition of "distinct population segments" (61 FR 4722, February 7, 1996). The earlier policy is more detailed and applies specifically to Pacific salmonids and, therefore, was used for this determination. This policy indicates that one or more naturally reproducing salmonid populations will be considered to be distinct and, hence, species under the ESA, if they represent an ESU of the biological species. To be considered an ESU, a population must satisfy two criteria: (1) It must be reproductively isolated from other population units of the same species, and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute but must have been strong enough to permit evolutionarily important differences to occur in different population units. The second criterion is met if the population contributes substantially to the ecological or genetic diversity of the species as a whole. Guidance on applying this policy is contained in a scientific paper entitled: "Pacific Salmon (*Oncorhynchus* spp.) and the Definition of 'Species' under the Endangered Species Act." It is also found in a NOAA Technical Memorandum: "Definition of 'Species' Under the Endangered Species Act: Application to Pacific Salmon." NMFS' proposed listing determination and rule (60 FR 38011, July 25, 1995) for west coast coho salmon and the west coast coho salmon status review (Weitkamp et al., 1995) describe the genetic, ecological, and life history characteristics, as well as human-caused genetic changes, that NMFS assessed to determine the number and geographic extent of the coho salmon ESUs.

With respect to the Umpqua River, NMFS recognizes that physical and hydrological conditions in this basin are unique (i.e., it is by far the largest basin in the Oregon Coast ESU, and it is the only basin in the ESU to cut through the Coast Range to drain the Cascade Mountains). However, NMFS believes that application of the agency's policy (described above) justifies including Umpqua River coho salmon populations as an integral part of the Oregon Coast ESU. Ocean distribution patterns (based on marine recovery locations of fish tagged with coded wire tags) for coho salmon released from this ESU (including releases from the Umpqua stocks) are distinctly different from the distribution patterns for coho salmon released from ESUs to the north and south. Thus, NMFS concludes that the ocean migration patterns of the Umpqua stocks are similar to the rest of the stocks in the ESU. In addition, genetic data that NMFS reviewed (Weitkamp *et al.*, 1995) indicate that genetic discontinuities are particularly pronounced at Cape Blanco and the mouth of the Columbia River. While there is evidence of genetic heterogeneity within this area (e.g., the Oregon Department of Fish and Wildlife (ODFW) has identified the Umpqua River basin as one of six distinct gene conservation groups of coho salmon), NMFS believes that this ESU, as a whole, which includes the Umpqua stocks, exhibits a reasonable degree of reproductive isolation from the other two ESUs that border it.

Comment: Most commenters expressed an opinion as to whether listing was warranted for these and other coho salmon ESUs, although few provided substantive new information relevant to making risk assessments. The majority of comments stated that both ESUs should be listed as threatened or endangered, while relatively few stated that listing was not warranted.

Response: Recent Status of the Southern Oregon/Northern California Coast ESU: The Estimates of natural population abundance in the ESU continue to be based on very limited information, but the ESU has clearly undergone a dramatic decline. Favorable indicators include recent increases in abundance in the Rogue River and the presence of natural populations in both large and small basins within the ESU—factors that may provide some buffer against the ESU's extinction. However, large hatchery programs, particularly in the Klamath/Trinity basin, raise serious concerns about effects on, and sustainability of, natural populations. For example, available information indicates that virtually all of the naturally spawning fish in the Trinity River are first-generation hatchery fish. Several hatcheries in the California portion of this ESU have used exotic stocks extensively in the past, in contrast to Cole Rivers Hatchery in Oregon which has only released Rogue River stock into the Rogue River. New data relating to coho salmon presence/absence in northern California streams that historically supported coho salmon are even more disturbing than earlier results, indicating that a smaller percentage of streams in this ESU contain coho salmon than did during an earlier study. However, it is unclear whether these new data represent actual trends in local extinctions, or if they are simply biased by sampling methods.

In the Rogue River basin, natural spawner abundance in 1996 was slightly above levels found in 1994 and 1995. Abundances in the most recent 3 years are all substantially higher than they were in 1989–93, and are comparable to counts at Gold Ray Dam (upper Rogue) in the 1940s. Estimated return ratios for 1996 are the highest on record, but this may be influenced by an underestimate of parental spawners. The Rogue River run included an estimated 60 percent hatchery fish in 1996; this figure is comparable to the percentages found in recent years. The majority of these hatchery fish return to Cole Rivers Hatchery, but NMFS has no estimate of the actual number that stray into natural habitat.

Response: Recent Status of the Oregon Coast ESU: While this ESU's current abundance is substantially less than it was historically, recent trends indicate that spawner escapements in this ESU are stable or increasing as a likely result of significant harvest restrictions (or other factors). Although escapement has been increasing for the ESU as a whole (1996 estimate of ESU-wide escapement indicates an approximately four-fold increase since 1990), recruitment and recruits-to-spawner ratios have remained low. While recent natural escapement has been estimated to be on the order of 50,000 fish per year in this ESU (reaching approximately 80,000 fish in 1996), this has been coincident with drastic reductions in harvest. Pre-fishery recruitment was higher in 1996 than in either 1994 or 1995, but it still exhibits a relatively flat trend since 1990. When looked at on a finer geographic scale, the northern Oregon coast still has very poor escapement, the north-central coast is mixed with strong increases in some streams but continued poor escapement in others, and the south-central coast continues to have increasing escapement.

In contrast to most of the 1980s, spawner-to-spawner ratios in this ESU have remained at or above replacement since 1990 (due primarily to sharp reductions in harvest). This represents the longest period of sustained replacement observed in the past 20 years. It is notable that this sustained replacement has occurred during a period of low recruitment and primarily poor-to-fair ocean conditions. However, significant concerns remain regarding the declining trend in this ESU's productivity.

Issue 3: Factors Contributing to the Decline of West Coast Coho Salmon ESUs

Comment: Many commenters addressed factors contributing to the decline of coho salmon. These included overharvest, predation by pinnipeds, effects of artificial propagation, and the deterioration or loss of freshwater and marine habitats. One peer reviewer and several commenters believed that NMFS' assessment did not adequately consider the large influence of natural environmental fluctuations. Some commenters took exception to generalizations that NMFS made regarding the various factors for decline and requested more detail on the various factors so that recovery efforts could be appropriately focussed.

Response: NMFS agrees with the commenters that many factors, past and present, have contributed to the decline of coho salmon. The agency also recognizes that natural environmental fluctuations have likely played a large role in the species' recent declines. However, NMFS believes that other human-induced impacts (e.g., from overharvest, hatchery practices, and habitat modification) have been equally significant and, moreover, have likely reduced the coho salmon populations' resiliency in the face of adverse natural factors such as drought and poor ocean conditions. Since the time of NMFS' proposed listing, several documents have been produced that describe in more detail the impacts of various factors contributing to the decline of coho and other salmonids (NMFS, 1996a, 1997a, and 1997b; OCSRI 1997). In addition, NMFS has developed a document titled "Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale" (NMFS, 1996b). This document presents guidelines to facilitate and standardize determinations of "effect" under the ESA and includes a matrix for determining the condition of various habitat parameters. This matrix is being implemented in several northern California and Oregon coastal watersheds and is expected to help guide efforts to define salmon risk factors and conservation strategies throughout the west coast. A concise description of information contained in these documents, as well as new information provided by commenters, has been incorporated in the section below titled "Summary of Factors Affecting Coho Salmon."

Issue 4: Adequacy of Existing Conservation Measures or Regulatory Mechanisms

Comment: Many commenters expressed opinions regarding the adequacy of existing conservation efforts or regulatory mechanisms. While many thought that existing programs were sufficient to conserve coho salmon (and hence avoid listing), others believed that efforts were either inadequate, poorly implemented, or of uncertain benefit to the species.

Response: The regulatory mechanisms established by Federal, state, tribal, and local governments provide the most effective and available means to prevent a species from facing the peril of extinction. In its proposed rule, NMFS concluded that existing measures were not sufficient to offset population declines. Since that time, several documents have been produced that describe in more detail the existing conservation efforts for salmon in Oregon and California (NMFS, 1996a, 1996c, and 1997b; OCSRI, 1997). Moreover, the agency has reviewed a variety of state and Federal conservation efforts (including regulatory mechanisms) aimed at protecting coho salmon and their habitats in these ESUs, and NMFS recognizes that significant conservation efforts have been made by an array of government agencies and private groups in California and Oregon. NMFS has also developed a document titled "Coastal Salmon Conservation: Working Guidance for Comprehensive Salmon Restoration Initiatives on the Pacific Coast" (NMFS, 1996d). This document was drafted to guide the Pacific Coast states, tribes, and other entities in taking the initiative for coastal salmon restoration; it also provides a framework for developing successful salmon restoration strategies. Information that commenters provided regarding existing regulatory mechanisms has been incorporated in the sections below titled: "Summary of Factors Affecting Coho Salmon, and Efforts to Protect Oregon and California Coho Salmon."

Issue 5: Information Received After the Close of the Comment Period

Comment: When the states of Oregon and California announced that they were in the process of developing salmon restoration initiatives (61 FR 56211, October 31, 1996), it generated considerable interest among the general public. This was especially true for the OCSRI. Between the time the August OCSRI draft was released and this **Federal Register** document was written, NMFS received a great deal of correspondence on this subject. Some of the mail was addressed to NMFS, but much of it arrived in the form of courtesy copies of mailings sent to the state. The majority of the comments NMFS received supported the concept of a state restoration initiative, but they also expressed the thought that NMFS should still provide the additional protections afforded by a listing under the ESA.

Response: NMFS has considered this information and thanked as many of these commenters as time has allowed, and, moreover, appreciates the input it has received from the many comments that were submitted.

Summary of Factors Affecting Coho Salmon

Section 4(a)(1) of the ESA and NMFS listing regulations (50 CFR part 424) set forth procedures for listing species. The Secretary of Commerce (Secretary) must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence.

The factors threatening naturally-reproducing coho salmon throughout its range are numerous and varied. For coho salmon populations in California and Oregon, the present depressed condition is the result of several long-standing, human-induced factors (e.g., habitat degradation, harvest, water diversions, and artificial propagation) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought, floods, and poor ocean conditions.

As noted earlier, NMFS received numerous comments regarding the relative importance of various factors contributing to the decline of coho salmon. Several recent documents have been produced that describe in more detail the impacts of various factors contributing to the decline of coho and other salmonids (NMFS, 1996a, 1997a, and 1997b; OCSRI, 1997). The following sections provide an overview of the various risk factors and their role in the decline of Oregon and California coho salmon.

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

NMFS, in conjunction with the State of Oregon, identified the habitat factors for decline that have affected coho salmon. The factors are: Channel morphology changes, substrate changes, loss of instream roughness, loss of estuarine habitat, loss of wetlands, loss/degradation of riparian areas, declines in water quality (e.g., elevated water temperatures, reduced dissolved oxygen, altered biological communities, toxics, elevated pH, and altered stream fertility), altered streamflows, fish passage impediments, elimination of habitat, and direct take. Additional detail on each of these factors for decline can be found in reports by NMFS (NMFS, 1996a, 1997a, and 1997b) and the State of Oregon (OCSRI, 1997).

The major activities responsible for the decline of coho salmon in Oregon and California are logging, road building, grazing and mining activities, urbanization, stream channelization, dams, wetland loss, beaver trapping, water withdrawals and unscreened diversions for irrigation. Many commenters expressed concern that these and other habitat-related activities, if unchecked, could ultimately lead to the ESUs' becoming endangered or extinct. The following discussion provides an overview of the types of activities and conditions that adversely affect coho salmon in coastal watersheds.

Numerous studies have demonstrated that land use activities associated with logging, road construction, urban development, mining, agriculture, and recreation have significantly altered the quantity and quality of coho salmon habitat. Impacts of concern associated with these activities include the following: Alteration of streambank and channel morphology, alteration of ambient stream water temperatures, alteration of the magnitude and timing of annual stream flow patterns, elimination of spawning and rearing habitat, fragmentation of available habitats, elimination of downstream recruitment of spawning gravels and large woody debris, removal of riparian vegetation resulting in increased stream bank erosion, and degradation of water quality (CDFG, 1965; Bottom *et al.*, 1985; California Advisory Committee on Salmon and Steelhead Trout, 1988; CDFG, 1991; Nehlsen *et al.*, 1991; California State Lands Commission, 1993; Wilderness Society, 1993; Bryant, 1994; CDFG, 1994; Brown *et al.*, 1994; Botkin *et al.*, 1995; McEwan and Jackson, 1996). Of particular concern is the increased sediment input into spawning and rearing areas that results from loss of properly functioning riparian areas, land management activities that occur on unstable slopes, and certain agricultural practices. Further, historical practices, such as the use of splash dams, widespread removal of log jams, removal of snags from river channels, and eradication of beaver have adversely modified fish habitat (Bottom *et al.*, 1985).

Agricultural practices have also contributed to the degradation of salmonid habitat on the west coast through irrigation diversions, overgrazing in riparian areas, and compaction of soils in upland areas from livestock (Botkin *et al.*, 1995; Spence *et al.*, 1996). The vigor, composition, and diversity of natural vegetation can be altered by livestock grazing in and around riparian areas. This in turn can affect the site's ability to control erosion, provide stability to stream banks, and provide shade, cover, and nutrients to the stream. Mechanical compaction can reduce the productivity of the soils appreciably and cause bank slough and erosion. Mechanical bank damage often leads to channel widening, lateral stream migration, increases in water temperature, and excess sedimentation. Agricultural practices are also a key producer of non-point source pollution which includes runoff from livestock and tilled fields (nutrients and sediments) and agricultural chemicals.

Urbanization has degraded coho salmon habitat through stream channelization, floodplain drainage, and riparian damage (Botkin *et al.*, 1995). When watersheds are urbanized, problems may result simply because structures are placed in the path of natural runoff processes, or because the urbanization itself has induced changes in the hydrologic regime. In almost every point that urbanization activity touches the watershed, point source and nonpoint source pollution occurs. Water infiltration is reduced due to an increase in impervious surfaces. As a result, runoff from the watershed is flashier, with increased flood hazard (Leopold, 1968). Flood control and land drainage schemes may concentrate runoff, resulting in increased bank erosion which causes a loss of riparian vegetation and undercut banks and eventually causes widening and down-cutting of the stream channel. Sediments washed from the urban areas contain trace metals such as copper, cadmium, zinc, and lead (CSLC, 1993). These, together with pesticides, herbicides, fertilizers, gasoline, and other petroleum products, contaminate drainage waters and harm aquatic life necessary for coho salmon survival. The California State Water Resources Control Board (CSWRCB, 1991) reported that nonpoint source pollution is the cause of 50 to 80 percent of impairment to water bodies in California.

Forestry has degraded coho salmon habitat through removal and disturbance of natural vegetation, disturbance and compaction of soils, construction of roads, and installation of culverts. Timber harvest activities can result in sediment delivered to streams through mass wasting and surface erosion that can elevate the level of fine sediments in spawning gravels and fill the substrate interstices inhabited by invertebrates. Where logging in the riparian areas occurs, inputs of leaf litter, terrestrial insects, and large woody debris to the stream are reduced. Loss of large woody debris, combined with alteration of hydrology and sediment transport, reduces complexity of stream micro-and macrohabitats and causes loss of pools and channel sinuosity. The structure of the biological community may also change. This includes fish assemblages and diversity as well as timing of life history events (Spence *et al.*, 1996).

Depletion and storage of natural flows have drastically altered natural hydrological cycles, especially in California and southern Oregon rivers and streams. Alteration of streamflows has increased juvenile salmonid mortality for a variety of reasons: Migration delay resulting from insufficient flows or habitat blockages; loss of usable habitat due to dewatering and blockage; stranding of fish resulting from rapid flow fluctuations; entrainment of juveniles into unscreened or poorly screened diversions; and increased juvenile mortality resulting from increased water temperatures (California Advisory Committee on Salmon and Steelhead Trout, 1988; CDFG, 1991; CBFWA, 1991; Bergren and Filardo, 1991; Palmisano *et al.*, 1993; Reynolds *et al.*, 1993; Chapman *et al.*, 1994; Cramer *et al.*, 1995; Botkin *et al.*, 1995). In addition, reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas.

Important elements of water quality include water temperatures within the range that corresponds with migration, rearing and emergence needs of fish and the aquatic organisms upon which they depend (Sweeney and Vannote, 1978; Quinn and Tallman, 1987). Desired conditions for coho salmon include an abundance of cool (generally in the range of 11.8 degrees C to 14.6 degrees C), well oxygenated water that is present year-round, free of excessive suspended sediments and other pollutants that could limit primary production and benthic invertebrate abundance and diversity (Cordone and Kelley, 1961; Reiser and Bjornn, 1979; Lloyd *et al.*, 1987).

There are approximately 18,137 miles (30,228 km) of streams in the coastal basins of Oregon. Of that number, 6,086 stream miles (10,143 km) (33.5 percent) have been assessed by Oregon Department of Environmental Quality (DEQ) for compliance with existing water quality standards using available water quality information. Of the 6,086 stream miles assessed (10,143 km), 3,035 stream miles (5,058 km) (49.9 percent) were found to be water quality limited, and 2,345 stream miles (3,908 km)(38.5 percent) need additional data or were of potential concern. Only 706 stream miles (1,177 km)(11.6 percent) of those assessed were found to be meeting all state water quality standards (OCSRI, 1997).

Eighteen water bodies in northern California, including eight within the range of the Southern Oregon/Northern California Coast ESU, have been designated as impaired by the Environmental Protection Agency (EPA) under section 303(d) of the Federal Clean Water Act (CWA). These eight river basins include the Mattole, Eel, Van Duzen, Mad, Shasta, Scott, Klamath, and Trinity Rivers. The primary factors for listing these river basins as impaired are excessive sediment load and elevated water temperatures.

Although individual management activities by themselves may not cause significant harm to salmonid habitats, incrementally and collectively, they may degrade habitat and cause long-term declines in fish abundance (Bisson *et al.*, 1992). Changes in sediment dynamics, streamflow, and water temperature are not just local problems restricted to a particular reach of a stream, but problems that can have adverse cumulative effects throughout the entire downstream basin (Sedell and Swanson, 1984; Grant, 1988). For example, increased erosion in headwaters, combined with reduced sediment storage capacity in small streams, from loss of stable instream large woody debris (LWD), can overwhelm larger streams with sediment (Bisson *et al.*, 1992). Likewise, increased water temperature in headwater streams may not harm salmonids there but can contribute to downstream warming (Bisson *et al.*, 1987; Bjornn and Reiser, 1991).

The most pervasive cumulative effect of past forest practices on habitats for anadromous salmonids has been an overall reduction in habitat complexity (Bisson *et al.*, 1992), from loss of multiple habitat components. Habitat complexity has declined principally because of reduced size and frequency of pools due to filling with sediment and loss of LWD (Reeves *et al.*, 1993; Ralph *et al.*, 1994). However, there has also been a significant loss of off-channel rearing habitats (e.g., side channels, riverine ponds, backwater sloughs) important for juvenile salmon production, particularly coho salmon (Peterson, 1982). Cumulative habitat simplification has caused a widespread reduction in salmonid diversity throughout California, Oregon, and the region.

B. Overutilization for Commercial, Recreational, Scientific, or Education Purposes

Coho salmon have historically been a staple of Pacific Northwest and northern California Indian tribes and have been targeted in recreational and commercial fisheries since the early 1800s (Nickelson *et al.*, 1992). Coho salmon harvested by California Native American tribes in the northern California portion of the Southern Oregon/Northern California Coast ESU is primarily incidental to larger chinook salmon subsistence fisheries in the Klamath and Trinity Rivers; in neither basin is tribal harvest considered to be a major factor for the decline of coho salmon. The recent estimated Yurok tribal net harvest of coho salmon in the Klamath River was 27 in 1994, 660 in 1995, and 540 in 1996. The Yurok tribal fishery is managed annually under a Harvest Management Plan adopted by the Tribal Council pursuant to the authority of the Yurok Tribal Fishing Rights Ordinance. The Hoopa Tribe's estimated net harvest of coho salmon from 1982–96 averaged 263 fish per year and ranged from a low of 25 fish in 1994 to a high of 1,115 fish in 1985. Harvest management practiced by the tribes is conservative and has resulted in limited impacts on the coho salmon stocks in the Klamath and Trinity Rivers.

Overfishing in non-tribal fisheries is believed to have been a significant factor in the decline of coho salmon. Marine harvest in the Oregon Coast and Southern Oregon/Northern California Coast ESUs occurs primarily in nearshore waters off Oregon, and California (Weitkamp *et al.*, 1995). Coho salmon landings off the California and Oregon coast ranged from 0.7 to 3.0 million in the 1970s, were consistently below 1 million in the 1980s, and averaged less than 0.4 million in the early 1990s prior to closure of the fisheries in 1994 (PFMC, 1995).

Significant overfishing occurred from the time marine survival turned poor for many stocks (ca. 1976) until the mid-1990s when harvest was substantially curtailed. This overfishing compromised escapement levels. Spawning escapement targets established for the Oregon Coastal Natural (OCN) coast wide aggregate (comprised of all naturally produced coho salmon from Oregon coastal streams) were rarely met over the past 2 decades. There are many reasons that escapement targets were not met, including excessive harvests and difficulty in estimating the maximum sustainable yield given extreme fluctuations in ocean productivity and the inability to properly distinguish wild spawners from stray hatchery fish.

Coho salmon stocks are managed by NMFS in conjunction with the Pacific Fishery Management Council (PFMC), the states, and certain tribes. Coho salmon ocean harvest is managed by setting escapement goals for OCN coho salmon. This stock aggregate constitutes the largest portion of naturally-produced coho salmon caught in ocean salmon fisheries off California and Oregon (PFMC, 1993). The PFMC prohibited the retention of coho salmon in both the commercial and recreational salmon fisheries along the entire west coast in 1994. A similar action prohibiting the retention of coho salmon in all salmon fisheries south of Cape Falcon (on the northern Oregon coast) was implemented in 1995. These actions were taken because of the depressed status of Oregon and California coastal coho salmon stocks in 1994 and 1995 and are believed to have immediately benefitted these stocks by increasing escapement.

New OCN coho salmon adult spawner escapement rebuilding criteria and associated fishery management strategy for OCN are currently being proposed by Oregon to the PFMC and NMFS and are described in more detail in the OCSRI (1997). Key provisions of this management strategy include: (1) Disaggregation of OCN stock into four components for better management of weaker stock units; (2) setting new adult spawner escapement rebuilding criteria for each component derived from a model based on freshwater habitat assessment and production capability; and (3) establishing future coho salmon fishery-related exploitation rates under a more restrictive fishery management regime that allocates most of future population increases to escapement.

Recreational fishing for coho salmon is pursued in numerous streams throughout the Oregon and California coast when adults return on their fall spawning migration. The contribution of coho salmon to the in-river sport catch is unknown for most California watersheds, and losses due to injury and mortality from incidental capture in other authorized fisheries, principally steelhead, are also unknown. The California Department of Fish and Game (CDFG) has monitored, with Trinity River Basin Fish and Wildlife Restoration Act funding, angler harvest of coho salmon in the Trinity River above Willow Creek with reward tags since 1977. In-river angler harvest estimates for coho salmon range from zero in 1980 to a high of 3,368 in 1987, with an average of 598 coho salmon harvested per year.

In the Oregon portion of the Southern Oregon/Northern California Coast ESU, marked hatchery coho salmon are allowed to be harvested in the Rogue River. All other recreational coho salmon fisheries in the Oregon portion of this ESU are closed. In the Oregon Coast ESU, recreational fisheries for coho salmon are limited to three rivers: North Fork Nehalem River (primarily a hatchery run), Trask River, and Yaquina River. Regulations for the latter two rivers allow only marked hatchery fish to be kept. With the marking of all hatchery fish, the Nehalem River recreational fishery will also be limited to harvest of marked hatchery coho salmon in the near future.

Collection for scientific research and educational programs is believed to have had little or no impact on coho salmon populations in these ESUs. In both California and Oregon, most of the scientific collection permits are issued to environmental consultants, Federal resource agencies, and universities by the CDFG and the ODFW. Regulation of take is controlled by conditioning individual permits. The state fish and wildlife agencies require reporting of any coho salmon taken incidentally to other monitoring activities; however, no comprehensive total or estimate of coho salmon mortalities related to scientific sampling is kept for watersheds in either state. Neither CDFG (F. Reynolds, pers. comm.) nor ODFW (R. Temple, pers. comm.) believe that mortalities, as regulated by the states' permitting processes, are detrimental to coho salmon in California and Oregon.

C. Disease or Predation

Relative to effects of fishing, habitat degradation, and hatchery practices, disease and predation are not believed to be major factors contributing to the overall decline of coho salmon in California and Oregon. However, disease and predation may have substantial impacts in local areas.

Coho salmon are exposed to numerous bacterial, protozoan, viral, and parasitic pathogens in freshwater and marine environments. Specific diseases such as bacterial kidney disease (BKD), ceratomyxosis, columnaris, furunculosis, infectious hematopoietic necrosis, redmouth and black spot disease, Erythrocytic Inclusion Body Syndrome, whirling disease, and others are present and known to affect salmon and steelhead (Rucker *et al.*, 1953; Wood, 1979; Leek, 1987; Cox, 1992; Foott *et al.*, 1994; Gould and Wedemeyer, undated). Very little current or historical information exists to quantify prevalences and mortality rates attributable to these diseases for coho salmon. However, studies have shown that native fish tend to be less susceptible to these pathogens than hatchery-reared fish (Buchanon *et al.*, 1983; Sanders *et al.*, 1992).

Infectious disease is one of many factors that can influence adult and juvenile survival (Buchanan *et al.*, 1983). Disease may be contracted by direct infection with waterborne pathogens or by interbreeding with infected hatchery fish (Fryer and Sanders, 1981; Evelyn *et al.*, 1984 and 1986). Salmonids typically are exposed to a variety of pathogens throughout their life; however, disease results only when the complex interaction among host, pathogen, and environment is altered.

Many natural and hatchery coho salmon populations throughout California's coast have tested positive for *Renibacterium salmoninarum*, the causative bacterium of BKD (Cox, 1992; Foott, 1992). For example, in the Central California Coast ESU, the overall prevalence of BKD measured by direct fluorescent antibody technique among Scott Creek coho salmon was 100 percent (13/13 fish) and 95.5 percent (21/22 fish) among San Lorenzo River coho salmon (Cox, 1992). The CDFG recently initiated a treatment protocol to attempt to control BKD outbreaks in hatchery fish released into the Russian River and Scott Creek (Cox, 1992). The impacts of this disease are subtle. Juvenile salmonids may survive well in their journey downstream but may be unable to make appropriate changes in kidney function for a successful

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transition to sea water (Foott, 1992). Stress during migration may also cause overt disease (Schreck, 1987). Water quantity and quality during late summer is a critical factor in controlling disease epidemics. As water quantity and quality diminishes, stress may trigger the onset of these diseases in fish that are carrying the infectious agents (Holt *et al.*, 1975; Wood, 1979; Matthews *et al.*, 1986; Maule *et al.*, 1988).

Freshwater predation by salmonids and other fishes is not believed to be a major factor contributing to the decline of coho salmon in the Oregon Coast and Southern Oregon/Northern California Coast ESUs, although it could be a factor for some individual populations. For example, predation by exotic warmwater fish is believed to be a major factor limiting the production in Tenmile Lake, formerly one of the largest producers of coho salmon along the Oregon coast (Reimers, 1989). Higgins *et al.* (1992) and CDFG (1994) reported that Sacramento River squawfish have been found occupying anadromous salmonid habitat throughout the Eel River basin and are considered to be a serious threat to native coho salmon. Avian predators have been shown to impact some juvenile salmonids in freshwater and nearshore environments. Ruggerone (1986) estimated that ring-billed gulls consumed 2 percent of the salmon and steelhead trout passing Wanapum Dam, in the Columbia River, during the spring smolt outmigration in 1982. Wood (1987) estimated that the common merganser, a known freshwater predator of juvenile salmonids, were able to consume 24 to 65 percent of coho salmon production in coastal British Columbia streams. Known avian predators in the nearshore marine environment include herons, cormorants, and alcids (Allen, 1974). Cooper and Johnson (1992) and Botkin *et al.* (1995) reported that marine mammal and avian predation may occur on some local salmonid populations; however, they believed that it was a minor factor in the decline of coastwide salmonid populations. With the decrease in quality riverine and estuarine habitats, increased predation by freshwater, avian, and marine predators will occur. With the decrease in avoidance habitat (e.g., deep pools and estuaries, and undercut banks) and adequate migration and rearing flows, predation may play a role in the reduction of some localized coho salmon stocks.

California sea lions and Pacific harbor seals (which occur in most estuaries and rivers where salmonid runs occur on the west coast) are known predators of salmonids and their populations are increasing. This raises concerns over the negative impacts of predation on small salmonid populations, particularly when the pinnipeds co-occur with depressed salmonid populations in estuaries and rivers during salmonid migrations (NMFS, 1997c). The observations of steelhead predation by California sea lions at the Ballard Locks in Seattle, WA, show that a significant proportion (65 percent) of an entire salmonid run can be consumed by sea lions (Scordino and Pfeifer, 1993) and this clearly demonstrates that the combination of high local predator abundance during salmonid migrations, restricted passage, and depressed fish stocks can result in significant impacts on local salmonid populations (NMFS, 1997c). Unfortunately, there are only a few areas on the west coast, other than the Ballard Locks, where studies have documented the influence of pinniped predation on local salmonid populations. In the Puntledge River estuary in British Columbia, Bigg *et al.* (1990) observed Pacific harbor seals surface feeding on salmonids and documented predation rates of up to 46 percent of the returning adult fall chinook. In the same river, observations of harbor seal predation on coho salmon smolts in 1995 indicated that the seals consumed 15 percent of the total production. Predation on coho salmon has also been observed at the Ballard Locks with a single California sea lion documented to have consumed 136 coho salmon in 62 hours (2.1 coho salmon per hour) (NMFS, 1997c). Although there have been no specific studies in any coastal estuary on the west coast on impacts of pinniped predation, it is known that pinniped foraging on coho salmon can be extensive based on ancillary information from hatcheries that have documented pinniped scarring on 11–20 percent of the returning coho salmon (NMFS, 1997c).

In many of the small coastal rivers and streams in southern Oregon and northern California, there is a situation that makes returning adult coho salmon and winter steelhead more vulnerable to pinniped predation than larger systems (NMFS, 1997c). In low rainfall years, or when rain arrives late in the winter season, small coastal rivers do not flow with sufficient volume to open the beach crest and flow into the sea. Low tide periods also create or compound this condition in low-flowing small rivers and streams. During such periods, adult fish arrive and accumulate in nearshore waters just offshore of the closed-off river mouth. The adult salmonids are then exposed to days or weeks of pinniped predation at these sites until sufficient rainfall occurs or higher tides allow access to the river or stream. During successive years of drought, the situation is exacerbated because the river mouths are open only intermittently during the salmonid spawning season. Downstream migrating smolts also become more vulnerable to pinniped and bird predation in these conditions as they congregate in the lagoons formed near the river mouth until it opens up to the sea.

It is unlikely that pinniped predation was a significant factor in the decline of coho salmon populations on the west coast; there have been no specific studies that demonstrate a cause-effect relationship between increases in pinniped numbers and declines in salmonid populations. However, with reduced salmonid populations and increased pinniped populations, pinniped predation can be a factor affecting the recovery of some salmonid populations. Pinniped predation on small salmonid populations, especially at areas of restricted fish passage, can have negative impacts on the recovery of depressed salmonids. Seasonal predation by pinnipeds on some salmonid populations has been observed, and a significant negative impact on at least one salmonid population has been documented (i.e., winter steelhead migrating through the Ballard Locks). Pinniped impacts on salmonids are more likely due to opportunistic behavior by certain individual pinnipeds that have learned to exploit situations where salmonids are concentrated and particularly vulnerable rather than being strictly related to pinniped population size. As the number of pinnipeds increases, however, the likelihood of more pinnipeds discovering these situations increases, as does the opportunity to pass on such learned behavior to other pinnipeds.

All in all, the relative impacts of marine predation on anadromous salmonids are not well understood, but marine predation was not likely a major factor in the coho salmon decline, although it can be a factor in the recovery of some localized coho salmon stocks. Normally, predators play an important role in the ecosystem, culling out unfit individuals, thereby strengthening the species as a whole. The increased impact of certain predators has been, to a large degree, the result of ecosystem modification. Therefore, it would seem more likely that increased predation is but a symptom of a much larger problem, namely, habitat modification and a decrease in water quantity and quality.

D. Inadequacy of Existing Regulatory Mechanisms

Habitat Management

1. Northwest Forest Plan (NFP). The NFP is a Federal program with important benefits for coho salmon, as described below (see Federal Conservation Efforts). While the NFP covers a very large area, the overall effectiveness of the NFP in conserving Oregon and California coho salmon is limited by the extent of Federal lands and the fact that Federal land ownership is not uniformly distributed in watersheds within the affected ESUs. In some areas, Federal lands tend to be located in the upper reaches of watersheds or river basins, upstream of lower gradient river reaches that were historically important for coho salmon production. In other areas, particularly Bureau of Land Management (BLM) ownership, Federal lands are distributed in a checkerboard fashion, resulting in fragmented landscapes. Both of these Federal land distribution factors place constraints on the ability of the NFP to achieve its aquatic habitat restoration objectives at watershed and river basin scales and highlight the importance of complementary salmon habitat conservation measures on non-Federal lands within the subject ESUs.

2. State Forest Practices. The California Department of Forestry and Fire Protection (CDF) enforces the State of California's forest practice rules (CFPRs) which are promulgated through the Board of Forestry (BOF). The CFPRs contain provisions that can be protective of coho salmon if fully implemented. However, NMFS believes that the ability of the CFPRs to protect coho salmon can be improved, particularly in the area of developing properly functioning riparian habitat. For this reason, NMFS is attempting to improve the condition of riparian buffers in ongoing habitat conservation plan negotiations with private landowners. Specifically, the CFPRs do not adequately address large woody debris recruitment, streamside tree retention to maintain bank stability, and canopy retention standards that assure stream temperatures are properly functioning for all life stages of coho salmon. The current process for approving Timber Harvest Plans (THPs) under the CFPRs does not include monitoring of timber harvest operations to determine whether a particular operation damaged habitat and, if so, how it might be mitigated in future THPs. The CFPR rule that permits salvage logging is also an area where better environmental review and monitoring could provide NMFS with the information to determine whether this practice impacts coho salmon.

There have been several reviews of the current CFPRs and particularly the rules associated with the Water/lake Protection Zones (WLPZs) for their adequacy in protecting aquatic dependent species such as coho salmon. Most reviews have shown that implementation and enforcement of the current rules are not adequate in protecting coho salmon or their habitats (CDFG, 1994; Murphy, 1995). NMFS' inability to assess the adequacy of the CFPRs is primarily due to the lack of published documentation that the CFPRs are functioning to protect coho salmon. NMFS is currently reviewing the CFPRs so that discussions can be opened with CDF to determine where improvements in the language and definition of the CFPRs would be beneficial.

The CDF has recently proposed 15 amendments to the CFPRs that would become effective on January 1, 1998, if approved by the BOF. The proposed changes are a positive sign that CDF recognizes the need to provide a higher level of protection to stream side zones, provide for additional control of sediment inputs from road construction and harvest operations, and clarify conditions for exemptions in stream zones. However, the adoption of the proposed changes to the CFPRs is uncertain at this time.

The BOF's Monitoring Study Group (MSG) has developed a Long-Term Monitoring Program (LTMP) for assessing the effectiveness of the CFPRs in protecting water quality. The MSG recently published a report on its Pilot Monitoring Program for the LTMP (January, 1997) which evaluated canopy retention in 50 randomly selected THPs in Mendocino and Humboldt Counties. The Pilot Study found that canopy retention was higher (70 percent) in the THPs which were evaluated than the minimum required by the CFPRs (50 percent).

The Oregon Forest Practices Act (OFPA), while modified in 1995 and improved over the previous OFPA, does not have implementing rules that adequately protect coho salmon habitat. In particular, the current OFPA does not provide adequate protection for the production and introduction of large woody debris (LWD) to medium, small and non-fish bearing streams. Small non-fish bearing streams are vitally important to the quality of downstream habitats. These streams carry water, sediment, nutrients, and LWD from upper portions of the watershed. The quality of downstream habitats is determined, in part, by the timing and amount of organic and inorganic materials provided by these small streams (Chamberlin *et al.* in Meehan, 1991). Given the existing depleted condition of most riparian forests on non-Federal lands, the time needed to attain mature forest conditions, the lack of adequate protection for non-riparian LWD sources in landslide-prone areas and small headwater streams (which account for about half the wood found naturally in stream channels) (Burnett and Reeves, 1997, citing Van Sickle and Gregory, 1990; McDade *et al.*, 1990; and McGreary, 1994), and current rotation schedules (approximately 50 years), there is a low probability that adequate LWD recruitment could be achieved under the current requirements of the OFPA. Also, the OFPA does not adequately consider and manage timber harvest and road construction on sensitive, unstable slopes subject to mass wasting, nor does it address cumulative effects.

3. Dredge, Fill, and Inwater Construction Programs. The Army Corps of Engineers (COE) regulates removal/fill activities under section 404 of the CWA, which requires that the COE not permit a discharge that would "cause or contribute to significant degradation of the waters of the United States." One of the factors that must be considered in this determination is cumulative effects. However, the COE guidelines do not specify a methodology to be used in assessing cumulative impacts or how much weight to assign them in decision-making. In 1996 the Portland District Office of the COE issued approximately 250 section 404 permits for removal/fill in Oregon. The COE does not have in place any process to address the additive effects of the continued development of waterfront, riverine, coastal, and wetland properties.

The Oregon Division of State Lands (DSL) manages the state-permitted portion of the removal fill laws. Oregon intends to halt habitat degradation through the development of standardized permit conditions incorporating best management practices for Removal-Fill activities and through strengthening interagency coordination in Removal-Fill permitting. The DSL also does not currently have methods to assess, analyze, or manage cumulative effects.

4. Water Quality Programs. The Federal CWA is intended to provide for the protection of beneficial uses, including fishery resources. To date, implementation has not been effective in adequately protecting fishery resources, particularly with respect to non-point sources of pollution. In Oregon, water quality standards are implemented by the DEQ pursuant to section 303(c) of the CWA. DEQ is required by section 303(d)(1) (C) and (D) of the CWA to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards.

TMDLs are a method for quantitative assessment of environmental problems in a watershed and identifying pollution reductions needed to protect drinking water, aquatic life, recreation, and other use of rivers, lakes, and streams. TMDLs may address all pollution sources, including point sources such as sewage or industrial plant discharges, and non-point discharges such as runoff from roads, farm fields, and forests. The CWA gives state governments the primary responsibility for establishing TMDLs, however, EPA can also develop them.

Oregon DEQ entered into a consent decree in 1987 to develop at least two TMDLs per year. The Healthy Streams Partnership describes a general approach to address non-point source water quality problems in Oregon, particularly with respect to agricultural activities. If Oregon's Healthy Streams Partnership is fully funded, DEQ expects to complete all TMDLs for all impaired coastal watersheds within 10 years. Oregon's guidance for non-point source TMDLs includes an implementation component that is lacking in prior non-point source TMDLs nationwide. Since the beneficial use of salmonid fishes is most often affected by the largely non-point source sediment and temperature impairments, this advance in non-point source TMDLs may be important. The development of strong TMDLs to cover all water quality impaired coastal waters could contribute substantially to coho salmon recovery.

The CWA gives state governments the primary responsibility for establishing TMDLs. However, EPA is required to do so if a state does not meet this responsibility. In California, as a result of recent litigation, the EPA has made a legal commitment guaranteeing that either EPA or the State of California will establish TMDLs, which identify pollution reduction targets, for these 18 impaired river basins in northern California by the year 2007. The State of California has made a commitment to establish TMDLs for approximately half the 18 river basins by 2007. The EPA will develop TMDLs for the remaining basins and has also agreed to complete all TMDLS if the state fails to meet its commitment within the agreed upon time frame.

The ability of these TMDLs to protect coho salmon in Oregon and California is expected to be significant in the long-term; however, it will be difficult to develop them quickly in the short-term and their efficacy in protecting coho salmon habitat will be unknown for years to come.

5. State Agricultural Practices. Historically, the impacts to fish habitat from agricultural practices have not been closely regulated. The Oregon Department of Agriculture has recently completed guidance for development of agricultural water quality management plans (AWQMPs) (as enacted by State Senate Bill 1010). Plans that are consistent with this guidance are likely to achieve state water quality standards. It is open to question, however, whether they will adequately address salmonid habitat factors, such as properly functioning riparian conditions. Their ability to address all relevant factors will depend on the manner in which they are implemented. AWQMPs are anticipated to be developed at a basin scale, so the entirety of coastal Oregon may be covered. AWQMPs include regulatory authority and enforcement provisions. The Healthy Streams Partnership schedules adoption of AWQMPs for all impaired waters by 2001.

6. State Urban Growth Management. On lands inside Oregon's urban growth boundaries, some upgraded riparian area protection will be afforded by the newly revised requirements for statewide planning Goal 5. Local governments will amend their local comprehensive plans to implement these new requirements. Unfortunately, Goal 5 does not require establishment and protection of riparian vegetation to provide adequate large woody debris and allows limited road building in riparian areas.

Harvest Management

Harvest of coho salmon in Federal waters off the west coast is managed by the PFMC and NMFS. Harvest of California and Oregon coastal coho salmon has been managed based on achieving adequate escapement of OCN coho salmon. Despite annual management and use of best available scientific information, spawning escapements have declined significantly over the past 20 years. Prior to 1994, harvest rates on OCN coho salmon were too high for the poor ocean conditions that are now realized to have been occurring. Further, declining numbers of natural spawning fish were masked by high stray rates of hatchery fish. Since 1994, the PFMC has recommended harvest rates of 10–13 percent even though regulations allowed up to a 20 percent harvest rate during the same time period. Since 1994, the PFMC also has recommended prohibiting the retention of coho salmon south of Cape Falcon, OR, which has resulted in relatively low levels of incidental mortality. Oregon also has begun marking all hatchery fish so that natural escapements can be more accurately quantified. Oregon has proposed that the PFMC amend its ocean fisheries regulations to adopt the OCSRI harvest framework.

Fisheries management of coho salmon in Oregon state waters inside the 3-mile (5 km) limit historically had similar problems and contributed to the overall decline. In more recent years, however, state angling regulations have required the release of all naturally-produced coho salmon in the Oregon portion of the Southern Oregon/Northern California Coast ESU. The harvest measures and associated monitoring plan in the OCSRI will provide a significantly better framework from which PFMC and Oregon will manage their coho salmon fisheries.

Oregon currently manages several populations of non-indigenous fish species (e.g., striped, largemouth, and smallmouth bass) for optimal recreational fisheries. These fish were in many cases introduced into Oregon waters in violation of Oregon law. Scientists have documented that at least in some circumstances, the presence of these non-indigenous species has reduced or eliminated coho salmon populations (OCSRI 1997). The ongoing management applied to these exotic fish species, in certain locales, may not be consistent with the goals of the ESA. The OCSRI contains provisions to review the science and management direction pertinent to the interaction of non-indigenous fish species and coastal coho salmon. Results of this review will guide NMFS and Oregon in the future management or actions addressing interactions of these species with coho salmon.

The State of California has jurisdiction over ocean salmon fishing within 3 miles (5 km) of the coast offshore California. Subsequent to NMFS's implementation of ocean salmon harvest regulations for the Exclusive Economic Zone, the California Fish and Game Commission (CFGC) and CDFG, respectively, conform the State's ocean salmon regulations for commercial and sportfishing within the 3-mile (5 km) limit to those adopted by NMFS. In most years the CFGC and CDFG issue regulations that conform fully with Federal ocean salmon regulation.

The CFGC is also responsible for issuing in-river sportfishing regulations in California. At present, the state's sportfishing regulations continue to allow fishing for coho salmon in the inland waters of the Southern Oregon/ Northern California Coast ESU, and the Commission has not proposed to take action in the event the ESU is listed under the Federal ESA.

The contribution of coho salmon to the in-river sport catch is unknown for most California watersheds, as are losses due to injury and mortality from incidental capture in other state-authorized fisheries such as steelhead. However, the CDFG has conducted limited in-river monitoring of coho salmon harvest by anglers in the Trinity River above Willow Creek since 1977, and estimates that in-river angler harvest for coho salmon in this reach of the Trinity River has averaged 598 coho salmon harvested per year. Current state funding and personnel resources are not available to implement comprehensive monitoring programs to evaluate the magnitude of in-river harvest impacts in California.

Hatchery Management

Oregon has adopted a Wild Fish Policy that guides many aspects of hatchery use, their broodstock protocols, and the degree of interaction between hatchery and wild fish. This policy has improved many hatchery operations throughout Oregon with respect to the protection of wild fish populations and their genetic diversity. However, full and prompt implementation of the policy has not occurred and Oregon continues to make program adjustments to achieve fish management consistent with the purposes of the policy and the Federal ESA.

One provision of the Wild Fish Policy is that hatcheries using local broodstock and managed according to specific protocols can contribute up to 50 percent of the number of fish spawning in the natural habitat. NMFS believes this 50 percent guideline can be appropriate when the hatchery fish are part of a recovery program needed to boost an at-risk population. However, current scientific information indicates that it is not appropriate in hatchery programs intended to enhance populations for the purposes of increased harvest. Consequently discussions between NMFS and ODFW have resulted in the OCSRI including a measure to manage coho salmon hatchery and harvest programs so that natural spawning populations contain no more than 10 percent hatchery strays.

In California, the CDFG directly operates artificial propagation programs for coho salmon at three hatcheries in the Southern Oregon/Northern California Coast ESU. These include Iron Gate Hatchery, Trinity River Hatchery, and the Mad River Hatchery. The CDFG has recently developed production goals and constraints for both the Iron Gate and Trinity River Hatchery programs (CDFG, 1997a). Both hatcheries now operate under goals and constraints which specify use of adults returning to the hatcheries and prohibits use of stocks from other drainages for spawning and rearing. Transfer of production to outside drainages is generally prohibited, but can occur under some circumstances. Additional privately-owned and operated hatchery programs for coho salmon are conducted in Rowdy Creek (Rowdy Creek Hatchery), the Eel River (Hollow Tree Creek Hatchery), and in the Mattole River. Other smaller programs that are not currently propagating coho salmon are in Freshwater Creek and Prairie Creek.

In the past, non-native coho salmon stocks have been introduced as broodstock in hatcheries and widely transplanted in many coastal rivers and streams in the California portion of the Southern Oregon/Northern California Coast ESU (Weitkamp *et al.*, 1995). Because of problems associated with this practice, CDFG developed its Salmon and Steelhead Stock Management Policy. This policy recognizes that such stock mixing is detrimental and seeks to maintain the genetic integrity of all identifiable stocks of salmon and steelhead in California, as well as minimize interactions between hatchery and natural populations. To protect the genetic integrity of salmon and steelhead stocks, this policy directs CDFG to evaluate each salmon and steelhead stream and classify it according to its probable genetic source and degree of integrity. However, this has not yet been accomplished by the state.

Although non-native coho salmon stocks have been introduced in the Southern Oregon/Northern California Coast ESU, most hatchery programs are now being conducted without the import of broodstock from other ESUs in accordance with CDFG's policy. With the exception of the Mad River Hatchery, hatchery programs in this ESU are being operated as supplementation hatcheries rather than production hatcheries. They are taking eggs from the rivers in which they operate and returning fish to the river from which they were taken. Release of hatchery fish occurs in streams with stocks similar to the native runs. Efforts are made to return hatchery fish to their natal streams, and they are held for an acclimation period to increase the probability of imprinting. In contrast, the Mad River Hatchery has used numerous out-of-basin and out-of-state coho salmon stocks. A review of CDFG hatchery production and planting records indicates that coho salmon smolts still continue to be planted in streams other than that where the hatchery is located. These out-of-stream plants have occurred both in other coho salmon ESUs and in other basins within individual ESUs. In addition, there are inadequate CDFG resources to tag enough hatchery coho salmon to monitor return rates and rates of straying (CDFG 1995).

The CFGC has also developed specific policies for Private Non-profit Hatcheries (section 1170–1175 of the Fish and Game Code) and Cooperative Salmon and Steelhead Rearing Facilities (sections 1200–1206 of the Fish and Game Code) that have been incorporated into the Fish and Game Code. These policies are intended to ensure that the bulk of the state's salmon and steelhead resources are produced naturally and that the state's goals of maintaining and increasing natural production take precedence over the goals of cooperatively operated rearing programs. Privately owned rearing and hatchery programs for coho salmon in the Southern Oregon/Northern California Coast ESU are operated in accordance with these policies.

In its comments on the proposed rule (CDFG, 1995), CDFG stated that its coho salmon hatchery programs can be integrated into recovery plans for each ESU within California through re-evaluation of each hatchery's goals and constraints with program modifications where appropriate. In a letter dated March 7, 1997 (CDFG, 1997b), CDFG reiterated its view that its coho salmon hatchery programs are compatible with the recovery of coho salmon and other at-risk salmon and steelhead populations in California.

E. Other Natural or Human-Made Factors Affecting Its Continued Existence

Natural Factors

Long-term trends in rainfall and marine productivity associated with atmospheric conditions in the North Pacific Ocean likely have a major influence on coho salmon production. Numerous comments received by NMFS underscored both the importance and uncertainties surrounding natural environmental fluctuations, but few provided substantive new information. Some commenters thought that recent coho salmon declines were merely reflective of a natural production cycle while others believed that declines had been exacerbated by human influences, especially on freshwater habitats.

Populations that are fragmented or reduced in size and range are more vulnerable to extinction by natural events. Whether recent climatic conditions represent a long-term change that will continue to affect salmonid stocks in the future or whether these changes are short-term environmental fluctuations that can be expected to reverse in the near future remains unclear. Many of the coho salmon population declines began prior to these recent drought conditions.

1. Drought. Many areas of the Pacific coast have experienced drought conditions during much of the past decade, a situation that has undoubtedly contributed to the decline of many salmonid populations. Drought conditions reduce the amount of water available, resulting in reductions (or elimination) of flows needed for adult coho salmon passage, egg incubation, and juvenile rearing and migration. There are indications in tree ring records that droughts more severe than the drought that California recently experienced occurred in the past (Stine 1994). Aside from the critical role that habitat complexity plays in providing fish with instream refugia during drought conditions, the key to survival in this type of variable and rapidly changing environment is the evolution of behaviors and life history traits that allow coho salmon to cope with a variety of environmental conditions.

2. Floods. With high inherent erosion risk, urban encroachment, and intensive timber management, flood events can cause major soil loss (Hagans *et al.*, 1986; Nawa *et al.*, 1991; Higgins *et al.*, 1992). As previously mentioned, sedimentation of stream beds has been implicated as a principal cause of declining salmonid populations throughout their range. Floods can result in mass wasting of erodible hillslopes and failure of roads on unstable slopes causing catastrophic erosion. In addition, flooding can cause scour and redeposition of spawning gravels in typically inaccessible areas.

During flood events, land disturbances resulting from logging, road construction, mining, urbanization, livestock grazing, agriculture, fire, and other uses may contribute sediment directly to streams or exacerbate sedimentation from natural erosive processes (California Advisory Committee on Salmon and Steelhead Trout, 1988; CSLC, 1993; FEMAT, 1993). Judsen and Ritter (1964), the California Department of Water Resources (CDWR, 1982), and the California State Lands Commission (CSLC, 1993) have stated that northwestern and central coastal California have some of the most erodible terrain in the world. Several studies have indicated that, in this region, catastrophic erosion and subsequent stream sedimentation (such as during the 1955 and 1964 floods) resulted from areas which had been clearcut or which had roads constructed on unstable soils (Janda *et al.*, 1975; Wahrhaftig, 1976; Kelsey, 1980; Lisle, 1982; Hagans *et al.*, 1986).

As streams and pools fill in with sediment, flood flow capacity is reduced. Such changes cause decreased stream stability and increased bank erosion, and, subsequently, exacerbate existing sedimentation problems (Lisle, 1982), including sedimentation of spawning gravels and filling of pools and estuaries. Channel widening and loss of pool-riffle sequence due to sedimentation has damaged spawning and rearing habitat of all salmonids. By 1980, the pool-riffle sequence and pool quality in some California streams still had not fully recovered from the 1964 regional flood. In fact, Lisle (1982) and Weaver and Hagans (1996) found that many Pacific coast streams continue to show signs of harboring debris flow from the 1964 flood. Such streams have remained shallow, wide, warm, and unstable.

More recently, between November 1995 and April 1996, the Pacific Northwest experienced a rare series of storm and flood events. High winds, heavy rainfall, rapid snowmelt, numerous landslides and debris torrents, mobilization of large woody debris and high runoff occurred over portions of Oregon, Washington, Idaho, and Montana (USFS and BLM, 1996). These storms, which resulted in 100-year floods in some Oregon coastal basins, also had a potentially large effect on the survival of Oregon coast coho salmon and the freshwater habitats upon which they depend. Aerial surveys from a study by Pacific Watershed Associates (PWA undated) in the middle Coast Range of Oregon noted that areas with the greatest impact were typically watersheds with a combination of steep slopes, unstable bedrock geology, recent timber harvesting, high road densities, and within the altitude range where precipitation intensities were probably the greatest. This study also stressed that landslides were highly correlated with management activities and originated from recent clear-cuts and forest roads at much higher frequencies than from wilderness or unmanaged areas. In addition to these observations, Pacific Watershed Associates concluded that the floods may have had long-term effects on watershed habitats. For example, they suggested that materials destabilized but not mobilized by the flood may remain unstable and therefore be susceptible to future flood events for some time, materials deposited in streams and rivers may persist for decades, and the impact to larger streams and rivers may actually increase over a period of several years as sediment is moved downstream.

With regard to impacts to in-stream coho salmon habitat, changes due to flooding were both positive and negative, depending on the area. For example, ODFW surveys (Moore and Jones, 1997) identified some areas with many new channels cut, which could provide off-channel habitat for coho salmon. In the Tillamook Bay basin, the Wilson River received major negative impacts, while the Tillamook and Trask Rivers received little impact. Siuslaw National Forest (SNF, 1996) reported that the February 1996 flooding actually increased positive habitat changes (increased pool area and quality, increased cover complexity, and shift from bedrock, boulder and cobble substrates to gravel and sand) in many smaller streams in areas undergoing habitat improvement projects but not in adjacent, untreated reaches, nor in habitat improvement projects in large streams. Bush *et al.* (1997) noted that decreases in pool area ranged from 10–50 percent, and largely resulted from a 60-percent loss of beaver pond habitat (which provide critical overwinter coho salmon habitat). Large woody debris decreased by approximately 25 percent from the initial surveys, although much of the lost wood had been pushed up onto the floodplain or out of the active channel. Overall, large amounts of gravel were added to most streams, and new gravel bars were common.

Recent stream production studies conducted by ODFW (Solazzi and Johnson, 1997) indicate that 1996 smolt production in four central Oregon coast study streams were lower than recent averages, with overwinter survival the lowest or second lowest on record for the two streams for which estimates were made, and that age zero fish production was also low. They concluded that the most significant impact of the flooding was on juveniles and coho salmon eggs that were in the gravel at the time of the flood. While these results are based on a small sample of streams and may not reflect average effects of the floods, it suggests that 1997 and 1998 adult returns to some coastal basins will be reduced by the floods. Longer-term effects of the floods can also be expected to vary among basins, but most reports available to us suggest that long-term effects should generally be neutral or slightly beneficial (e.g., from sediment removal and increased off-channel habitat) to coho salmon.

3. Ocean Conditions and El Niño. Large fluctuations in Pacific salmon catch have occurred during the past century. Annual world harvest of Pacific salmon has varied from 772 million kg in the 1930s to about 409 million kg in 1977 and back to 818 million kg by 1989 (Hare and Francis, 1993). Mechanisms linking atmospheric and oceanic physics and fish populations have been suggested for Pacific salmon (Rogers, 1984; Nickelson, 1986; Johnson, 1988; Brodeur and Ware, 1992; Francis *et al.*, 1992; Francis, 1993; Hare and Francis, 1993; Ward, 1993). Many studies have tried to correlate the production or marine survival of salmon with environmental factors (Pearcy, 1992; Neeley, 1994). Vernon (1958), Holtby and Scrivener (1989), and Holtby *et al.* (1990) have reported associations between salmon survival and sea surface temperature and salinity, especially during the first few months that salmonids are at sea. Francis and Sibley (1991), Rogers (1984), and Cooney *et al.* (1993) also found relationships between salmon production and sea surface temperature. Some studies have tried to link salmon production to oceanic and atmospheric climate change. For example, Beamish and Bouillon (1993) and Ward (1993) found that trends in Pacific salmon catches were similar to trends in winter atmospheric circulation in the North Pacific.

Francis and Sibley (1991) and Francis *et al.* (1992) have developed a model linking decadal-scale atmospheric variability and salmon production that incorporates hypotheses developed by Hollowed and Wooster (1991) and Wickett (1967), as well as evidence presented in many other studies. The model developed by Francis *et al.* (1992) describes a time series of biological and physical variables from the Northeast Pacific that appear to share decadal-scale patterns. Biological and physical variables that appear to have undergone shifts during the late 1970s include the following: Abundance of salmon (Rogers, 1984 and 1987; Hare and Francis, 1993) and other pelagic fish, cephalopods, and zooplankton (Brodeur and Ware, 1992); oceanographic properties such as current transport (Royer, 1989), sea surface temperature and upwelling (Holowed and Wooster, 1991); and atmospheric phenomena such as atmospheric circulation patterns, sea-surface pressure patterns, and sea-surface wind-stress (Trenberth, 1990; Trenberth *et al.*, 1993).

Finally, Scarnecchia (1981) reported that near-shore conditions during the spring and summer months along the California coast may dramatically affect year-class strength of salmonids. Bottom *et al.* (1986) believed that coho salmon along the Oregon and California coast may be especially sensitive to upwelling patterns because these regions lack extensive bays, straits, and estuaries, such as those found along the Washington, British Columbia, and Alaskan coast, which could buffer adverse oceanographic effects. They speculate that the paucity of high quality near-shore habitat, coupled with variable ocean conditions, makes freshwater rearing habitat more crucial for the survival and persistence of many coho salmon populations.

An environmental condition often cited as a cause for the decline of west coast salmonids is the condition known as "El Niño." El Niño is a warming of the Pacific Ocean off South America and is caused by atmospheric changes in the tropical Pacific Ocean. During an El Niño event, a plume of warm sea water flows from west to east toward South America, eventually reaching the coast where it is deflected south and north along the continents.

El Niño ocean conditions are characterized by anomalously warm sea surface temperature and changes in thermal structure, coastal currents, and upwelling. Principal ecosystem alterations include decreases in primary and secondary productivity and changes in prey and predator species distributions. Several El Niño events have been recorded during the last several decades, including those of 1940–41, 1957–58, 1982–83, 1986–87, 1991–92, and 1993–94. The degree to which adverse ocean conditions can influence coho salmon production was demonstrated during the El Niño event of 1982–83, which resulted in a 24 to 27 percent reduction in fecundity and a 58 percent reduction (based on pre-return predictions) in survival of adult coho salmon stocks originating from the Oregon Production Index area (Johnson, 1988).

Manmade Factors—Artificial Propagation

Potential problems associated with hatchery programs include genetic impacts on indigenous, naturally-reproducing populations, disease transmission, predation of wild fish, difficulty in determining wild stock status due to incomplete marking of hatchery fish, depletion of wild stock to increase brood stock, and replacement rather than supplementation of wild stocks through competition and continued annual introduction of hatchery fish (Waples, 1991; Hindar *et al.*, 1991; Stewart and Bjornn, 1990). All things being equal, the more hatchery fish that are released, the more likely natural populations are to be impacted by hatchery fish. Similarly, the more genetically similar hatchery fish are to natural populations they spawn with, the less change there will be in the genetic makeup of future generations in the natural population. Non-native coho salmon stocks have been introduced as broodstock in hatcheries and widely transplanted in many coastal rivers and streams in Oregon and California (Bryant, 1994; Weitkamp *et al.*, 1995; NMFS, 1997a).

Advancement and compression of run timing have been common phenomena in hatchery populations, and these changes can affect future generations of naturally-reproducing fish. Fry of early-spawning adults generally hatch earlier and grow faster and can thus displace fry of later-spawning natural fish (Chapman, 1962). Conversely, early-spawning coho salmon redds are more prone to being destroyed by early fall floods. Consequently, early-spawning individuals may be unable to establish permanent, self-sustaining populations but may nevertheless adversely affect existing natural populations (Solazzi *et al.*, 1990). A recent study found that over a period of 13 years, the range of spawning timing of coho salmon at five Washington hatcheries decreased from 10 weeks to 3 weeks, causing the range of the period of return to the hatcheries to decrease by one-half (Flagg *et al.*, 1995).

Another common hatchery practice with coho salmon is release of "excess" hatchery production into natural habitat as fry or parr. Outplanting large numbers of large hatchery juveniles into streams already occupied by naturally-produced juveniles may place the resident fish at a competitive disadvantage and may force them into marginal habitats that have low survival potential (Chapman, 1962; Solazzi *et al.*, 1990).

Stock transfers of coho salmon were common throughout the Oregon and California coast; the nature and magnitude of these transfers varied by area and basin. Compared to areas farther north, hatcheries in central California and southern Oregon/ northern California are relatively small and widely dispersed, given the size of both areas. Northern California hatcheries have received fairly large transplants of coho salmon from hatcheries in Washington and Oregon, which have spread to central California through stock transfers. Because of the predominance of hatchery stocks in the Klamath River basin, stock transfers into Trinity and Iron Gate Hatcheries may have had a substantial impact on natural populations in the basin and raises serious concerns about their sustainability. Available information indicates that virtually all of the naturally spawning fish in the Trinity River are first generation hatchery fish. In contrast, Cole Rivers Hatchery (on the Rogue River) appears to have relied exclusively on native stocks.

In recent years, large hatcheries in southern Oregon/northern California (e.g., Mad and Trinity River Hatcheries) have produced 400,000 to 500,000 juveniles annually, while smaller hatcheries, and most hatcheries in central California, produce no more than 100,000 to 200,000 juveniles each year. Most Oregon coastal hatcheries recently produced approximately 400,000 to 1,400,000 juveniles annually, although private hatcheries (no longer in operation) recently produced 2 to 5 million juvenile coho salmon annually. Most historic transfers of coho salmon into Oregon coastal hatcheries used other Oregon coastal stocks. However, some coastal hatchery programs (notably private hatcheries no longer in existence) made extensive use of Puget Sound coho salmon stocks. Some transfers of Columbia River coho salmon into Oregon coastal hatcheries have occurred, but these were relatively infrequent and minor. Similarly, most outplants of coho salmon into Oregon coastal rivers have used Oregon coastal stocks, with outplants of stocks from other areas being relatively small and infrequent.

NMFS received a number of comments regarding the impacts of hatchery fish on wild coho salmon populations. Some commenters (including a peer reviewer) contended that NMFS overstated the significance of impacts from hatchery fish on wild coho salmon. NMFS has worked with the state agency comanagers to resolve uncertainties regarding these impacts, and has documented these findings in a status review update (NMFS 1997a). These findings note that widespread spawning by hatchery fish continues to be a major concern for both the Oregon Coast and Southern Oregon/Northern California Coast ESUs. Scale analyses to determine hatchery-wild ratios of naturally spawning fish indicate moderate to high levels of hatchery fish spawning naturally in many basins on the Oregon coast, and at least a few hatchery fish were identified in almost every basin examined. Although it is possible that these data do not provide a representative picture of the extent of this problem, they represent the best information available at the present time. In addition to concerns for genetic and ecological interactions with wild fish, these data also suggest that the natural portion (i.e., fish born in the gravel) of the natural spawner abundance may be overestimated by ODFW and that the declines in recruits per spawner in many areas may have been even more severe than current estimates indicate (NMFS, 1997a). However, Oregon has made some significant changes in its hatchery practices, such as substantially reducing production levels in some basins, switching to on-station smolt releases, and decreasing fry releases, and proposes additional changes (discussed below), to address this and other concerns about the impacts of hatchery fish on natural populations.

While there are obvious concerns over the negative effects of hatchery fish on wild coho salmon stocks, it is important to note that artificial propagation could play an important role in coho salmon recovery and that some hatchery populations of coho salmon may be deemed essential for the recovery of threatened or endangered ESUs (e.g., if the associated natural population(s) were already extinct or at high risk of extinction). Under these circumstances, NMFS would consider taking the administrative action of listing the hatchery fish.

Efforts To Protect Oregon and California Coho Salmon

Under section 4 of the ESA, a determination to propose a species for listing as threatened or endangered requires considering the biological status of the species, as well as efforts being made to protect the species. Since the early 1990s Federal agencies, state and local governments and private parties have taken substantial measures to protect coho salmon in Oregon and California. These measures affect habitat, harvest, and hatchery activities. In the agency's decision to invoke a statutory extension for the listing determination (October 31, 1996, 61 FR 56211), it was noted that the State of Oregon was planning to submit a peer-reviewed salmon restoration initiative (i.e., the Oregon Coastal Salmon Restoration Initiative) for NMFS' consideration in the spring of 1997. California was undertaking a similar effort, but it was less certain when its plan would be completed. These plans were expected to contain detailed summaries and assessments of conservation measures which benefit coho salmon in the respective states, and hence aid NMFS in making a listing determination. The following sections summarize these Federal and state conservation efforts.

I. Federal Conservation Efforts. 1. NFP. The NFP is a Federal interagency cooperative program, the Record of Decision for Amendments to U.S. Forest Service (USFS) and BLM Planning Documents Within the Range of the Spotted Owl, which was signed and implemented in April 1994. The NFP represents a coordinated ecosystem management strategy for Federal lands administered by the USFS and BLM within the range of the Northern spotted owl (which overlaps considerably with the freshwater range of coho salmon). The NFP region-wide management direction either amended or was incorporated into approximately 26 USFS land and resource management plans (LRMPs) and two regional guides.

The most significant element of the NFP for anadromous fish is its Aquatic Conservation Strategy (ACS), a regional-scale aquatic ecosystem conservation strategy that includes: (1) Special land allocations, such as key watersheds, riparian reserves, and late-successional reserves, to provide aquatic habitat refugia; (2) special requirements for project planning and design in the form of standards and guidelines; and (3) new watershed analysis, watershed restoration, and monitoring processes. These ACS components collectively ensure that Federal land management actions achieve a set of nine Aquatic Conservation Strategy objectives, which include salmon habitat conservation. In recognition of over 300 "at-risk" Pacific salmonid stocks within the NFP area (Nehlsen et al., 1991), the ACS was developed by aquatic scientists, with NMFS participation, to restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands. The ACS strives to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources and to restore currently degraded habitats. The approach seeks to prevent further degradation and to restore habitat on Federal lands over broad landscapes.

In the final rule listing Umpqua River cutthroat trout as endangered (August 9, 1996, 61 FR 41514), NMFS acknowledged that NFP amendments to Federal LRMPs were "intended to ultimately reverse the trend of aquatic ecosystem degradation and contribute toward recovery of fish habitat," however, it was noted at the time that the results of the NFP ACS were "yet to be demonstrated." Following 3 years of NFP implementation, NMFS subsequently reviewed the adequacy of 14 individual LRMPs, as modified by the NFP and its ACS, for conserving Oregon Coast and Southern Oregon/ Northern California Coast coho salmon. The results of these reviews are described in two conference opinions (NMFS, 1995 and 1997d) that document NMFS" determinations that the programmatic direction for Federal land management actions embodied in the 14 LRMPs would not be likely to jeopardize the continued existence of Oregon Coast or Southern Oregon/ Northern California Coast coho salmon. Moreover, the opinions concluded that implementation of management direction in the LRMPs and RMPs will result in substantially improved habitat conditions for these ESUs over the next few decades and into the future. Improved habitat conditions will result in increased survival of the freshwater life stages of these fish. Implementation of actions consistent with the ACS objectives and components—including watershed analysis, watershed restoration, reserve and refugia land allocations, and associated standards and guidelines—will provide high levels of aquatic ecosystem understanding, protection, and restoration for aquatic habitat-dependent species.

Federal lands managed under the NFP comprise about 35 percent of the total area of the Oregon Coast coho salmon ESU. This includes all or part of the Siskiyou, Siuslaw, and Umpqua National Forests (NF); and the Coos Bay, Eugene, Medford, Roseburg and Salem BLM Districts. Federal land ownership in the Southern Oregon/Northern California Coast coho salmon ESU represents approximately 53 percent of the total area of the ESU and includes Federal land managed by the USFS, BLM, and National Park Service (NPS). The USFS lands, for example, include all or substantial portions of four National Forests (Klamath NF, Six Rivers NF, Shasta-Trinity NF, and Mendocino NF). The vast majority of the USFS land is concentrated in the northernmost California watersheds, including significant portions of the Smith River basin (including the Smith River National Recreational Area, which is part of Six Rivers NF), the mid-to upper Klamath basin (with the exception of Scott and Shasta Rivers), and the Trinity River basin.

2. Other Federal Programs. Other significant federally funded and/or managed conservation programs or activities in the California portion of the Southern Oregon/Northern California Coast ESU include the Klamath Basin Restoration Program, the Trinity River Basin Fish and Wildlife Restoration Program, the Action Plan for the Restoration of the South Fork Trinity River Watershed and Fisheries, and Redwood National Park efforts to restore anadromous salmonid habitat in the Redwood Creek basin.

In addition to these major efforts, NMFS is also engaged in significant ESA section 7 consultation actions on several Federal projects or activities in the California portion of this ESU. These efforts include: (1) Consultation with the Bureau of Reclamation (BOR) concerning operations management of the Klamath Project in the upper Klamath River basin to provide adequate flows for anadromous salmonids in the mainstem Klamath River, (2) consultation with the FWS and BOR to provide adequate flows and temperatures for anadromous salmonids in the mainstem Trinity River, (3) consultation with the COE to address gravel mining and other instream activities, and (4) consultation with the Federal Energy Regulatory Commission (FERC) concerning inter-basin water transfers from the Eel River to the Russian River (between the Southern Oregon/Northern California Coast ESU and Central California ESU) via Pacific Gas & Electric's Potter Valley Project. These consultation efforts are expected to contribute significantly to the long-term conservation of coho salmon and its habitat. Other Federal efforts in Oregon include the South Slough National Estuarine Research Reserve located in Coos Bay, an upcoming consultation on a hydropower facility on the Umpqua River, continued road retirement and obliteration on Federal forest lands, and ongoing review of Elk Creek Dam and Savage Rapids Dam on the Rogue River and the proposed Milltown Hill Dam on the Umpqua River.

The Natural Resource Conservation Service (NRCS) assists agriculture in addressing impacts to anadromous fish. The NRCS is currently engaged with the NMFS in discussions about updating their Field Office Technical Guides (FOTGs) to better assist landowners in California and Oregon desiring to implement voluntary conservation measures protective of, or benefitting, salmonids. A subset of the FOTGs are the guidance that local field offices follow when engaging in actions that may affect anadromous fish or their habitats.

3. Habitat Conservation Plans. NMFS and the FWS are engaged in an ongoing effort to assist in the development of multiple species Habitat Conservation Plans (HCPs) for state and privately owned lands in both California and Oregon. While section 7 of the ESA addresses species protection on Federal lands, Habitat Conservation Planning under section 10 of the ESA addresses species protection on private (non-Federal) lands. HCPs are particularly important since approximately 65 percent of the habitat in the range of these ESUs is in non-federal ownership. The intent of the HCP process is to reduce conflicts between listed species and economic development activities, and to provide a framework that would encourage "creative partnerships" between the public and private sectors and state, municipal, and Federal agencies in the interests of endangered and threatened species and habitat conservation (NRC, 1995).

II. Oregon's Coastal Salmon Restoration Initiative (OCSRI). Beginnings of the OCSRI. In October 1995, Oregon's Governor John Kitzhaber launched the OCSRI. One of the Governor's first steps was to establish a team approach for developing an action plan to restore the health of coastal salmon and trout populations. The following key teams were formed early in the process: (1) A Salmon Strategy Team in which the directors of key state agencies met with the Governor on a biweekly basis; (2) an Outreach and Education Team that was directed to work with key agency stakeholders, ask for their advice, and present ideas for their comment; (3) a Science Team to work on technical issues; and (4) an Agency Planning & Implementation Team to coordinate many aspects of the development of the conservation plan. Senior NMFS staff members participated as members of the Salmon Strategy Team, the Science Team, and the Agency Planning & Implementation Team.

This effort focussed each of the major state agencies on developing a plan, removing institutional barriers, and working through difficult issues with their state and Federal colleagues, stakeholders, and the public. Meanwhile, the science team was working on the biological underpinnings of the OCSRI.

Essential Tenets of the OCSRI

1. The plan comprehensively addresses all factors for decline of the coho salmon, most notably, those factors relating to harvest, habitat, and hatchery activities.

2. Under this plan, all State agencies whose activities affect salmon are held accountable for coordinating their programs in a manner that conserves and restores the species and their habitat. This is essential because coastal salmon have been affected by the actions of many different state agencies.

3. The Plan includes a framework for prioritizing conservation and restoration efforts. Draft coho salmon "core areas" are identified in order to focus measures on retaining current salmon strongholds while rebuilding other areas.

4. The Plan includes a comprehensive monitoring plan that coordinates Federal, state, and local efforts to improve our understanding of freshwater and marine conditions, determine populations trends, evaluate the effects of artificial propagation, and rate the OCSRI's success in restoring the salmon.

5. The Plan recognizes that actions to conserve and restore salmon must be worked out by communities and landowners—those who possess local knowledge of problems and who have a genuine stake in the outcome. Watershed councils, soil and water conservation districts, and other grassroots efforts are the vehicles for getting this work done.

6. The Plan is based upon the principles of adaptive management. Through this process, there is an explicit mechanism for learning from experience, evaluating alternative approaches, and making needed changes in the programs and measures.

7. The Plan includes an Independent Multidisciplinary Science Team (IMST). The IMST's purpose is to provide an independent audit of the OCSRI's strengths and weaknesses. They will aid the adaptive management process by compiling new information into a yearly review of goals, objectives, and strategies, and by recommending changes.

8. The Plan requires that a yearly report be made to the Governor, the legislature, and the public. This will help the agencies make the adjustments described for the adaptive management process (above).

Development of the OCSRI

The state distributed a draft OCSRI to interested parties in August 1996. Shortly thereafter, county commissioners sponsored a series of public information meetings to involve key groups and interested individuals in the following locations: Astoria, Tillamook, Newport, Coos Bay, Grants Pass, Gold Beach, Roseburg, and Portland. The Governor's staff presented the draft OCSRI and explained the opportunities for public comment. More than 550 people attended these public meetings. The August 1996 OCSRI draft was critically reviewed and over 600 pages of comments, suggestions, and questions on the draft Plan were received. Those comments were used by Oregon to revise the Plan.

In September 1996, NMFS published and distributed *Coastal Salmon Conservation: Working Guidance For Comprehensive Salmon Restoration Initiatives On the Pacific Coast* (NMFS, 1996d). The intent of the document was to help guide restoration initiatives such as the OCSRI. The OCSRI was revised and supplemented in many areas in response to that guidance. In early November 1996, William Stelle, Jr., NMFS' Northwest Regional Administrator, sent Governor Kitzhaber a package of substantive comments on the August OCSRI draft.

A second draft of the OCSRI was issued on February 24, 1997. Although time was short, Legislators, constituents, and NMFS technical staff reviewed this draft and provided additional suggestions for improving the Plan. Many of these were incorporated into the final document. As part of the Oregon Legislature's consideration of the OCSRI, several more public hearings were held and testimony was taken. In March 1997, NMFS received the final OCSRI for consideration in this coho salmon listing decision.

Addressing Coho Salmon Factors for Decline

The protective measures contained in the OCSRI represent commitments by various state agencies (and their stakeholders), watershed councils, the forest industry, and the Federal government to address coho salmon "factors for decline." Factors for decline identified in the OCSRI include: Loss/degradation of riparian areas, changes in channel morphology, changes in stream substrate, loss of instream roughness (structure), fish passage impediments, loss of estuarine rearing habitat, loss of wetlands, water quality degradation/sedimentation, changes in flow, elimination of habitat, harvest impacts on spawner escapement, illegal salmon catch, salmon bycatch, low ocean productivity, loss of genetic adaptation through interbreeding with genetically dissimilar hatchery fish, competition with hatchery fish, predation by pinnipeds and sea birds, and interaction with exotic fishes. The OCSRI incorporates measures presented by state agencies and their stakeholders as well as Federal agencies to address these factors for decline.

OCSRI Habitat Measures

The OCSRI organized its habitat measures by the 17 habitat-related factors for decline listed above. This organization enables an evaluation of the extent to which the OSCRI's measures influence or reverse each of the factors for decline. Typically, more than one management sector (forestry, agriculture, urban, etc.) contributed to each of the factors for decline. For example, forestry and agricultural measures both address several factors for decline, including loss of riparian areas, channel morphology, substrate changes, instream roughness, water quality and sedimentation (NMFS, 1997b).

On state lands, the Oregon Department of Forestry is preparing a Northwest Oregon State Forest Management Plan. The State of Oregon has indicated interest in working with NMFS and FWS on a multiple-species HCP for approximately 600,000 acres in the Clatsop, Tillamook, and possibly Elliott State Forests. These HCPs would contain aquatic conservation strategies that meet the standards of section 10 of the ESA. Additional HCPs with private landowners may increase the total acreage managed under protective HCPs within this timeframe.

On private forested lands, the State of Oregon developed new forest practices regulations (effective July 1995) that represent an improvement over past forest practices. The OCSRI also provides some additional voluntary measures on the part of industrial forest landowners and small woodland owners that focus on OCSRI core areas, including increased conifer retention in riparian management areas and in-unit leave tree placement for some fish and non-fish bearing streams. Another voluntary measure with significant promise is a road erosion and risk reduction measure that could reduce road-related sediment inputs, road related mass failures, and culvert problems.

On agricultural lands, the State of Oregon addresses coho salmon habitat protection and restoration through the 1993 Senate Bill (SB) 1010 (ORS 568.900–933) and its extension, the Healthy Streams Partnership (HSP). The purpose of SB1010 is to meet the requirements of the Federal CWA on agricultural lands. Complete and successful implementation of the CWA, and the State's water quality programs, could substantially benefit coho salmon.

The OCSRI's greatest contribution is that it provides a comprehensive framework for integrating habitat protection and restoration efforts by all entities, public and private. An important innovation is the emphasis upon voluntary citizen action, utilizing the industry and resource management expertise of local private property owners. Critical components of the OCSRI that should contribute to habitat restoration include watershed council programs, monitoring, and adaptive management described below.

OCSRI Harvest Measures

Overfishing has greatly depleted the coastal coho salmon; it is a primary factor for the species' decline. Harvest rates on coho salmon have at times exceeded 80 percent, but have recently been reduced to an average of less than 15 percent. Ocean harvest of coho salmon stocks is managed by NMFS in conjunction with the Pacific Fishery Management Council, the states, and certain tribes. Coho salmon ocean harvest is managed by setting escapement goals for OCN coho salmon. Due to concerns over declining population status, directed harvest of coho salmon has been eliminated since 1994.

The OCSRI establishes a comprehensive, weak-stock management framework for ensuring that fishing-related mortalities remain at low levels. The harvest levels may increase in the future, but only moderately, and only based on (1) substantiated increases in coho salmon escapement beyond targeted levels, and (2) greater marine survival that will ensure continued growth of the natural spawning populations.

More specifically, the OCSRI establishes new, disaggregated escapement objectives for four component stocks of the existing OCN coho salmon stock. Harvest rates on each of these four stock components will be allowed to increase from current levels of 10–13 percent (to a maximum of 35 percent) only if significant increases are attained in escapement and productivity. In mixed-stock areas, such as most ocean waters, harvest rates will be limited by the weakest stock component. Within any given stock component, terminal and in-river harvest will be regulated to achieve escapement limits for that component. In addition, if any individual basin has a severe conservation problem, harvest within that basin and in mixed-stock areas may be further restricted.

In the near term, Oregon proposes to limit ocean coho salmon harvest impacts (mostly incidental to the harvest of chinook salmon) to low levels. As populations achieve abundance and productivity targets, fisheries may be established to target marked, unlisted hatchery coho salmon. Ultimately, after high escapement levels have been achieved and evaluated, specific fisheries may be allowed that take some unmarked, naturally-produced coho salmon from healthy populations, as other weaker populations continue to recover. Any downturn in either the marine survival or escapement targets will result in further restrictions.

As described in OCSRI's monitoring program, harvest impacts will be regulated through established, public forums that evaluate the most recent data on natural escapements, population abundance, direct and indirect fishing mortalities, and measurements of wild and hatchery fish survival rates in ocean waters.

OCSRI Hatchery Measures

Hatchery production of coho salmon has been identified as a factor in the decline of natural coho salmon populations. Past increases in hatchery programs to enhance sport and commercial fisheries are now believed to have adversely affected natural populations: Hatchery fish competed with wild coho salmon for limited food and habitat; stray hatchery adults spawned, often in excessive numbers, with wild fish, likely reducing the fitness and productivity of the wild populations. This problem of genetic introgression was, at times, compounded by the use of non-local hatchery broodstocks.

Under the OCSRI, coho salmon smolt releases that numbered 6.4 million in 1990 (and were subsequently reduced to 3.5 million in 1996) will be reduced 64 percent by 1998, thus decreasing adverse competitive interactions. Hatchery releases will be further reduced or modified, if necessary, to keep adult stray rates to less than 10 percent, thus minimizing the effects of genetic introgression. As deemed appropriate to meet wild fish management needs, hatchery broodstocks will receive infusion of wild fish to minimize genetic divergence of the populations.

Oregon has already begun marking all hatchery coho salmon to differentiate them from naturally-produced fish. This will allow more accurate assessment of stray rates and allow for any future selective fisheries on hatchery coho salmon when conditions permit. Artificial propagation may be used to boost natural coho salmon populations or reintroduce coho salmon into vacant habitats, but only after specific management plans are developed and reviewed.

Watershed Councils

Watershed councils are voluntary groups established to improve the condition of the state's watersheds. Oregon laid the foundation for its statewide local watershed council program in 1993. That year, House Bill 2215 set up the program and established two pilot project areas. Due to the success of the program pilots, in 1995 the legislature passed House Bill 3441. This law delegates to the Governor's Watershed Enhancement Board (GWEB) the responsibility to work with local councils and to coordinate project funding. The GWEB approves funding for only those projects based on sound principles of watershed management and encourages the use of nonstructural methods to enhance riparian areas and associated uplands. The GWEB uses the expertise of state agencies according to the type of enhancement project in development, and cooperates with the Federal agencies to ensure integrated efforts.

The premise of the OCSRI is that factors for decline are, and will continue to be, identified in individual watersheds, and that one of the primary means to address those factors will be action plans implemented on a local level involving watershed councils, soil and water conservation districts (SWCDs), the Oregon State University Cooperative Extension Service, landowners, local governments, conservation groups and other grassroots stakeholders. Since 1993, over 60 watershed Councils have been formed in Oregon. The entire Oregon coast is now represented by local watershed Councils. Three of these watersheds will be used as model integration projects for the OCSRI. Two of these, the Applegate and the Coquille Councils, already have strong programs that will act as a templates for other Councils on the coast.

Watershed Councils are currently in different stages in their development of watershed action plans. The action plan is a working document that characterizes the conditions on the watershed, identifies priority areas (based on watershed analysis) for restoration and protection, sets out public involvement strategies, and identifies funding sources. Currently, Councils in the Rogue and South Coast watersheds are participating in an effort to develop a guidance document that will address the decline of salmon in those basins. A key to this process is identification of current conditions and trends and developing an understanding of their causes. The guidance document, once fully developed, will allow the watershed Councils to update their action plans and assessments.

Councils generally request participation from local, state, Federal, and private resource professionals to participate in a Technical Advisory Committee (TAC). A TAC is a voluntary, scientific, interdisciplinary, nonpolitical group whose purpose is to provide advice and guidance on technical issues. A TAC advises Councils on how to complete a watershed assessment, develop strategic plans, set priorities, and design and implement projects and monitoring programs.

Since 1994, coastal watershed Council TACs have helped review, design, and implement over 250 projects (including one riparian restoration project that involved over 200 private land owners). TACs have also been heavily involved in developing 11 watershed assessments and action plans for watershed Councils. The process is continuing. TACs are being created for new Councils, helping OCSRI, updating watershed Council action plans and assessments, developing new watershed Council action plans and assessments, and continuing to develop, design, and implement on-the-ground projects.

The future success of watershed Councils depends on many factors—including strong TACs. State agencies have made providing scientific and technical support for watershed Councils a priority. Under the OCSRI, state agencies and the Governor have requested new budget packages that will enable agencies to better meet the increased Council demands by adding field staff and increasing communication.

Monitoring Results and Adaptive Management

The OCSRI describes a comprehensive, aggressive, and coordinated monitoring program. Full implementation of the monitoring program is a crucial tool for adaptive management and the success of the OSCRI. State and Federal agencies and other groups have made major commitments to developing and supporting this effort. The objectives of the monitoring program are to develop accurate information on the status of salmon populations and their habitats, detect trends in abundance, determine the effectiveness of measures designed to improve conditions for salmon, and provide the analysis needed to help develop adaptive management strategies for agencies, private landowners, watershed Councils, and individuals. More specifically, monitoring and reporting at the regional, basin, or subbasin scale will include: (1) Stream biotic condition and ambient water quality assessments, (2) juvenile salmon abundance surveys, (3) stream channel and habitat assessments, (4) spawner abundance surveys, (5) genetic and life history monitoring, (6) fish propagation monitoring, (7) harvest monitoring, (8) "core area" and "index area" population and habitat monitoring, (9) ocean condition monitoring, (10) estuary and riverine wetland population and habitat monitoring, (11) Oregon Forest Practices and Northwest Forest Plan conservation strategy monitoring, and (12) cumulative effects/watershed assessment for mixed ownership.

For more localized decision making, the key monitoring and assessment data will be provided on an ongoing basis to agency managers, watershed Councils and initiative groups, and other interested participants. Regional interagency groups have been organized around state agency administrative boundaries. Participants in the regional groups are lead agency decision-makers for field operational programs. Relevant watershed assessment efforts and data will be routinely reported to this group for coordination and application purposes. The participants of this group are expected to coordinate with the watershed Councils and SWCDs to ensure they all receive the same information in a timely manner.

Watershed Councils, SWCDs, and other partners will report the results of their watershed assessment efforts to the Monitoring Program coordinator as each module is completed. These results will also be given to the involved state and Federal agencies to support their day-to-day decision making.

The interagency monitoring group will convene an annual monitoring conference at which agencies and other partners will be required to present the results of their monitoring efforts. This conference will be used to adjust monitoring efforts and protocols and describe the habitat and population trends. Annual progress of the OCSRI will be assessed by comparing these monitoring results and trends with the OCSRI's published biological objectives. The report (and results of the conference) will be sent to the IMST established by the Oregon Legislature (SB 924–B) for its use in auditing the program.

A bipartisan Joint Legislative Committee on Salmon and Stream Enhancement will receive reports from the IMST including recommendations for changes to the OCSRI. On the basis of these reports, and reports of Oregon's Salmon Restoration and Production Task Force, the Committee may recommend changes to the OSCRI. The annual Governor's report on the "State of the Salmon" will also include discussion and recommendations based upon the monitoring results. This report will describe how the monitoring results will be used to adjust the OSCRI's best management practices (BMPs) and program measures.

Funding for the OCSRI

The Natural Resource Investment Budget (authorized by the 69th Oregon Legislative Assembly [House Bill 5042 and 5044] for the biennium beginning July 1, 1997) provides $20 million in new grant funding to support watershed Council coordinators and other local organizations. The existing Governor's Watershed Enhancement Board will administer the grant program. The budget also provides approximately $10 million to add new technical staff to the Department of Agriculture (19 positions), the Department of Environmental Quality (19 positions), the Department of Fish and Wildlife (14 positions), the Department of Forestry (6 positions), the Water Resources Department (4 positions), and the Department of Land Conservation and Development (1 position). In addition, Oregon State Police reprogrammed 13 officers for public education and enforcement of the OCSRI.

Memorandum of Agreement (MOA) between NMFS and Governor of Oregon

NMFS welcomed adoption of the OCSRI by Oregon and believed it would provide significant protections for Oregon Coast ESU in a number of areas. In particular, the harvest and hatchery measures will continue to contribute to improved spawning escapement and the near-term population stability of the ESU. NMFS was concerned, however, that the habitat measures contained in the OCSRI will not secure adequate high quality habitat over the long term to ensure coho survival under a range of environmental conditions. To address this concern, NMFS entered into a MOA in April 1997 with the Governor of Oregon (MOA 1997). Under the MOA, NMFS will provide the state of Oregon guidance on those specific measures it considers adquate and necessary for habitat protection. If these or equivalent measures are not adopted by Oregon within 2 years, NMFS will promptly change the ESA status of this ESU to the extent warranted. The MOA further commits the parties to full implementation of all elements of the OCSRI, including harvest and hatchery measures and provisions for monitoring and scientific review.

III. California Efforts. In 1995, the California Resources Agency initiated its Coastal Salmon Initiative (CSI), a community-oriented planning effort designed to produce a conservation program based on voluntary measures and incentives to protect fish and wildlife habitat in a manner that would protect the economic interests of communities within the range of coho salmon. The CSI planning process progressed slowly and was suspended in late 1996, before a comprehensive state conservation plan for coho salmon in California was developed.

Recently, however, the State of California has proposed instead to develop and implement a state conservation plan known as the California Watersheds Protection Program based on the State's Natural Communities Conservation Planning (NCCP) Act. This conservation program is intended to provide for the long-term protection and conservation of coho salmon and other anadromous salmonids on non-Federal lands in California's coastal watersheds, as well as a means for incidental take authorization for activities on non-Federal lands. As part of this conservation effort, the State would convene a Scientific Review Panel to develop conservation guidelines for the implementation of the Watershed Protection Program. These guidelines would include conservation strategies and monitoring protocols necessary to protect salmonid habitat in coastal watersheds. The State would subsequently adopt these conservation guidelines under the California Fish and Game Code and then begin the development of individual watershed protection plans.

The Governor of California has proposed a $3.8 million Watershed Initiative to assist in the development and implementation of the California Watersheds Protection Program. The Governor's Budget specifically proposes: (1) $1.5 million for CDFG to participate on inter-agency watershed management team, lead wildlife standard teams, provide guidance and technical assistance to community-based watershed groups, and make grants for habitat restoration, (2) $1.0 million for the state Water Resources Control Board and Regional Boards, for watershed coordinators who will facilitate prioritization of regulatory functions on a watershed basis, integrate resources in priority watersheds, and maximize community involvement in the development and implementation of water quality control plans, (3) $900,000 for the Department of Conservation for inter-agency watershed management teams and for grants to Resource Conservation Districts, and (4) $400,000 for the Department of Forestry and Fire Protection to lead inter-agency watershed teams, conduct watershed assessments, and provide geographic information data base support.

In California, the Range Management Advisory Committee has developed a Rangeland Water Quality Management Plan for inclusion in the State's Nonpoint Source Management Plan. Its purpose is to maintain and improve the quality and associated beneficial uses of surface water as it passes through and out of rangeland resources in the State. The programmatic emphasis is on a voluntary, cooperative approach to water quality management. This includes appropriate technical assistance, planning mechanisms, program incentives, and regulatory authorities. This Plan has been favorably received by the State Water Resources Control Board, EPA, and the BOF.

The state agencies identified in the Governor's Watershed Initiative have developed budget plans, but the likelihood of funding and implementation are unknown at this time. Implementation of the Watershed Initiative will depend on the State Legislature's approval of the budget request. Specific deficiencies of the Watershed Initiative are that no funding past the current fiscal cycle is proposed, and landowner participation in the program is voluntary. NMFS believes that stakeholder-based solutions at the watershed level are essential to recovering coho salmon but that adequate long-term funding and full participation by all stakeholder groups will be necessary for the state's program to succeed.

Local and private efforts are also underway in California. At least eight industrial timber landowners are in the process of developing HCPs that cover approximately 1.2 million acres of privately owned land in Del Norte, Humboldt, Siskiyou, Trinity, and Mendocino counties. This acreage includes ownership in the river basins: Smith River, Klamath River, Redwood Creek, Little River, Mad River, Eel River, and several smaller coastal streams. NMFS anticipates these landowners will be submitting applications for ESA section 10 incidental take permits within the next 6–12 months. These efforts are critical to the conservation of coho salmon in the Southern Oregon/Northern California Coast ESU because nearly 50 percent of the land is privately owned.

Long-term sustained gravel mining plans have been, or are being, developed by three northern California counties (Del Norte, Humboldt, and Mendocino) which comprise a substantial portion of the Southern Oregon/Northern California Coast ESU's range in California. The approach that is being used is to evaluate the impacts of all gravel extraction projects within a watershed as part of a long-term gravel mining plan, and then obtain a Letter of Permission (LOP) from the COE to approve graveling mining projects at the county level. The LOPs would be issued for a period of 3 years and would require annual monitoring reports on gravel recruitment, river geomorphology, and fisheries. Humboldt County currently has an LOP in-place and Del Norte and Mendocino Counties are in the process of obtaining their LOPs. NMFS will be working with the counties and the COE to ensure that any LOPs issued for gravel mining are protective of coho salmon.

Timber, farming, and fishing interests formed the Fish, Forests, and Farms Community (FFFC) organization in California in an effort to address land management and fisheries issues related to salmon and steelhead listings in California. The FFFC has focused its efforts in: (1) Promoting research projects to improve the scientific knowledge regarding salmonid life histories and habitat requirements in coastal watersheds, and (2) developing standardized protocols for biological and physical assessment and monitoring of anadromous fish habitat and populations in coastal watersheds. The FFFC has made important progress to date, and it should be recognized for its efforts to bring together multiple and diverse interests. More importantly, FFFC is attempting to fill a void for standardizing data collection and to quantify technical processes that should eventually lead to a better scientific understanding of coho salmon.

In 1996, the California Forestry Association established the Forest Science Project (FSP) at Humboldt State University. The purpose of the industry-sponsored FSP is to acquire, compile, and disseminate baseline biological and habitat information being developed by private timber companies operating within the California portion of the Southern Oregon/Northern California Coast ESU. The timber industry expects to continue this on-going effort to compile and synthesize biological, habitat, and other types of data, and has expressed interest in developing a process with NMFS that would assure that such data are available for future decision making.

Local habitat restoration and planning efforts are also currently ongoing in several watersheds that should contribute to the conservation of coho salmon in the Southern Oregon/ Northern California Coast ESU. These include efforts by the Scott River Watershed Committee and French Creek Watershed Advisory Group in the Scott River watershed, the Shasta River Project (Shasta River watershed), the South Fork Trinity River (South Fork Trinity River), and the Mattole Restoration Council (Mattole River). In several counties within the range of the Southern Oregon/Northern California Coast ESU, there are county-based Resource Conservation Districts (RCDs) that are providing the focus for agricultural and local conservation groups to use Federal grants to develop and prioritize restoration plans.

An extensive network of RCDs exists within the range of coho salmon in the Southern Oregon/Northern California Coast ESU. These RCDs represent an important vehicle through which the agricultural community can voluntarily address and correct management practices that impact coho salmon and its habitat, and their potential is significant. Working with individual landowners or through organizations such as the California Farm Bureau, these RCDs can assist landowners in developing and implementing best management practices that are protective of salmonids, including coho salmon. NMFS believes that the conservation and recovery of coho salmon in California will require the active participation of the agriculture community.

Finding and Withdrawal

Based on its assessment of the best available information, NMFS has determined that the Southern Oregon/ Northern California Coast and the Oregon Coast coho salmon ESUs constitute distinct "species" under the ESA. NMFS has further determined that the Oregon Coast ESU does not warrant listing at this time, and that the Southern Oregon/Northern California Coast ESU does warrant listing as a threatened species. Accordingly, NMFS is listing the Southern Oregon/Northern California Coast coho salmon ESU as threatened. NMFS will consider the Oregon Coast coho salmon ESU to be a candidate species and will review its listing status in 3 years (or earlier if warranted by new information). NMFS will publish shortly in the **Federal Register** protective regulations, pursuant to ESA section 4(d), which will apply the ESA section 9(a) prohibitions to the listed ESU, with certain exceptions. NMFS does not expect those regulations to become effective before July 1, 1997.

Oregon Coast Coho Salmon ESU

Section 4(b)(1)(A) of the ESA provides that the Secretary shall make a listing determination solely on the basis of the best scientific and commercial data available, after conducting a review of the species' status and "after taking into account those efforts * * * being made by any state or foreign nation * * * to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within an area under its jurisdiction." NMFS has carefully considered the conclusions of the scientists on NMFS' Biological Review Team (BRT) regarding the species' status and has taken into account the OCSRI, the NFP and other actions that protect coho in this ESU.

The scientists on the BRT generally agreed that implementation of the harvest and hatchery measures of the OCSRI would have a positive effect on the status of the ESU. Previous harvest rate reductions on Oregon coastal coho, as refined and continued in the OCSRI, will continue to contribute to improved spawning escapement and near-term population stability of the Oregon coast ESU. The BRT expressed the view that these harvest and hatchery reforms may substantially reduce the short-term risk of extinction. The BRT was about evenly split as to whether the effects of these reforms would be substantial enough to move the ESU out of the "likely to become endangered" category. Some members felt that, in addition to the extinction buffer provided by the estimated 80,000 naturally produced spawners in 1996, the reforms would promote higher escapements and alleviate genetic concerns enough that the ESU would not be at significant risk of extinction or endangerment in the foreseeable future. Other members were not convinced that the hatchery and harvest reforms by themselves would be sufficient to alleviate risk due to declining productivity and habitat degradation.

Habitat degradation was one of the primary concerns of the BRT in evaluating long-term risks to this ESU. The BRT concluded that while the harvest and hatchery improvements may substantially reduce the short-term risk of extinction, habitat protection and restoration are key to ensuring the long-term survival of the ESU, especially under variable and unpredictable future climate conditions. There were two primary concerns with respect to habitat: First, that the habitat capacity for coho salmon within the range of the ESU has significantly decreased from historical levels; and, second, that preliminary results of the Nickelson-Lawson model predicted that, during poor ocean survival periods, only high quality habitat is capable of sustaining coho populations, and subpopulations dependent on medium and low quality habitats would be likely to go extinct. Both of these concerns caused the BRT to consider risks from habitat loss and degradation to be relatively high for this ESU.

The previous section of this document describes the Federal NFP and the OCSRI adopted by Oregon to protect and restore Oregon coastal coho salmon stocks. The NFP, which covers 35 percent of the geographic range of this ESU, will provide a high level of protection for coho habitat into the future. The OCSRI also contains many programs that will improve habitat conditions. The forest practices regulations adopted by Oregon in 1995 provide improvements over past practices, and the measures regarding agricultural practices should result in improvements in water quality. Overall, however, the habitat measures of the OCSRI do not currently provide the protections NMFS considers essential to creating and maintaining the high quality habitat needed to sustain Oregon Coast coho over the long term across a range of environmental conditions.

The OCSRI contains the tools necessary to ensure that adequate habitat measures are ultimately adopted and implemented: a comprehensive monitoring program, scientific review, and an adaptive management program. Natural escapement has been increasing markedly in recent years and reached 80,000 fish in 1996. On the basis of the harvest and hatchery improvements together with the habitat protections in the NFP and given the improving trends in escapement, the Oregon Coast coho is not likely to become endangered in the interval between this decision and the adoption of improved habitat measures by the State of Oregon. Under the April 1997 MOA between NMFS and the Governor of Oregon (MOA, 1997), described in the previous section, NMFS will propose to Oregon additional forest practices modifications necessary to provide adequate habitat conditions for coho. If these or other comparable protections are not adopted within 2 years, NMFS will act promptly to change the ESA status of this ESU to whatever extent may be warranted.

Because the determination not to list the Oregon Coast ESU relies heavily on continued implementation of the OCSRI (in accordance with the MOA), including the enactment of improved habitat protective measures, NMFS intends to review this listing determination no later than the conclusion of 3 years (which represents one full life cycle and 3 year classes of coho salmon) or at any time sooner if substantive new information warrants consideration. During the interim, NMFS is designating the Oregon Coast ESU as a candidate species under the ESA and will continue to monitor the ESU's status as well as the efficacy of the OCSRI and other conservation measures.

Southern Oregon/Northern California Coast Coho Salmon ESU

Coho salmon populations are very depressed in this ESU, currently numbering fewer than 10,000 naturally-produced adults. The threats to this ESU are numerous and varied as described elsewhere in this document. Several human-caused factors, including habitat degradation, harvest, and artificial propagation, exacerbate the adverse effects of natural environmental variability brought about by drought, floods, and poor ocean conditions. NMFS has determined that existing regulatory mechanisms over the ESU as a whole are either inadequate or not implemented well enough to conserve this ESU. While conservation efforts are underway for some populations in this ESU, particularly in the Oregon portion of the ESU, they are not considered sufficient to reduce the risk that the ESU as a whole will become endangered in the foreseeable future. Accordingly, NMFS concludes that this ESU warrants listing as threatened. NMFS will issue shortly protective regulations that will apply the section 9(a) prohibitions to this ESU, with certain exceptions.

As described in the BRT status reviews (Weitkamp et al., 1995; NMFS, 1997a) and the proposed listing determination for west coast coho salmon (July 25, 1995, 60 FR 38011), NMFS defines the Southern Oregon/ Northern California Coast coho salmon ESU to include all naturally spawned populations of coho salmon (and their progeny) that are part of the biological ESU and reside below long-term, naturally impassible barriers in streams between Punta Gorda (CA) and Cape Blanco (OR). NMFS has also evaluated the status of seven hatchery stocks of coho salmon presently reared and released within the range of this ESU (NMFS, 1997a). Two of these hatchery stocks from California are either not considered part of the ESU (Mad River Hatchery) or are of uncertain relationship to the ESU (Iron Gate Hatchery). In contrast, NMFS has concluded that fish from four California hatchery populations (Mattole River, Eel River, Trinity River, and Rowdy Creek) and Oregon's Rogue River hatchery stock should be included in the definition of this ESU. None of these five hatchery stocks considered part of this ESU are presently deemed "essential" for its recovery, hence these hatchery fish are not being listed at this time. However, NMFS has determined that two of the hatchery populations may play an important role in recovery efforts: Mattole River, because the natural population is very depressed, and the Trinity River, because there appears to be essentially no natural production in the basin. It is important to note that the determination that a hatchery stock is not "essential" for recovery does not preclude it from playing a role in recovery. Any hatchery population that is part of the ESU is available for use in recovery if conditions warrant. In this context, an "essential" hatchery population is one that is vital to fully incorporate into recovery efforts (for example, if the associated natural population(s) were extinct or at high risk of extinction). Under these circumstances, NMFS would consider taking the administrative action of listing the existing hatchery fish.

NMFS' "Interim Policy on Artificial Propagation of Pacific Salmon Under the Endangered Species Act" (58 FR 17573, April 5, 1993) provides guidance on the treatment of hatchery stocks in the event of a listing. Under this policy, "progeny of fish from the listed species that are propagated artificially are considered part of the listed species and are protected under the ESA." In the case of Oregon's Rogue River hatchery (Cole Rivers), the protective regulations that NMFS will issue shortly will exempt take of naturally spawned listed fish for use as broodstock as part of an overall conservation program. According to the interim policy, the progeny of these hatchery-wild crosses would also be listed. NMFS has determined in this case, however, not to consider hatchery-reared progeny of intentional hatchery-wild crosses as listed. The Rogue River natural population is relatively abundant, the take of naturally spawned fish for broodstock purposes is specifically limited, and the BRT concluded that this hatchery population was not essential for recovery, nor does it have an important role to play in recovery. NMFS therefore concludes that it is not inconsistent with NMFS' interim policy, nor with the policy and purposes of the ESA, to consider these progeny as part of the ESU but not listed.

Critical Habitat

Section 4(a)(3)(A) of the ESA requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a species. NMFS has completed its analysis of the biological status of the Southern Oregon/Northern California Coast ESU but has not completed the analysis necessary for the designation of critical habitat. NMFS has decided to proceed with the final listing determination now and to proceed with the designation of critical habitat in a separate rulemaking. Section 4(b)(6)(C)(ii) provides that, where critical habitat is not determinable at the time of final listing, NMFS may extend the period for designating critical habitat by not more than 1 additional year. Congress further stated in the 1982 amendments to the ESA, "where the biology relating to the status of the species is clear, it should not be denied the protection of the Act because of the inability of the Secretary to complete the work necessary to designate critical habitat." (H. Rep. No. 567, 97th Cong., 2d Sess. 19, 1982). NMFS believes that proceeding with this final listing determination, even though critical habitat has not been designated, is appropriate and necessary to protect this ESU and is consistent with congressional direction.

NMFS further concludes that critical habitat is not determinable at this time, because information sufficient to perform the required analysis of the impacts of the designation is lacking. NMFS has solicited information necessary to designate critical habitat in its proposed rule (60 FR 38011, July 25, 1995) and will consider such information in the proposed designation. Specifically, designation requires a determination of those physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. It further requires the consideration of an economic analysis of the impacts of the designation. These analyses have not yet been completed, and, therefore, critical habitat is not determinable at this time. NMFS is extending the period for the designation of critical habitat by not more than 1 additional year.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the ESA include recognition, recovery actions, Federal agency consultation requirements, and prohibitions on taking. Recognition through listing promotes public awareness and conservation actions by Federal, state, and local agencies, private organizations, and individuals.

With respect to the Southern Oregon/Northern California Coast coho salmon ESU, several efforts are underway (described previously) that may slow or reverse the decline of coho salmon in this ESU. The NMFS intends to move rapidly during the next year to work with Federal, state, and tribal entities to develop and implement a comprehensive strategy to halt the decline and begin the recovery of coho salmon populations within this ESU. Because a substantial portion of land in this ESU is in private ownership (approximately 46 percent), conservation measures on private lands will be key to protecting and recovering coho salmon in this ESU.

Section 4(d) of the ESA directs the Secretary to implement regulations "to provide for the conservation of [threatened] species," that may include extending any or all of the prohibitions of section 9 to threatened species. Section 9(a)(1)(g) also prohibits violations of protective regulations for threatened species implemented under section 4(d). NMFS will issue shortly protective regulations pursuant to section 4(d) for the conservation of the species.

For listed species, section 7(a)(2) of the ESA requires Federal agencies to ensure that activities they authorize, fund, or conduct are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with NMFS.

Examples of Federal actions most likely to be affected by listing this ESU include COE section 404 permitting activities under the CWA, COE section 10 permitting activities under the River and Harbors Act, FERC licensing and relicensing for non-Federal development and operation of hydropower, EPA implementation of TMDLs and 303(c) water quality standards, and NRCS funded activities. These actions will likely be subject to ESA section 7 consultation requirements that may result in conditions designed to achieve the intended purpose of the project and avoid or reduce impacts to coho salmon and its habitat within the range of the listed ESU.

There are likely to be Federal actions ongoing in the range of the Southern Oregon/Northern California Coast ESU at the time that this listing becomes effective. Therefore, NMFS will review all on-going actions that may affect the listed species with the Federal agencies and will complete formal or informal consultations, where requested or necessary, for such actions as appropriate, pursuant to ESA section 7(a)(2).

Sections 10(a)(1)(A) and 10(a)(1)(B) of the ESA provide NMFS with authority to grant exceptions to the ESA's "taking" prohibitions (see regulations at 50 CFR 222.22 through 222.24). Section 10(a)(1)(A) scientific research and enhancement permits may be issued to entities (Federal and non-Federal) conducting research that involves directed take of listed species.

NMFS has issued section 10(a)(1)(A) research or enhancement permits for other listed species (e.g., Snake River chinook salmon, Sacramento River winter-run chinook salmon) for a number of activities, including trapping and tagging to determine population distribution and abundance, and collection of adult fish for artificial propagation programs. NMFS is aware of several sampling efforts for coho salmon in the Southern Oregon/Northern California Coast ESU, including efforts by Federal and state fisheries agencies, and private landowners. These and other research efforts could provide critical information regarding coho salmon distribution and population abundance.

Section 10(a)(1)(B) incidental take permits may be issued to non-Federal entities to authorize take of listed species incidental to otherwise lawful activities. The types of activities potentially requiring a section 10(a)(1)(B) incidental take permit include the operation and funding of hatcheries and release of artificially propagated fish by the state, state or university research not receiving Federal authorization or funding, the implementation of state fishing regulations, and timber harvest activities on non-Federal lands.

Classification

The 1982 amendments to the ESA, in section 4(b)(1)(A), restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in *Pacific Legal Foundation* v. *Andrus*, 675 F. 2d 825 (6th Cir., 1981), NMFS has categorically excluded all ESA listing actions from the environmental assessment requirements of NEPA (48 FR 4413, February 6, 1984).

As noted in the Conference Report on the 1982 amendments to the ESA, economic considerations have no relevance to determinations regarding the status of the species. Therefore, the economic analysis requirements of the Regulatory Flexibility Act are not applicable to the listing process. Similarly, this final rule is exempt from review under E.O. 12866.

References

The complete citations for the references used in this document can be obtained by contacting Garth Griffin or Craig Wingert, NMFS (see **ADDRESSES**).

List of Subjects in 50 CFR Part 227

Endangered and threatened species, Exports, Imports, Marine mammals, Transportation.

Dated: April 25, 1997.

Rolland A. Schmitten,

Assistant Administrator for Fisheries, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR part 227 is amended as follows:

PART 227—THREATENED FISH AND WILDLIFE

1. The authority citation for part 227 continues to read as follows:

Authority: 16 U.S.C. 1531 *et seq.*

2. In § 227.4, paragraph (i) is added to read as follows:

§ 227.4 Enumeration of threatened species.

* * * * *

(i) Southern Oregon/Northern California Coast coho salmon (*Oncorhynchus kisutch*). Includes all coho salmon naturally reproduced in streams between Cape Blanco in Curry County, OR, and Punta Gorda in Humboldt County, CA.

[FR Doc. 97-11571 Filed 5-5-97; 8:45 am]
BILLING CODE 3510-22-P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Shortnose Sucker and Lost River Sucker

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The Service determines endangered status for the shortnose sucker (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*), fishes restricted to the Klamath Basin of south-central Oregon and north-central California. Dams, draining of marshes, diversion of rivers and dredging of lakes have reduced the range and numbers of both species by more than 95 percent. Remaining populations are composed of older individuals with little or no successful recruitment for many years. Both species are jeopardized by continued loss of habitat, hybridization with more common closely related species, competition and predation by exotic species, and insularization of remaining habitats. This rule implements the protection provided by the Endangered Species Act of 1973, as amended, for the shortnose sucker and Lost River sucker.

EFFECTIVE DATE: August 17, 1988.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Lloyd 500 Building, 500 NE. Multnomah Street, Suite 1692, Portland, Oregon 97232.

FOR FURTHER INFORMATION CONTACT: Mr. Wayne S. White, Chief, Division of Endangered Species, U.S. Fish and Wildlife Service, Lloyd 500 Building, 500 NE. Multnomah Street, Suite 1692, Portland, Oregon 97232 (503/231-6131 or FTS 429-6131).

SUPPLEMENTARY INFORMATION:

Background

Cope (1879) originally described the shortnose sucker (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*) from Upper Klamath Lake, Oregon. Later, Gilbert (1898) and Evermann and Meek (1898) described two other species of *Chasmistes* from the same lake. A careful review of all available specimens, however, documented that *brevirostris* is the only valid species of *Chasmistes* from Upper Klamath Lake and that the other two "species" were merely sex or condition variants of *brevirostris* (Miller and Smith 1981).

The Lost River sucker was originally placed in the genus *Chasmistes* by cope (1879). *Deltistes*, a monotypic genus, was erected for the Lost River sucker in 1896 based on the delta-shaped gill rakers (Seale 1896). In addition to the deltoid, short gill rakers, the Lost River sucker is characterized by subterminal mouth, small hump on the snout (at least in preserved specimens), and large size of adults (ca. 10 lbs.). The primary morphological characters that distinguish the shortnose sucker from other species of *Chasmistes* include the presence of a terminal, oblique mouth with weak or no papillae on the lips. Scales are small, with 65 to 79 in the lateral line and 21 to 25 around the caudal peduncle (Miller and Smith 1981).

Upper Klamath Lake and its tributaries are now the primary refuge for both the Lost River and shortnose suckers. A substantial population of shortnose suckers occurs in Copco Reservoir on the Klamath River, but the Lost River sucker population has practically been eliminated there (Beak Consultants 1987). Remnant or highly hybridized populations of these two species occur in the Lost River system and other nearby areas.

In addition to Upper Klamath Lake, Copco Reservoir, and their tributary streams, shortnose suckers and Lost River suckers have been collected from Iron Gate Reservoir, California (California Dept. of Fish and Game 1980), J.C. Boyle Reservoir, Oregon (Jeff S. Ziller, pers. comm.) and Clear Lake Reservoir, California (Coots 1965, Koch *et al.* 1975). Additionally, shortnose suckers have been collected from Lake of the Woods, Oregon (Andreasen 1975a). The Lost River sucker also was known from Sheepy Lake, Lower Klamath Lake and Tule Lake in California (Coots 1965).

The populations of shortnose and Lost River suckers in Copco and Iron Gate Reservoirs may have resulted from drift of individuals downstream in the Klamath River from Upper Klamath Lake. Specimens of shortnose suckers collected from Copco Reservoir in 1962, 1978 and 1979 were introgressed with the Klamath smallscale sucker (*Catostomus rimiculus*) (Miller and Smith 1981). Nonetheless, Miller and Smith (1981) regarded the Copco Reservoir population as consisting of a "relatively intact gene pool of *Chasmistes brevirostris*." A few shortnose suckers have recently been collected from J.C. Boyle Reservoir, located along the Klamath River between Upper Klamath Lake and Copco Reservoir. The status of this population, which appears quite small, is uncertain. Other reaches of the Klamath River between Copco Reservoir and Upper Klamath Lake also may harbor small remnant populations of both species. The remaining populations of shortnose suckers have not fared as well. The Lake of the Woods population was lost in 1952 during a fish eradication program aimed at removing carp and perch from the lake (Andreasen 1975a). The Clear Lake Reservoir population of shortnose suckers shows evidence of extensive hybridization with the Klamath largescale sucker (*Catostomus snyderi*) (Williams *et al.* 1985), but further work is needed to precisely determine the genetic constitution of suckers in this system.

A few Lost River suckers have been collected from J.C. Boyle Reservoir in the Klamath River between Upper Klamath Lake and Copco Reservoir (Jeff S. Ziller, pers. comm.). Only one Lost River sucker was collected from Copco Reservoir in 1987 despite intensive collection efforts (Beak Consultants 1987). Populations of Lost River suckers in Sheepy Lake, Lower Klamath Lake and Tule Lake were lost after 1924, when the lakes were drained for farming (Moyle 1976). Prior to 1924, large numbers of Lost River suckers were taken from Sheepy Creek, the spawning stream tributary to Sheepy Lake, for human consumption and livestock feed (Coots 1965). The Clear Lake Reservoir population of Lost River suckers is the last known remnant of the species in the Lost River system. The population in Clear Lake Reservoir is small and suffers from large numbers of exotic species and lack of sufficient spawning area (Koch *et al.* 1975).

The primary factors in the widespread decline of the shortnose sucker and Lost River sucker have included damming of rivers, instream flow diversion, draining of marshes, dredging of Upper Klamath Lake and other forms of water manipulation. Dams have been particularly destructive in that they have blocked spawning runs of the fish and facilitated hybridization with other types of suckers in the dam's tailwaters. Although the construction of large reservoirs may provide suitable feeding and resting habitat for these lacustrine species, the reservoirs often lack long stretches of large inflowing rivers that are necessary for successful spawning. Such is the case in Clear Lake Reservoir, where small intermittent creeks are the only habitat that remains for spawning attempts.

Survey work performed in 1984–1986 by the Oregon Department of Fish and

Wildlife, The Klamath Tribe, and the Service have shown drastic declines in the largest remaining populations of both species in Upper Klamath Lake (Bienz and Ziller, ms.). During the 1984 survey, the population of shortnose suckers moving out of Upper Klamath Lake in the spawning run was estimated at 2,650 individuals. The 1985 and 1986 surveys found too few shortnose suckers to accurately estimate the population size. The catch per unit effort of shortnose suckers declined 34 percent between the 1984 and 1985 spawning runs. In 1986, catch per effort statistics yielded 74 percent decrease in the spawning run when compared to 1985. Although the population levels of the Lost River sucker have remained substantially above those critically low levels observed for the shortnose, the overall decline has been equally precipitous. In 1984, a population of 23,123 Lost River suckers was estimated in the Upper Klamath Lake spawning run. By the 1985 spawning run, the population had declined to 11,861 (Bienz and Ziller, ms.). Although the shortnose sucker and Lost River sucker are long-lived (up to at least 43 years in the latter species), the drastic decline can be explained by lack of successful spawning. No significant recruitment of young into the populations has occurred for approximately 18 years (Scoppettone 1986).

The Service included both the Lost River and shortnose suckers in category 2 of its December 30, 1982, comprehensive notice of review (47 FR 58954) of vertebrate species under consideration for listing as endangered or threatened. Category 2 includes those species for which information indicates that proposing to list as endangered or threatened is possibly appropriate but for which additional data are needed. These two suckers were maintained in the September 18, 1985, update (50 FR 37958) of the 1982 notice. Surveys conducted since 1984 provided the additional information on which to base a proposed rule. The shortnose sucker and Lost River sucker were proposed as endangered species on August 26, 1987 (52 FR 32145–32149) in accordance with section 4(b) of the Endangered Species Act of 1973, as amended.

Summary of Comments and Recommendations

In the August 26, 1987, proposed rule (52 FR 32145–32149) and associated notifications, all interested parties were requested to submit factual reports or information that might contribute to the development of a final rule. Appropriate State agencies, county governments, city governments, Federal agencies, scientific organizations, and other interested parties were contacted and requested to comment. Newspaper notices inviting public comments were published in the *Ashland Tidings* (September 22, 1987), *Medford Mail Tribune* (September 22, 1987), *Redding Record-Searchlight* (September 22, 1987), *Klamath Falls Herald & News* (September 20, 1987), *The Oregonian* (September 20, 1987), and *Siskiyou News* (September 20, 1987).

A total of 13 written comments were received during the 60-day comment period following publication of the proposed rule. Comments were submitted by two Federal agencies, two State agencies, one Indian tribe, one City government, five conservation organizations, and two private parties. Twelve responses supported listing and one response expressed no opinion regarding the listing. No comments in opposition to the listing were received. The City of Klamath Falls took no position regarding the listing, but offered results of studies on the potential impact of the proposed Salt Caves Hydroelectric Project on both species. It is the opinion of the City that the project would not impact either species, however, data to support this position are lacking. Government agencies writing to express their support for the listing included the U.S. Forest Service, Bureau of Land Management, California Department of Fish and Game, and Oregon Department of Fish and Wildlife.

In addition to voicing support for the listing, The Klamath Tribe, Desert Fishes Council, Rogue Chapter of the Sierra Club, and Save our Klamath River also stated their belief that critical habitat should be officially designated for both species. The critical habitat designation is discussed below.

Additional data on the decline of the shortnose sucker and Lost River sucker were provided by The Klamath Tribe, California Department of Fish and Game, Oregon Department of Fish and Wildlife, and an independent biologist familiar with the species. As appropriate, this additional information was incorporated into this final rule.

Summary of Factors Affecting the Species

After a thorough review and consideration of all information available, the Service has determined that the shortnose sucker and Lost River sucker should be classified as endangered species. Procedures found at section 4(a)(1) of the Endangered Species Act (16 U.S.C. 1531 *et seq.*) and regulations (50 CFR Part 424) promulgated to implement the listing provisions of the Act were followed. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the shortnose sucker (*Chasmistes brevirostris* and Lost River sucker (*Deltistes luxatus*) are as follows:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Initial biological surveys of the Klamath Basin indicated the presence of large populations of fishes, and suckers in particular (Cope 1879, Gilbert 1898). Spawning runs of suckers from Upper Klamath Lake were large enough to provide a major food source for Indians and local settlers. The shortnose sucker and Lost River sucker were staples in the diet of the Klamath Indians for thousands of years (Charles E. Kimbol, pers. comm.). In the late 1890's, a cannery was operated for commercial harvest of the Lost River sucker on the Lost River near Olene, Oregon (Howe 1984). Even through the 1960's and 1970's, runs of suckers moving from Upper Klamath Lake up into the Williamson and Sprague Rivers were great enough to provide a major sport fishery that annually attracted many people from throughout the West (Bienz and Ziller, ms.; John Fortune, pers. comm.). The primary species was the larger Lost River sucker, locally known as mullet, but significant numbers of shortnose suckers also occurred in the runs. During the past years, however, The Klamath Tribe and local biologists have been so alarmed by the population decline of both suckers that in 1987, the Oregon Fish and Wildlife Commission closed the fishery for both species and place them on the State's list of protected species.

Causes of the declines are varied and not fully understood. Clearly, there has been a drastic reduction in spawning success. Recent data show that neither species of sucker has successfully spawned in Oregon for approximately 18 years (Bienz and Ziller, ms.; Scoppettone 1986). Similar results have recently been obtained for populations of both species in Copco Reservoir, California (Beak Consultants 1987). Most of the spawing habitat for the shortnose sucker and Lost River sucker in the Upper Klamath Lake drainage has been lost. The primary factor may have been the construction of the Sprague River Dam at Chiloquin, Oregon. The dam is located just upstream of the junction of the Sprague and Williamson Rivers and probably eliminated more than 95 percent of the historical spawning habitat. Neither the shortnose sucker nor Lost River sucker spawn in the

Williamson River upstream of its confluence with the Sprague. Fish ladders have been constructed at various times on the Sprague River Dam but their effectiveness in facilitating movement of suckers around the structure has been minimal to non-existent because, although these suckers are strong-swimmers, their leaping ability is greatly limited. Any successfully-spawned larvae may be diverted into agricultural fields by unscreened irrigation pumps and diversions. Minor secondary spawning occurred in the larger springs that flow from along the shores of Upper Klamath Lake. However, the usefulness of these spawning areas along the east shore of the lake was lost when a railroad was constructed and riprap was used to fill in the springs. Further problems may have been caused by decreases in water quality that result from timber harvest, dredging activities, removal of riparian vegetation and livestock grazing.

B. *Overutilization for commercial, recreational, scientific, or educational purposes.* Prior to 1987, Oregon State law allowed a snag fishery for the Lost River sucker. In 1987, the Oregon Fish and Game Commission removed both species from the list of fishes in the State that may be harvested. The shortnose sucker was incidentally taken each spring during its spawning runs by sport fishermen snagging the larger Lost River sucker. In the 1985 sport fishery, Lost River suckers comprised 92 percent of the catch, whereas shortnose and Klamath largescale accounted for 3 and 6 percent, respectively (Bienz and Ziller, ms.). Prior to recent population declines, some recreational take of the shortnose sucker and Lost River sucker was acceptable. No commercial take is known. It should be noted that nearly all scientific data has been obtained from fish collected in natural die-offs (see Factor E, below), or during sport fishing. High mortality of the shortnose sucker occurred during a recent study at Copco Reservoir (Beak Consultants 1987), indicating that great care should be taken in future studies of these species.

C. *Disease or predation.* Exotic fishes have been stocked into the Klamath Basin and have played some role in the decline of the shortnose sucker and Lost River sucker. In addition to preying on young suckers, such exotic species can serve as sources of parasites and/or diseases.

D. *The inadequacy of existing regulatory mechanisms.* Recent action by the State of Oregon to remove the shortnose sucker and Lost River sucker from the list of fishes that may be harvested, and place both species on the State's list of protected species has improved the adequacy of regulations to protect these species. California State Law lists the shortnose sucker and Lost River sucker as endangered. Although the California Endangered Species Act has provisions for State agencies to consult with the California Department of Fish and Game on projects affecting State-listed species, neither State law protects habitat of the species from projects that are permitted, funded or carried-out by Federal agencies.

E. *Other natural or manmade factors affecting its continued existence.* Hybridization with the Klamath largescale and Klamath smallscale suckers has been recognized as a problem in maintaining the genetic purity of shortnose sucker populations (Miller and Smith 1981, Williams *et al.* 1985). Similarly, hybridization between the Klamath largescale sucker and Lost River sucker has been reported in Upper Klamath Lake (Andreasen 1975a). Although hybridization occurs naturally between many species of suckers (family Catostomidae), increased incidence of hybridization occurs if one of the parental species experiences a major population decline, as in the case of the shortnose sucker. Further hybridization is facilitated by dams that block spawning runs and force individuals of closely related species to spawn in mass in the dam's tailwaters. Spawning of the shortnose, Lost River and Klamath largescale sucker occurs below the Sprague River Dam at Chiloquin.

An additional source of mortality is late-summer die-offs in Upper Klamath Lake. A major die-off of Lost River and shortnose suckers was observed during 1986 that resulted from blue-green algal blooms (genus *Aphanizomenon*) (Scoppettone 1986). Sucker die-offs do not occur every year, but may occur in dry or particulary hot years. Pollution of the lake and decreased summer inflows, perhaps caused by diversion of water for agricultural purposes, aggravate this phenomenon.

The presence of exotics, such as fathead minnows (*Pimephales promelas*) and yellow perch (*Perca flavescens*), may inhibit recovery. Fathead minnows were first documented in the Klamath River system during 1974 and have now spread into Upper Klamath Lake, where they have become abundant (Andreasen 1975b; Jeff S. Ziller, pers. comm.). The minnows may compete with the native suckers for food. Perhaps in response to the increased number of fathead minnows, the yellow perch population in Upper Klamath Lake has increased recently (Jeff S. Ziller, pers. comm.). The perch are potential predators on larval suckers and may be a major factor in preventing any young suckers from being recruited into the population. Exotic fishes in the Lost River system include bullheads (*Ictalurus* spp.), largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* sp.), green sunfish (*Lepomis cyanellus*), and Sacramento perch (*Archoplites interruptus*) (Koch *et al.* 1975; Jack E. Williams, pers. obs.).

The Service has carefully assessed the best scientific and commercial information availabe regarding the past, present, and future threats faced by these species in determining to make this rule final. Based on this evaluation, the preferred action is to list the shortnose and Lost River suckers as endangered. Threatened status would not adequately reflect the sharp decline of either species, lack of recruitment, or the continued threat to remaining habitat fragments. Critical habitat is not being designated for this species at this time for reasons discussed below.

Critical Habitat

Section 4(a)(3) of the Act, as amended, requires that to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time a species is determined to be endangered or threatened. The Service finds that designation of critical habitat is not prudent or determinable for these species at this time. As noted in Factor "A" of the above "Summary of Factors Affecting the species" much of the historic spawning grounds of the Upper Klamath Lake population is no longer accessible because a dam blocks the spawning run near the confluence of the Sprague and Williamson Rivers. Similarly, dams on the Klamath River downstream of Upper Klamath Lake have eliminated or blocked access to spawning habitat. Therefore, determining the boundaries of areas to be included as critical habitat is difficult. Further, agency personnel are well-aware of the distribution of both species through the Klamath Basin Sucker Interagency Working Group. Little additional benefits of notification of the species presence would be achieved through critical habitat designation. Because of these factors, the Service finds that the determination of critical habitat cannot be made at this time.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered

Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Endangered Species Act provides for possible land acquisition and cooperation with the States and requires that recovery actions be carried out for all listed species. Such actions are initiated by the Service following listing. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Federal actions that may affect the shortnose sucker and Lost River sucker are issuances of lincenses or permits for dam projects by the Federal Energy Regulatory Commission; grazing or timber harvesting practices on Forest Service land in the Upper Klamath Lake and Clear Lake Reservoir watersheds; and agreements, leases, or other arrangements between the Klamath Tribe and local irrigation interests that would result in the diversion of water from the Williamson or Sprague Rivers; and management of canals and diversion structures by the Bureau of Reclamation. Permitting activities of the Army Corps of Engineers pursuant to section 404 of the Clean Water Act or section 10 of the River and Harbor Act also may be affected.

The Act implementing regulations found at 50 CFR 17.21 set forth a series of general prohibitions and exceptions that apply to all endangered wildlife. These prohibitions, in part, would make it illegal for any person subject to the jurisdiction of the United States to take, import, ship in interstate commerce in the course of a commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits may be issued to carry out otherwise prohibited activities involving endangered fish or wildlife species under certain circumstances. Regulations governing permits are at 50 CFR 17.22 and 17.23. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or for incidental take in connection with otherwise lawful activities. In some instances, permits may be issued during a specified period of time to relieve undue economic hardship that would be suffered if such relief were not available.

National Environmental Policy Act

The Fish and Wildlife Service has determined that an Environmental Assessment, as defined by the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act of 1973, as amended. A notice outlining the Service's reasons for this determination was published in the **Federal Register** on October 25, 1983 (48 FR 49244).

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Author

The primary author of this final rule is Dr. Jack E. Williams, U.S. Fish and Wildlife Service, Sacramento, California; and Department of Wildlife and Fisheries Biology, University of California, Davis, California 95616 (telephone 916/752–7703).

List of Subjects in 50 CFR Part 17

Endangered and threatened wildlife, Fish, Marine mammals, Plants (agriculture).

Regulations Promulgation

Accordingly, Part 17, Subchapter B of Chapter I, Title 50 of the Code of Federal Regulations, is amended as set forth below:

PART 17—[AMENDED]

1. The authority citation for Part 17 continues to read as follows:

Authority: Pub. L. 93–205, 87 Stat. 884; Pub. L. 94–359, 90 Stat. 911; Pub. L. 95–632, 92 Stat. 3751; Pub. L. 96–159, 93 Stat. 1225; Pub. L. 97–304, 96 Stat. 1411 (16 U.S.C. 1531 *et seq.*); Pub. L. 99–625, 100 Stat. 3500 (1986), unless otherwise noted.

2. Amend § 17.11(h) by adding the following, in alphabetical order, under "Fishes" to the List of Endangered and Threatened Wildlife:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*	*	
FISHES							
Sucker, Lost River	*Deltistes luxatus*	U.S.A. (OR, CA)	Entire	E	313	NA	NA
*	*	*	*	*	*	*	
Sucker, Short-nose	*Chasmistes brevirostris*	U.S.A. (OR, CA)	Entire	E	313	NA	NA
*	*	*	*	*	*	*	

Dated: June 27, 1988.

Susan Recce,

Acting Assistant Secretary for Fish and Wildlife and Parks.

[FR Doc. 88-16062 Filed 7-15-88; 8:45 am]

BILLING CODE 4310-55-M

ONRC *et al.*/106
McCarthy/1

September 2002 Klamath River Fish-Kill: Final Analysis of Contributing Factors and Impacts

July 2004

California Department of Fish and Game
Northern California-North Coast Region
The Resources Agency
State of California

Acknowledgements:

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Executive Summary:

This report presents the Department of Fish and Game's (DFG) final evaluation of causative factors and impacts of the September 2002 Klamath River fish-kill and makes recommendations to minimize the occurrence of future fish-kills. This report finalizes and supercedes the January 2003 DFG report entitled: "September 2002 Klamath River Fish Kill: Preliminary Analysis of Contributing Factors". This document addresses questions and concerns regarding the preliminary report. In addition, this report was peer reviewed by academia and contributing federal and state agencies, tribes and other stakeholders.

The September 2002 fish-kill was unprecedented in that it was the first major adult salmonid mortality event ever recorded in the Klamath River. Fall-run Chinook salmon were the primary species affected, but coho salmon, steelhead and other fish species were also lost. At least 33,000 adult salmonids died during mid to late September 2002 in the lower 36 miles of river. Although a larger number of Klamath River fall-run Chinook died, a greater proportion of the Trinity River run was impacted by the fish-kill, because the Trinity run is substantially smaller than the Klamath run on an annual basis and the peak of the Trinity run was present during the height of the fish-kill.

The primary cause of the fish-kill was a disease epizootic from the ubiquitous pathogens ich and columnaris. However, several factors contributed to stressful conditions for fish, which ultimately led to the epizootic. An above average number of Chinook salmon entered the Klamath River between the last week in August and the first week in September 2002. River flow and the volume of water in the fish-kill area, were atypically low. Combined with the above average run of salmon, these low-flows and river volumes, resulted in high fish densities. Fish passage may have been impeded by low-flow depths over certain riffles or a lack of cues for fish to migrate upstream. Warm water temperatures, which are not unusual in the Klamath River during September, created ideal conditions for pathogens to infect salmon. Presence of a high density of hosts and warm temperatures caused rapid amplification of the pathogens ich and columnaris, which resulted in a fish-kill of over 33,000 adult salmon and steelhead.

Flow is the only controllable factor and tool available in the Klamath Basin (Klamath and Trinity rivers) to manage risks against future epizootics and major adult fish-kills. Increased flows when adult salmon are entering the Klamath River (particularly during low-flow years such as 2002) can improve water temperatures, increase water volume, increase water velocities, improve fish passage, provide migration cues, decrease fish densities and decrease pathogen transmission between fish.

The total fish-kill estimate of 34,056 fish, was conservative and DFG analyses indicate actual losses may have been more than double that number. If fish-kill numbers were substantially underestimated, more fall-run Chinook salmon could have been included in modeling efforts, for allocation to harvest allotments in ocean and in-river Klamath fisheries, during 2003. In addition, Klamath Basin tribal net and sport anglers may have lost the opportunity to harvest roughly 4,000 to 14,600 fall-run Chinook salmon in 2002, due to the fish-kill. This impact was more pronounced in the Trinity River than the Klamath River, because the fish-kill occurred below the confluence of the Trinity and Klamath, and precluded much of the harvest opportunity on the Trinity River.

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III. C. 1. Introduction

Stream-flow is an integral component and contributor to the overall biophysical character and ecological health of streams and rivers. Structure and function of riverine systems are influenced by hydrology, geomorphology, water quality, biology, and connectivity (Instream Flow Council 2002). Riverine flow timing, magnitude, duration, and rate of change, directly influence channel abiotic structure, function, and dynamics (Leopold et al. 1964). Aquatic and riparian biotic components, in turn, respond to flow and channel conditions and dynamics. Altered natural flow regimes, can radically change riverine dynamics, species composition and richness, habitat diversity, habitat quality, and the natural template (Instream Flow Council 2002, Li and Li 1996, Sanford 1996). Water quality, temperature, and living space quality and quantity, are influenced by river flows.

The purpose of this section is to address the null-hypothesis; flow in the Klamath and Trinity rivers during 2002 were not out of the ordinary and should not have contributed to the fish-kill. The alternative hypothesis is; flows in 2002 were atypical and could have contributed to the fish-kill. To address these hypotheses, this section will characterize and evaluate flow conditions existing in the Klamath River and Trinity River, immediately before and during the 2002 fish-kill, compare those flow conditions to past years, and identify years during which river discharges were similar or less than those in 2002.

Another flow related concern was whether events in the fish-kill area would have been significantly different in 2002, if higher flows had been released from upstream sources. To address this concern, we must first address the null-hypothesis; there was no additional water available to increase flows in the lower Klamath River during September 2002. The alternative hypothesis was; there was additional water available to increase flows in the Klamath River during September 2002. To address these hypotheses, this section will compare actual 2002 flow conditions existing in the Klamath River, to unimpaired flows modeled by Hardy and Addley (2001). These competing hypotheses only address whether more flow could have been available in September 2002 and not if more flow would have created better conditions for downstream resources. Hypotheses related to the benefits or detriments of increased flows for fishery resources in the Klamath Basin during 2002, will be addressed in later sections of this report.

III. C. 2. Methods

Mean daily flow data for four gaging stations on the Klamath River from Iron Gate Dam downstream to Klamath, and for the Trinity River at Hoopa, were obtained from the U.S. Geological Survey (USGS) web page (www.usgs.gov). Gaging stations included:

Station Number	Station Name	Abbreviation	Period of Record Analyzed[1/]	River Mile
11516530	Klamath River Below Iron Gate Dam	KIG	1961 to present	190
11520500	Klamath River near Seiad Valley	KSV	1952 to present	129
11523000	Klamath River at Orleans	KAO	1951 to present	59
11530500	Klamath River near Klamath	KNK	1951 to present[2/]	6
11530000	Trinity River at Hoopa	TRH	1951 to present	12

1. Flow records for 2001 and 2002 are provisional and subject to change.
2. River flows for the near Klamath gage are missing for 1996 and 1997.

Average daily flow data for the Klamath River are relatively complete for the Iron Gate gage from 1961 to present, for the Seiad Valley gage from 1952 to present, for the Orleans gage from 1928 to present, for the Klamath gage from 1951 to present, and for the Trinity River at Hoopa gage from 1932 to present. Flow data from water year 2001 onward, are provisional and may be subject to change.

Average September flow was examined for the KIG gage from 1961 to 2002, and for the KNK, KAO, and KSV gages from 1951 to 2002. Average September flow for 2002 was provisional and does not reflect daily flows after September 26, 2002. After September 26, 2002, USBR directed Pacificorp to increase releases from Copco and Iron Gate reservoirs from 760 cfs to 1,300 cfs, in an effort to abate the fish-kill. This 540 cfs increase in flow at the end of September, would have introduced a positive bias and inflated the average September 2002 flow.

The KNK average September flow data was sorted and ranked to identify other low-flow years (1988, 1991, 1992, and 1994) that were either similar to, or less than, those occurring during the 2002 fish kill. Although flows reported for KNK were substantially higher in September 2001 than 2002, 2001 was actually a drier year and has been included in this analysis.

A similar sorting and ranking of the September flow data was performed for the KAO, KSV, KIG and the combined KAO+TRH gages. Analysis of KAO+TRH was conducted as a result of a USGS report evaluating the historic context of flow conditions in Klamath River (USGS 2003). In this report, USGS evaluated flow downstream of the confluence of the Klamath and Trinity rivers, by summing Trinity River flows at the TRH gage and Klamath River flows at the KOA gage. One of the report's authors indicated the KNK gage was omitted from analysis, because of the potential for inaccuracies in the data (i.e., greater than 15% error). Error bars on the data were much larger than for the vast majority of USGS gages (Lynch 2003, written communication). In addition, Lynch (2003) indicated the KNK gage was tidally influenced and resisted development of an accurate and stable rating curve. Thus, USGS considered summing flows, at the Orleans gage on the Klamath and near Hoopa on the Trinity, to be the best method to estimate river flows within the fish-kill area. As a result of the KAO+TRH ranking, 1981 was added to our low-flow years, because combined flows were below 2002. Finally, an analysis of daily flow data for the lower river was also made by comparing daily data from August 1 to October 15 of 2001 and 2002, for KNK and for KAO+TRH.

Average daily flows for USGS stations KIG, KSV, KAO, TRH, KAO+TRH and KNK, were plotted for August 1 through October 15 of 1973, 1981, 1988, 1991, 1992, 1994, 2001 and 2002, to evaluate day to day changes in flow during low-flow years.

III. C. 3. Results

The five years with lowest average September flows at KIG, were 1973, 1991, 1992, 1994, and 2002 (Table C1). September flows during these years fell in the lowest tenth percentile and were below the 90 % exceedence value for the period of record from 1961 to 2002 (Figure C1). The average monthly flow for September 2002 was 760 cfs, and ranked fourth lowest for the period of record (Table C1). The lowest average flow (538 cfs) occurred in September 1992 and was 29% lower than the September 2002 average flow. September flows in 1973 (725 cfs) and 1991 (749 cfs) were 5% and 1% lower than 2002, respectively. Average flow during September 2001 (1,026 cfs), was the eighth lowest flow year, and was near the 80% exceedence value (in the lowest twentieth percentile) for the period of record.

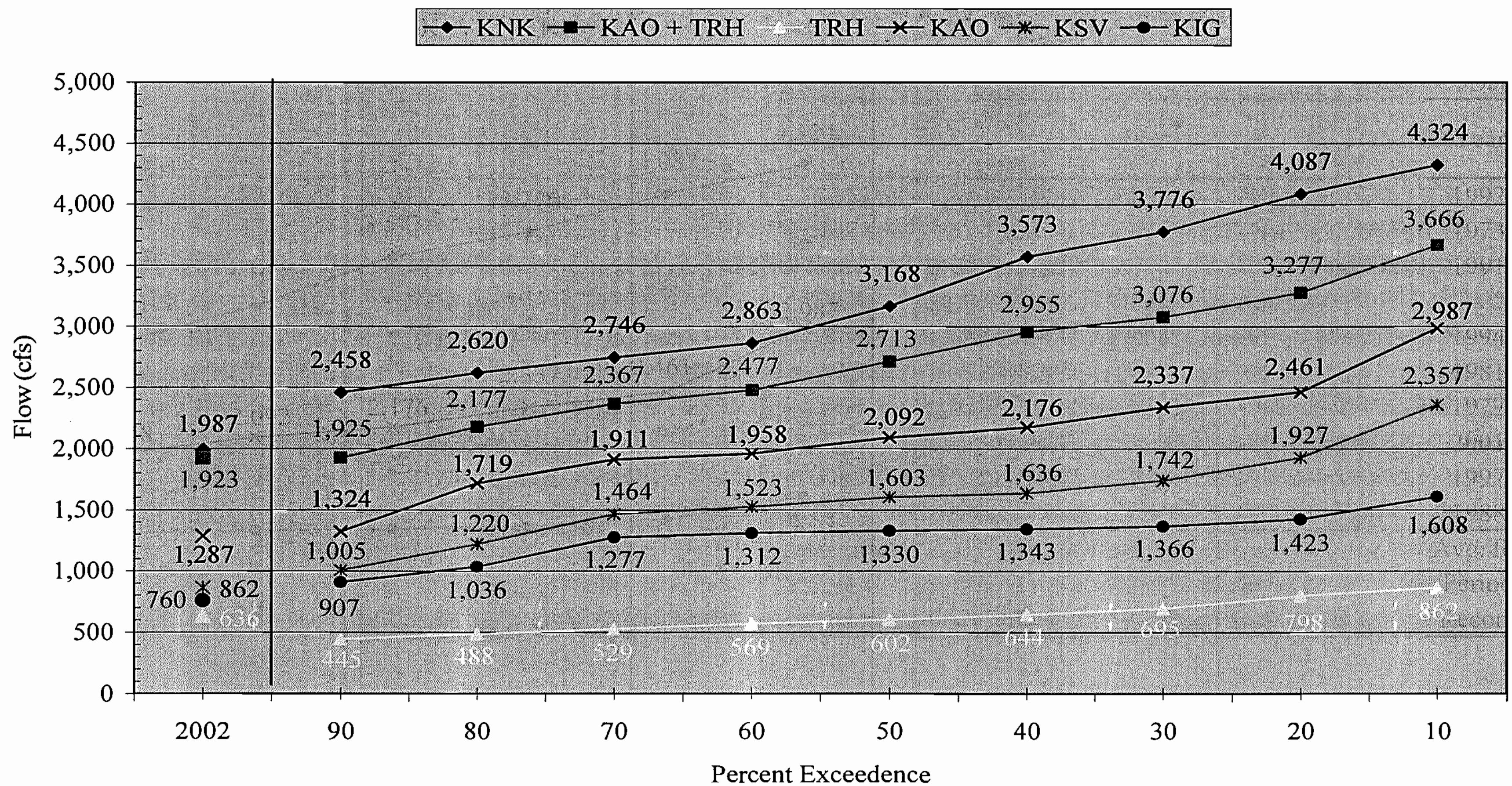
Six years fell in the lower tenth percentile for average September flows at KSV for the period of record from 1951 to 2002. These low-flow years were, 1973, 1981, 1991, 1992, 1994, and 2002 (Table C1). Average monthly flow at KSV for September 2002 was 862 cfs and was the third lowest flow for the period of record (Table C1). The lowest average flow occurred in 1992 (604 cfs) and was 30% lower than the September 2002 average flow. September flows in 1973 (915 cfs), 1981 (995 cfs), 1991 (849 cfs), and 1994 (1,005 cfs), ranged from 2% lower in 1991 to 17% higher in 1994 than in 2002. The average flow in September 2001 (1,070 cfs), ranked as the seventh lowest year (Table C1), was 24% higher than 2002, and fell between the 80% and 90% exceedence values for the period of record (Figure C1).

The average monthly flow at KAO for September 2002 was 1,287 cfs, and ranked as the fourth lowest year for the period of record (Table C1). Six years fell into the lowest tenth percentile and included, 1981, 1991, 1992, 1994, 2001, and 2002 (Table C1). These years were below the 90 % exceedence value for the period of record from 1951 to 2002 (Figure C1). September 1992 had the lowest average flow (790 cfs) and was 39% lower than September 2002. Average September flows in 1981, 1991, 1994, and 2001, ranged from 1,204 cfs in 1991 to 1,311 cfs in 1981. KAO flows in 1991 were 6% less than September 2002, while 1981 flows were 2% greater than in 2002. September 2001 was inconsistent with other Klamath gages with a flow of 1,224 cfs, and falling in the lower tenth percentile for the period of record from 1951 to 2002. This is the only individual Klamath gaging station where data for 2001 showed lower average September flows than in 2002 (Table C1).

Table C1. Ten lowest average September flow years sorted by Klamath River gaging station. * = Flow falls in the lowest tenth percentile for the period of record (1951-2002 for KNK, KAO, KSV, TRH and TRH+KAO and 1961-2002 for KIG). 2002 data is in bold-red and 2001 is in bold-blue.

Klamath River below Iron Gate Dam (KIG)		Klamath River near Seiad Valley (KSV)		Klamath River at Orleans (KAO)		Trinity River at Hoopa (TRH)		Klamath River near Klamath (KNK)		KAO+TRH		TRH flow corrisponding to TRH+KAO years	
Year	Flow (cfs)	Year	Flow (cfs)	Year	Flow (cfs)	Year	Flow (cfs)	Year	Flow (cfs)	Year	Flow (cfs)	Year	Flow (cfs)
1992	538*	1992	604*	1992	790*	1969	336*	1991	1977*	1992	1489*	1992	699
1973	725*	1991	849*	1991	1204*	1967	399*	**2002**	**1987***	1991	1771*	1991	567
1991	748*	**2002**	**862***	**2001**	**1224***	1964	408*	1994	1990*	**2001**	**1857***	**2001**	**633**
2002	**760***	1973	915*	**2002**	**1287***	1987	445*	1992	2007*	1994	1894*	1994	593
1994	906*	1981	994*	1994	1301*	1970	449	1988	2103*	1981	1918*	1981	608
1981	916	1994	1004*	1981	1311*	1951	467	1968	2,523	**2002**	**1923***	**2002**	**636**
1977	1,014	**2001**	**1,070**	1968	1,438	1962	477	1973	2,538	1968	1,938	1968	500
2001	**1,026**	1988	1,143	1987	1,516	1988	483	1964	2,544	1987	1,961	1987	445*
1997	1,035	1977	1,159	1973	1,542	1966	487	**2001**	**2,601**	1988	2,026	1988	483
1988	1,038	1968	1,199	1988	1,543	1965	491	1987	2,625	1973	2,147	1973	605
Avg. for Period Record	1,279	Avg. for Period Record	1,624	Avg. for Period Record	2,136	Avg. for Period Record	639	Avg. for Period Record	3,338	Avg. for Period Record	2,774	Avg. for Period Record	639

Figure C1. Average September flow values corrisponding to the percentage of years those average flows are exceeded for selected Klamath and Trinity River stations during the period of 1951 - 2002. Note that Iron Gate period of record is 1961 - 2002.



The lowest flow years on the Trinity River do not correspond to the lowest flow years identified on the Klamath River (Table C1). The average monthly flow at TRH for September 2002 was 636 cfs, and does not fall in the lowest ten years for flows since 1951 (Table C1). Four years fell into the lowest tenth percentile and included, 1964, 1967, 1969, and 1987 (Table C1). These years were below the 90 % exceedence value for the period of record from 1951 to 2002. Average September flows in 1964, 1967, 1969, and 1987, ranged from 336 cfs in 1969 to 445 cfs in 1987. TRH flows in September 2002 (636 cfs) were nearly equal to the long-term September average of 639 cfs since 1951 (Table C1). The September 2002 flow falls between the 40% and 50% exceedence values for TRH data, indicating that over 50% of the years have had lower flows at TRH between 1951 and 2002. The September 2001 flow was 633 cfs and also falls between the 40% and 50% exceedence values for TRH.

Flows at KNK averaged 1,987 cfs for September 2002 and ranked as the second lowest average flow for September from 1951 to 2002 (Table C1). Years where average September flows fell in the lowest tenth percentile for the period of record included, 1988, 1991, 1992, 1994, and 2002. These years were below the 90 % exceedence value for the period of record from 1951 to 2002 (Figure C1). Of the five lowest flow years, average September flows ranged from 1,977 cfs in 1991 to 2,103 cfs in 1988. Flows in 1991 were 0.5% lower than in 2002, while 1988 flows were about 6% higher than 2002. The average flow in September 2001 (2,601 cfs), represented an estimate rather than actual gage measurements (USGS data at www.usgs.gov) and fell outside of the lowest tenth percentile of flows at KNK. Estimated September flows in 2001 at KNK were 31% higher than in 2002, ranked as the ninth lowest flow year (Table C1), and were near the 80% exceedence value (in the lowest twentieth percentile) for the period of record from 1951 to 2002.

When combining flows at KAO and TRH to represent conditions in the fish-kill area as recommended by USGS (2003), six years (1981, 1991, 1992, 1994, 2001 and 2002) fell into the lowest tenth percentile for average September flows (Table C1). These years were below the 90 % exceedence value for flows during the period of record from 1951 to 2002 (Figure C1). The combined average monthly flow for KAO+TRH for September 2002 was 1,923 cfs and ranked sixth lowest for the period from 1951 to 2002 (Table C1). The lowest year was 1992 (1,489 cfs) and was 23% lower than 2002. Flows in 2001 fell within the lowest tenth percentile and ranked third lowest with an average September flow of 1,857 cfs, which was 3% lower than 2002. The lower percentile ranking of flows in September 2001 was due to Klamath flows at the KAO gage and not Trinity flows. KAO was the only individual Klamath gaging station where data for 2001, showed lower average September flows than in 2002, and fell within the lowest tenth percentile for the period of record from 1951 to 2002 (Table C1). September 2001 flow at TRH (633 cfs) was near the long-term average of 639 cfs for 1951-2002, and fell between the 40% and 50% exceedence values for TRH data.

Analysis of average September flows for the period of record (1961-2002 for KIG and 1951-2002 for KSV, KAO and KNK) at various Klamath River gaging stations, showed eight years that fell in the lowest tenth percentile at one or more stations (Table C1). DFG designated these as low-flow years for further analysis. Average September flows in 1991, 1992, 1994 and 2002 consistently ranked in the lowest tenth percentile at each Klamath River gage location (Table C1). Average flows for September 1973 were in the lowest tenth percentile at KIG and KSV, and 1981 flows were in the lowest tenth percentile at KSV and KAO. September flows only occurred in the lowest tenth percentile for 1988 at KNK and for 2001 at KAO.

September flows during low-flow year's increase as the Klamath River moves downstream from KIG to KNK (Table C2). The lowest accretion rate occurs between KIG and KSV. A more substantial level of accretion takes place between KSV and KAO. The years of 1992 and 2001 were unusual, because the increase in flow between KSV and KAO was much lower compared to other low-flow years (Table C2). The most notable increase in flow occurred between KAO and the lower river, due to a fairly consistent contribution from the Trinity River. Trinity contributions during low-flow years were usually around 600 cfs, and ranged from 483 cfs in 1988 to 699 cfs in 1992 (Table C2).

Low-flow years were compared between stations to identify differences between using KNK data versus TRH+KAO data to characterize flow in the fish-kill area (Table C2). USGS (2003) did not use KNK data, due to concerns with accuracy of the gage in 2001 and 2002. The years of 1981 and 2001 showed the greatest discrepancies between use of KNK versus TRH+KAO data to characterize flow in the fish-kill area, followed by 1992, 1973, and 1991. Flows in 1988, 1994, and 2002, compared more closely using the two separate estimates and showed a difference of less than 10% (Table C2).

Mean daily flow data, from August 1 to October 15, 2001 for KNK, indicated flow in the lower river remained above 2,500 cfs throughout August and September (Figure C2). In 2002, flow began dropping in mid-August to approximately 2,000 cfs, and remained at that level until flow releases were increased at Iron Gate Dam to abate the fish-kill in late September. A similar comparison of combined KAO+TRH flows, indicated flow in the lower river, through the fish-kill reach, was slightly lower in 2001 than in 2002 (Figure C3). Until August 15, 2002, reported flows at KNK were approximately 500 cfs greater than the combined KAO+TRH gages (Figure C4). After August 15, 2002, KNK flow dropped off until it approximated the combined KAO+TRH gages around September 1. KNK and combined KAO+TRH flows then coincide until flow was increased in late September (Figure C4).

Average daily flows for USGS stations, KIG, KSV, KAO, TRH, KAO+TRH, and KNK, for August 1 through October 15 of 1973, 1981,1988, 1991, 1992, 1994, 2001, and 2002, showed day-to-day changes in flow for low-flow years (Figures C5–C10). KIG showed the least day-to-day changes in flow, with occasional sharp increases or decreases representing flow schedule changes at Iron Gate Dam (Figure C5). Notable increases in flow were evident at KIG for the first four days in September 1981, early August 1988, mid-August and late September 1991, mid and late September 1992, late September and early August 2001, and late September 2002. A two-week increase in flow of about 600 cfs to abate the fish-kill was clearly evident starting September 27, 2002 and ending in early October (Figure C5). The fish-kill was first reported on September 19, 2002. Flows were not increased at KIG until ten days after the first reports of dead fish, and did not fully reach the fish-kill area until October 1, 2002 (Figure C10).

Table C2. Comparison of average September flows for low-flow years at various Klamath River and Trinty River Stations with means, maximums and minimums for the period of record of 1951-2002 at all stations except KIG. KIG period of record is 1961-2002.

Year	Klamath River below Iron Gate Dam (KIG)	Klamath River near Seiad Valley (KSV)	Klamath River at Orleans (KAO)	Trinity River at Hoopa (TRH)	Trinity River + Klamath River (KAO + TRH)	Klamath River near Klamath (KNK)	Percent Difference KNK to KAO + TRH
1973	725	915	1,542	605	2,147	2,538	15
1981	916	995	1,311	608	1,919	2,732	30
1988	1,038	1,143	1,543	483	2,026	2,103	4
1991	749	849	1,204	567	1,771	1,976	10
1992	538	604	790	699	1,489	2,007	26
1994	906	1,005	1,301	593	1,894	1,990	5
2001	1,026	1,070	1,224	633	1,857	2,601	29
2002	760	862	1,287	636	1,923	2,129	10
Mean	1,279	1,624	2,136	639	2,774	3,338	
Maximum	2,052	2,861	3,807	1,308	4,750	5,923	
Minimum	538	604	790	336	1,489	1,976	

Table C3. Comparison of average September flow exceedence values (cfs) for modeled unimpared flows from Hardy and Addley 2001 with actual average September flows for the Klamath River below Iron Gate Dam, near Seiad Valley and at Orleans.

Percent Exceedence	Klamath River below Iron Gate Dam (KIG) 1961 - 2002	KIG Unimpaired Flows, Hardy and Addley 2001 1974 - 1997	Klamath River near Seiad Valley (KSV) 1952 - 2002	KSV Unimpaired Flows, Hardy and Addley 2001 1974 - 1997	Klamath River at Orleans (KAO) 1951 - 2002	KAO Unimpaired Flows, Hardy and Addley 2001 1974 - 1997
10	1,608	2,076	2,357	2,470	2,987	3,228
20	1,423	1,843	1,927	2,323	2,461	2,909
30	1,366	1,813	1,742	2,079	2,337	2,757
40	1,343	1,754	1,636	1,995	2,176	2,423
50	1,330	1,502	1,603	1,677	2,092	2,206
60	1,312	1,377	1,523	1,512	1,958	2,084
70	1,277	1,295	1,464	1,454	1,911	1,839
80	1,036	1,174	1,220	1,274	1,719	1,652
90	907	1,021	1,005	1,092	1,324	1,403

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Figure C2. Mean daily flows for the Klamath River near Klamath gage (KNK) for the period from August 1 to October 15, 2001 and 2002.

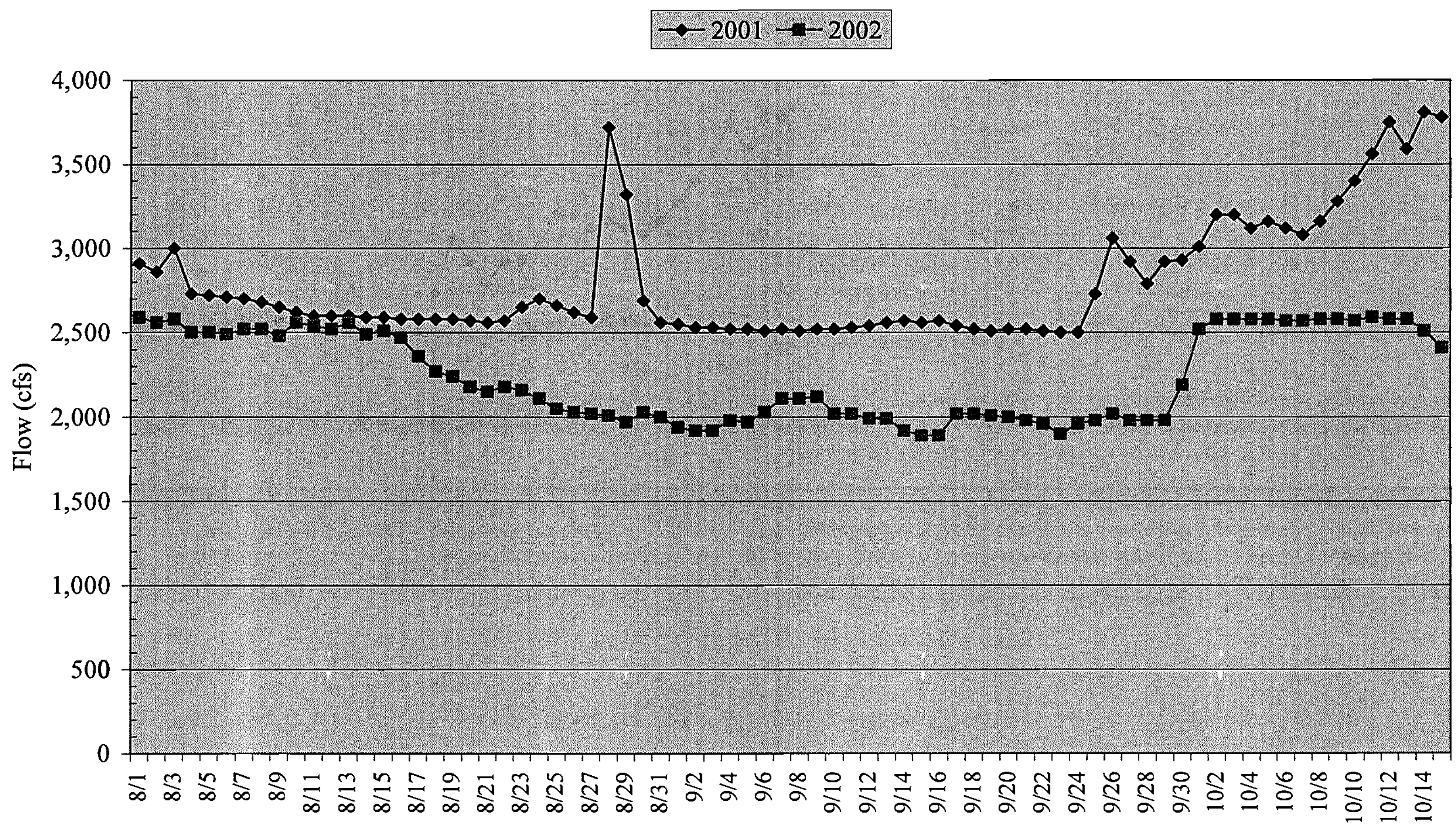


Figure C3. Mean daily flows for the Klamath River at Orleans plus Trinity River at Hoopa gages (KAO+TRH) for the period from August 1 to October 15, 2001 and 2002.

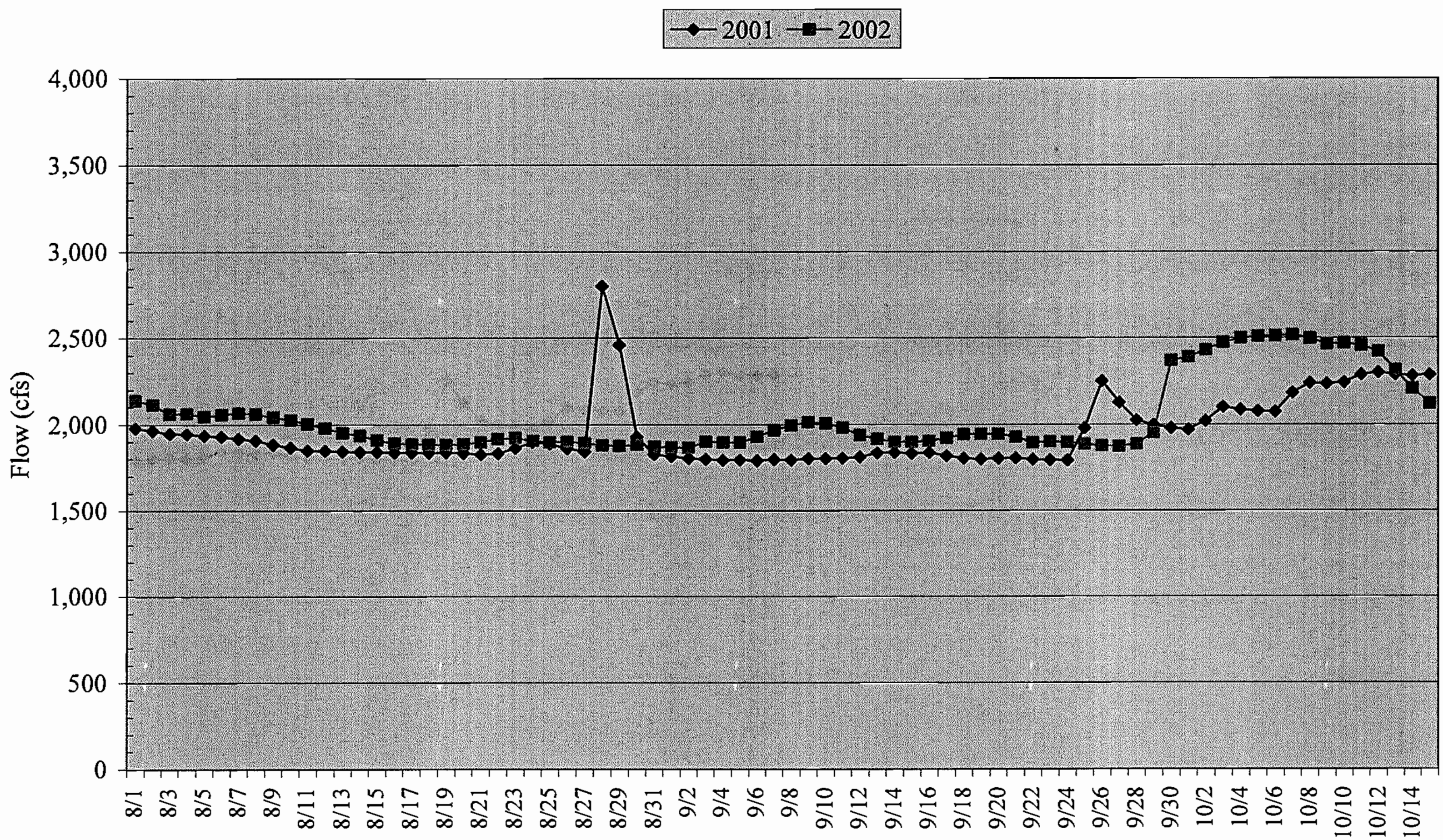


Figure C4. Mean daily flows for the Klamath River near Klamath gage (KNK) vs. the Klamath River at Orleans plus Trinity River at Hoopa gages (KAO+TRH) for the period from August 1 to October 15, 2002.

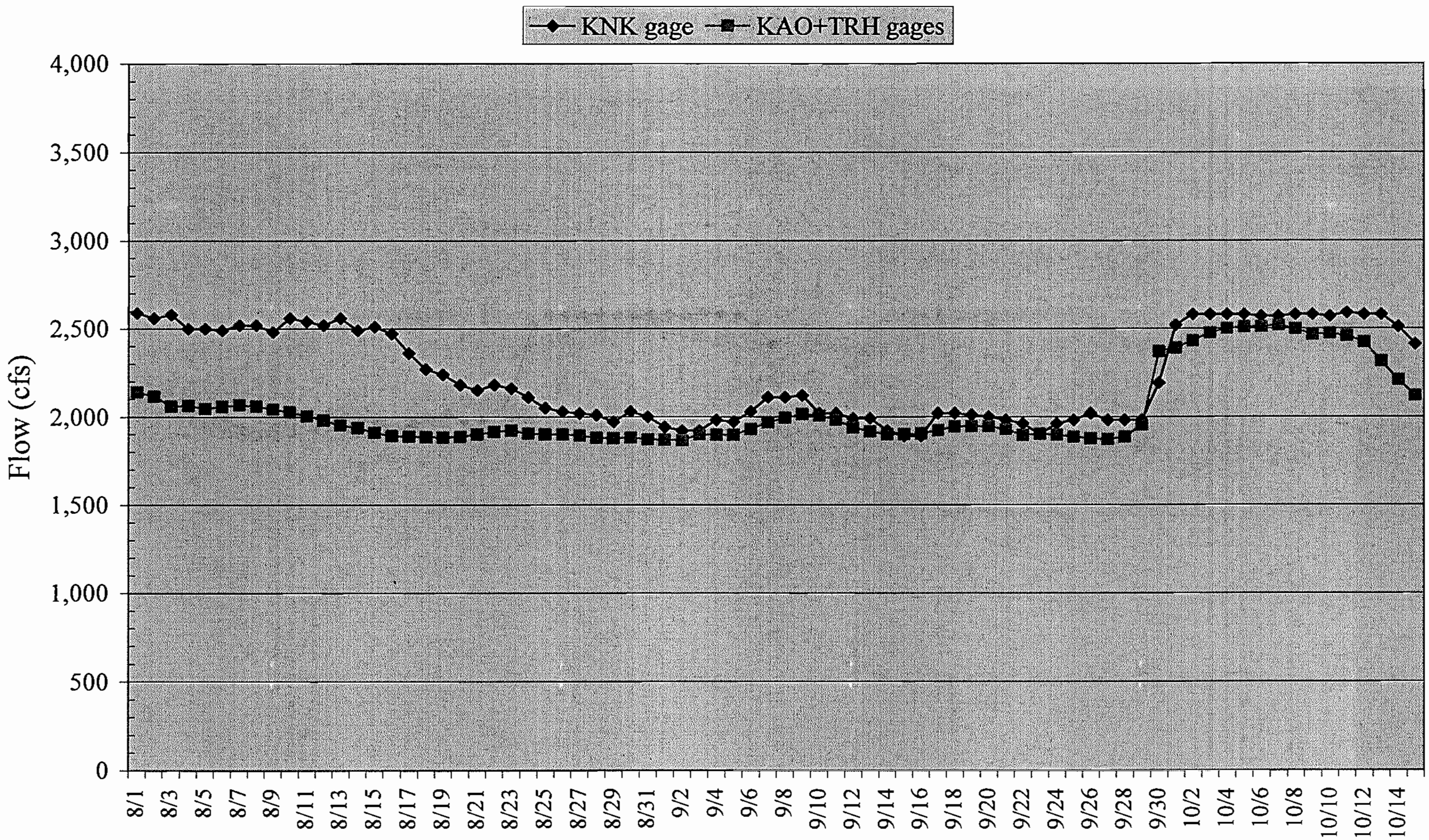


Figure C5. Mean daily flows for the Klamath River below Iron Gate Dam from August 1 to October 15 for low-flow years.

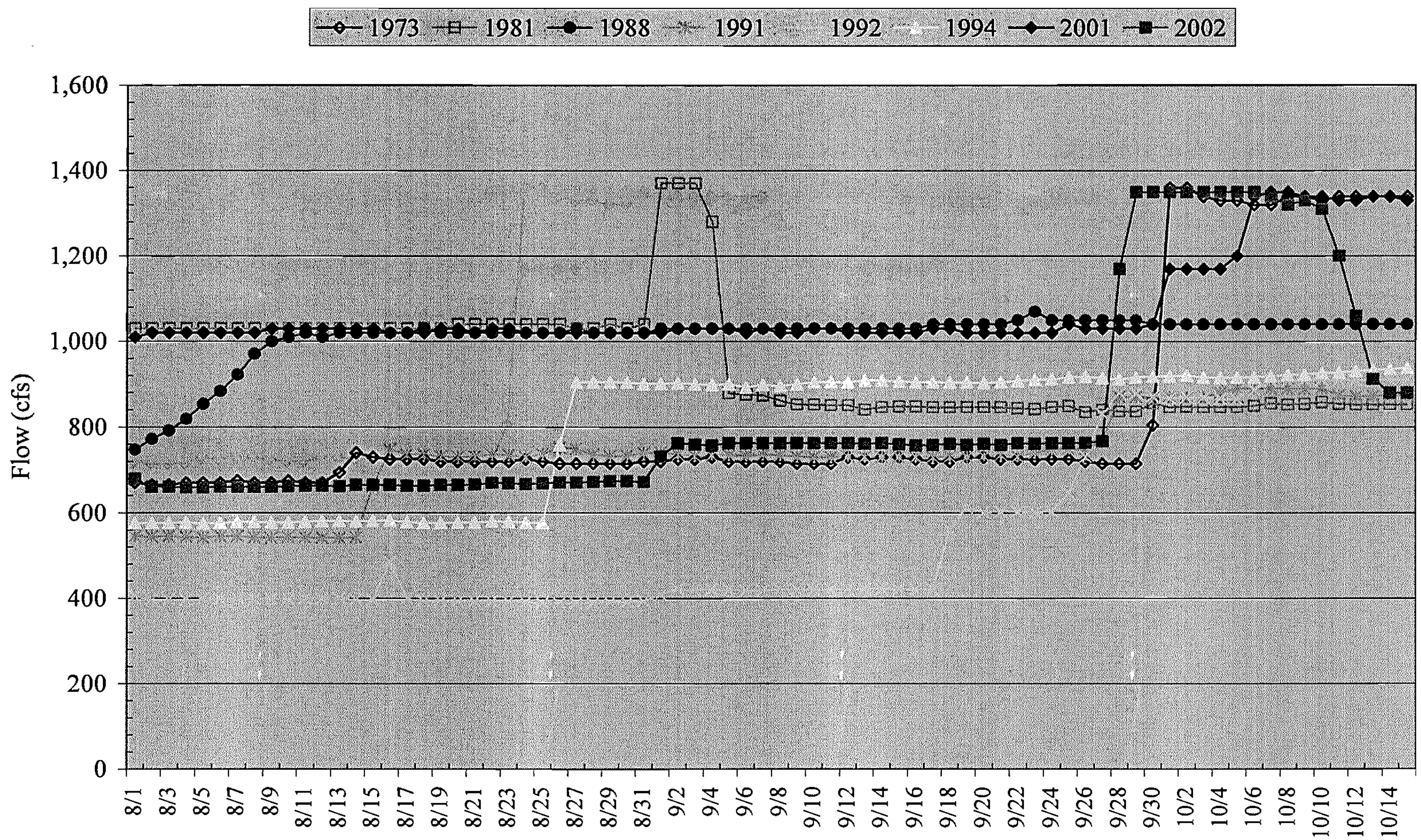


Figure C6. Mean daily flows for the Klamath River near Seiad Valley from August 1 to October 15 for low-flow years.

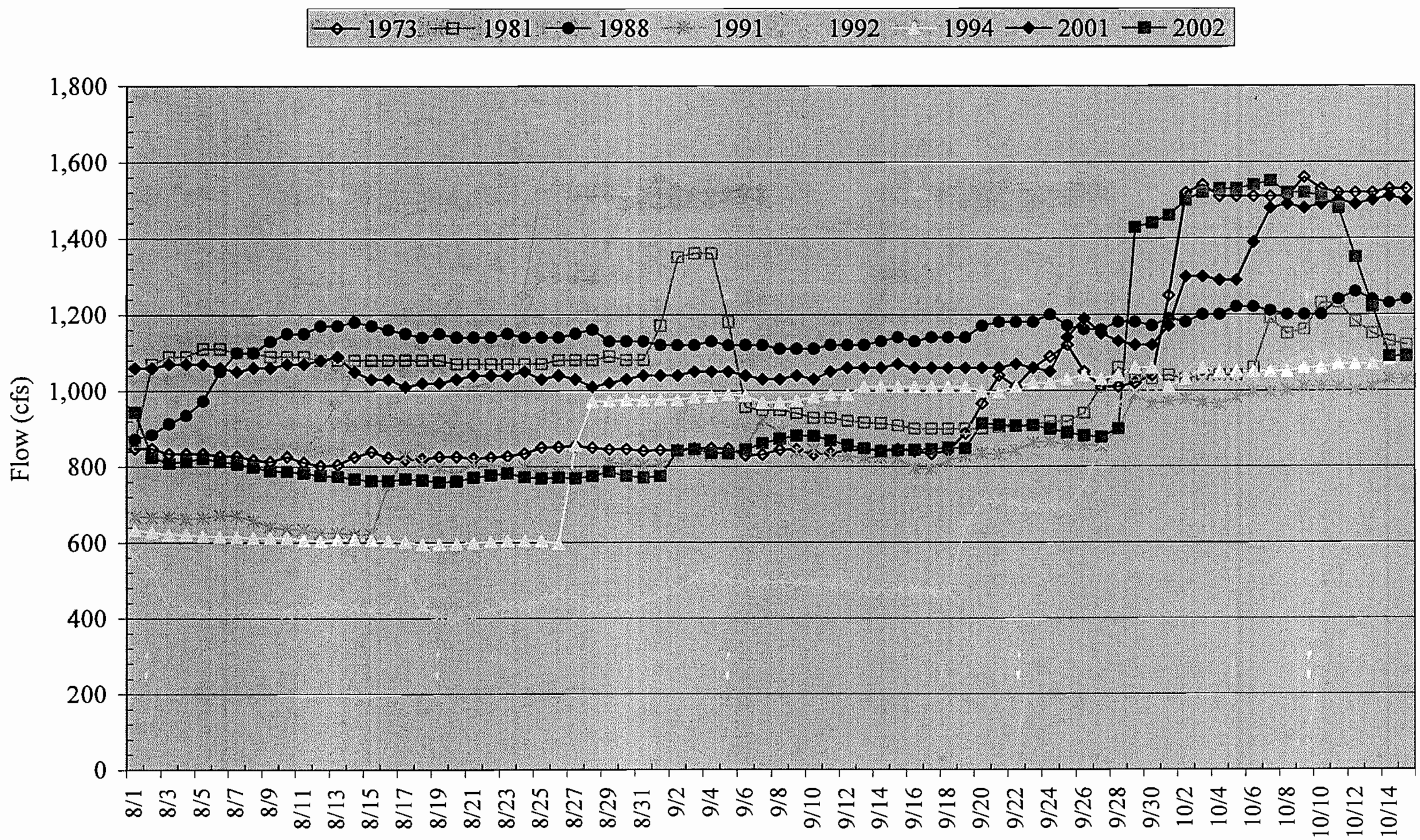


Figure C7. Mean daily flows for the Klamath River at Orleans from August 1 to October 15 for low-flow years.

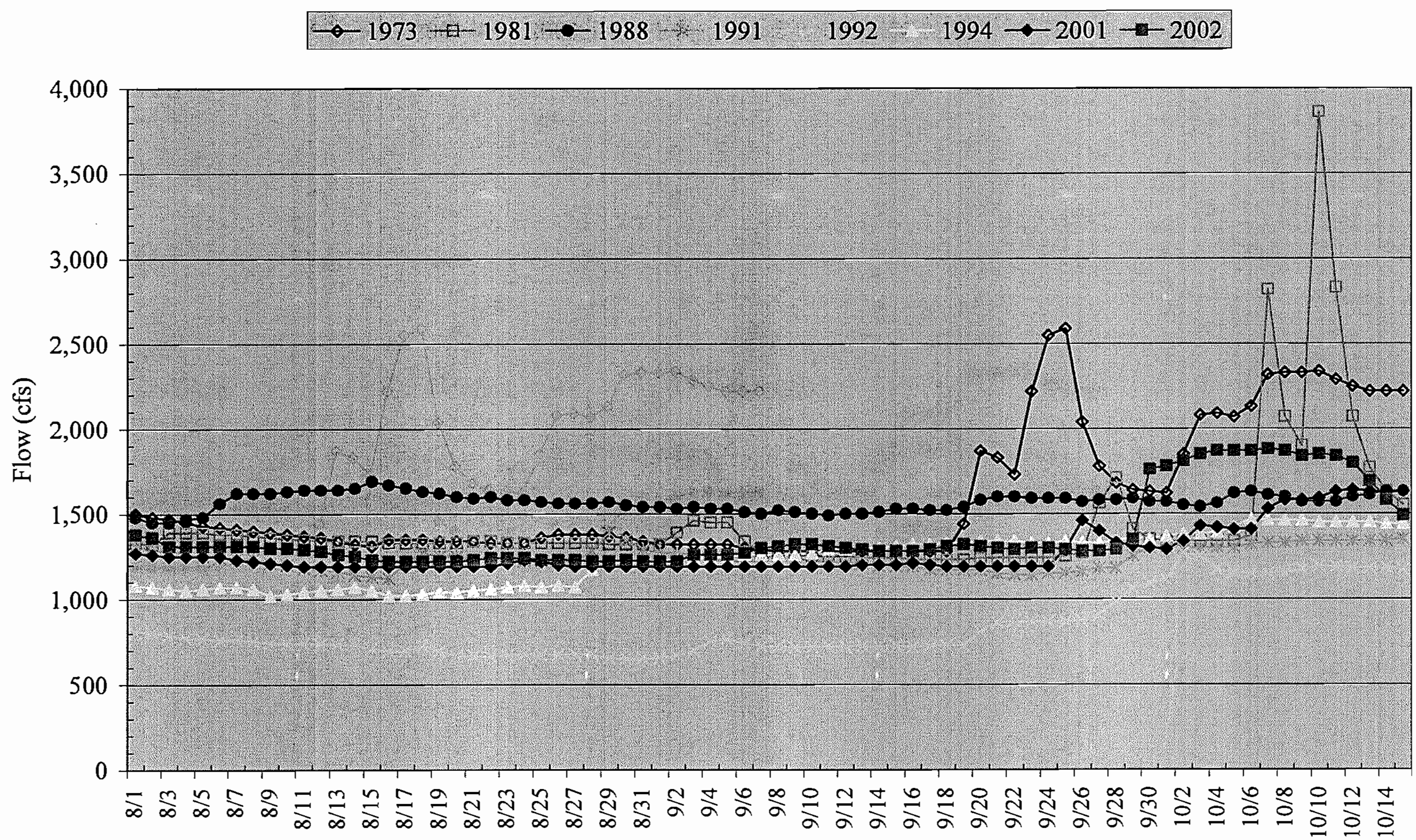


Figure C8. Mean daily flows for the Trinity River at Hoopa from August 1 to October 15 for low-flow years identified on the Klamath River.

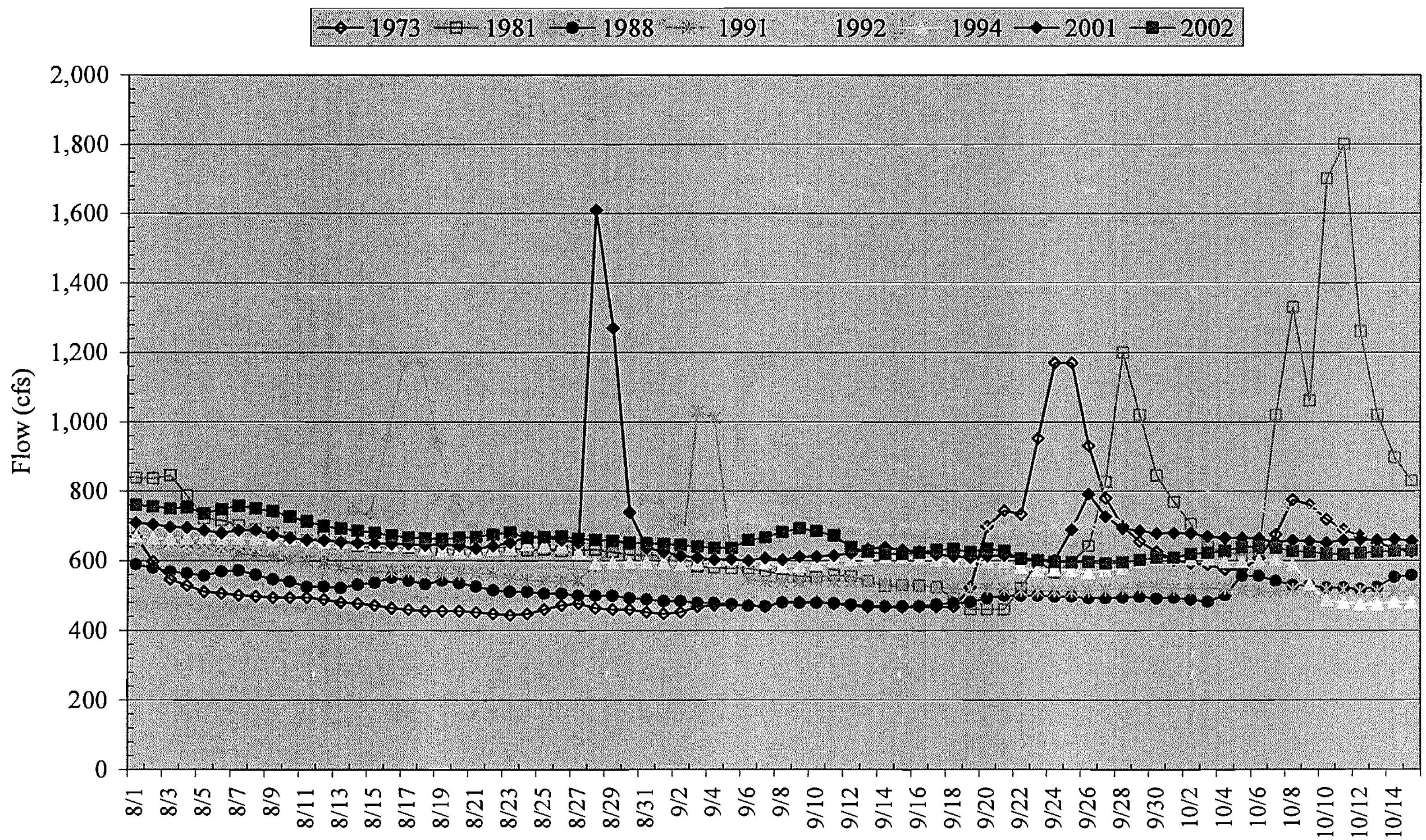


Figure C9. Combined mean daily flows for the Klamath River at Orleans and the Trinity River at Hoopa from August 1 to October 15 for low-flow years.

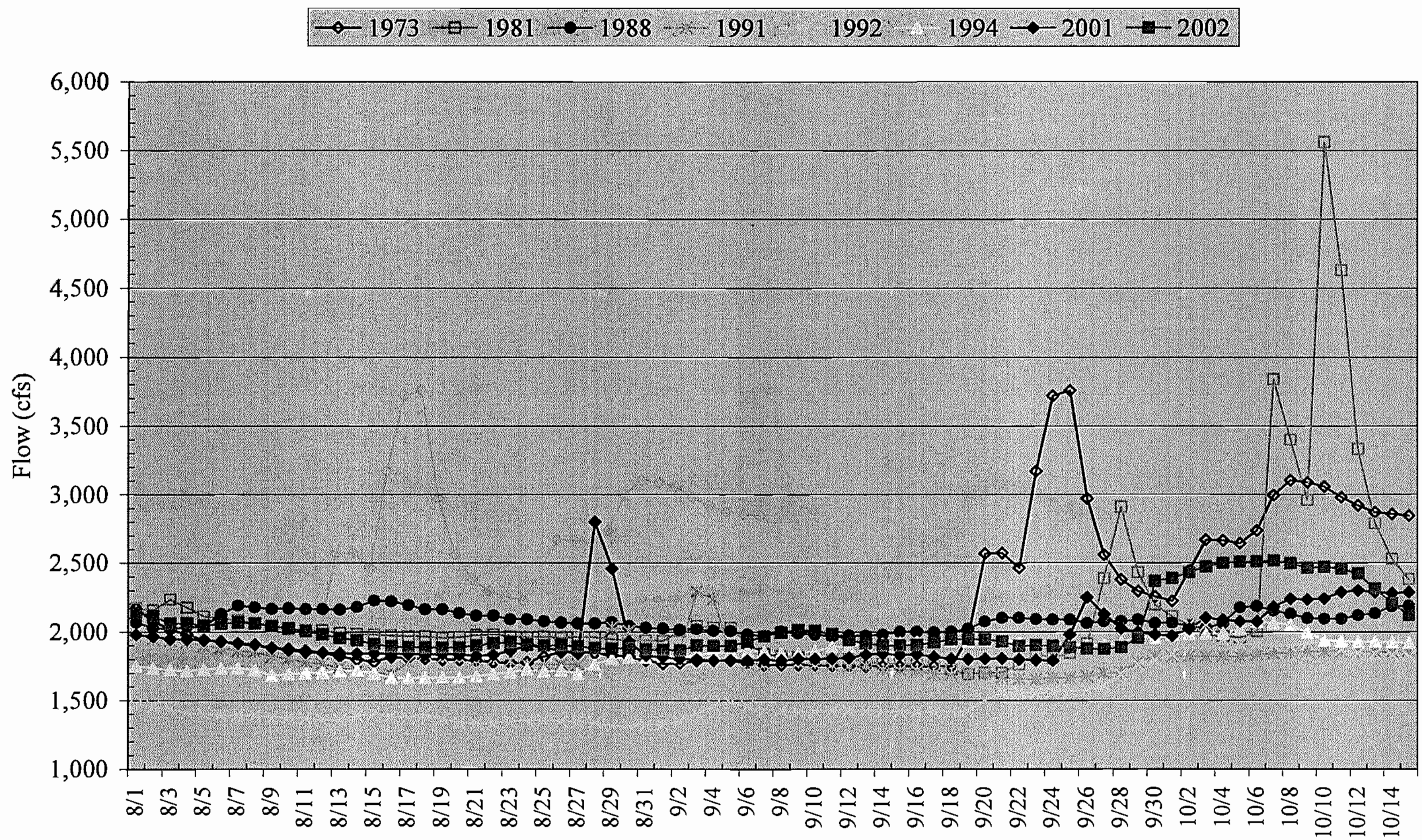
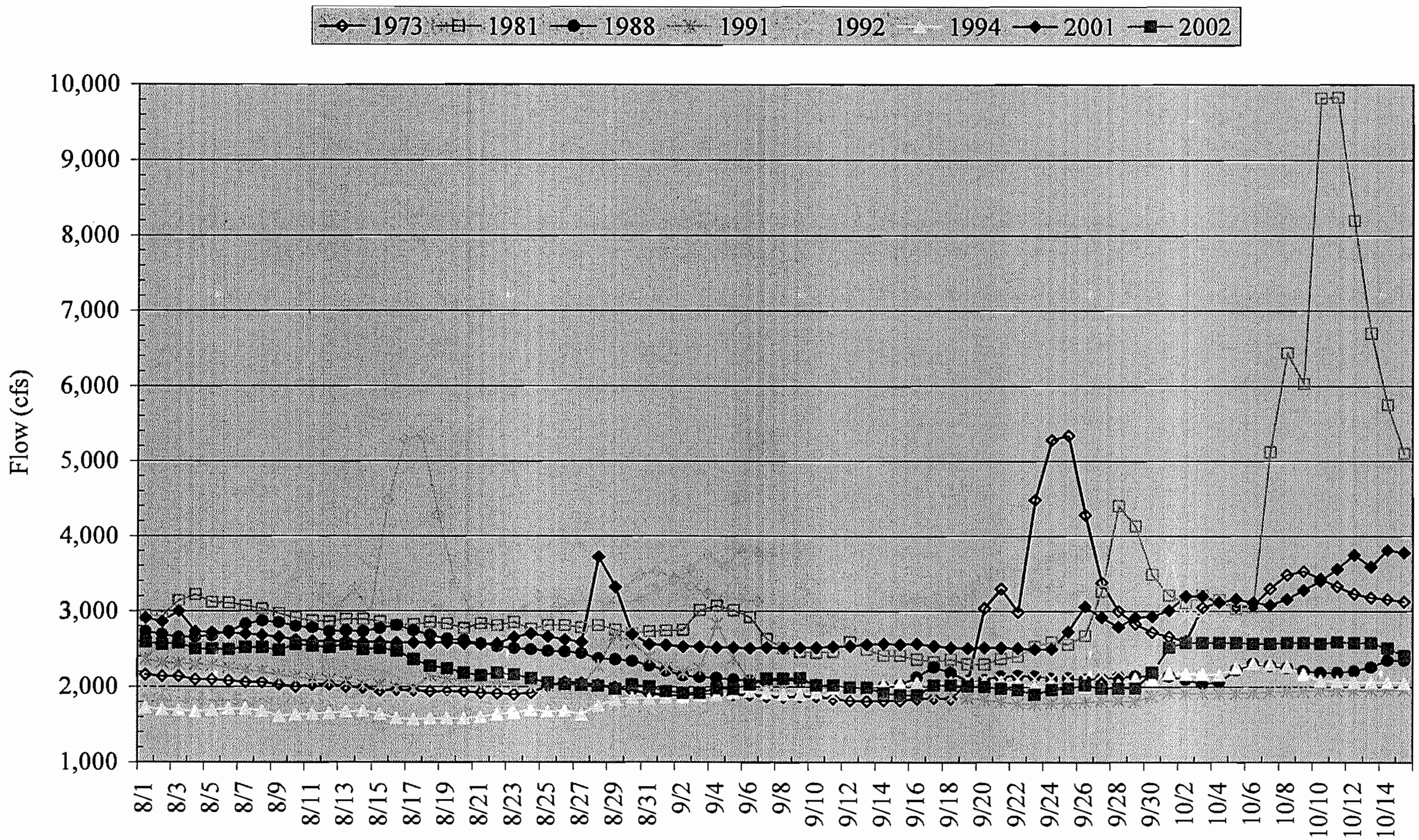


Figure C10. Mean daily flows for the Klamath River near Klamath from August 1 to October 15 for low-flow years.



As the river moves downstream to KSV (Figure C6) and KAO (Figure C7), changes in flows at KIG were evident, but subtle day-to-day variations in flow also occurred due to tributary inflows. Notable increases in flow were evident in late September 1973 and early October 1981 at KAO (Figure C7). These increases may have represented early storm events.

Daily TRH flows were quite consistent, and usually ranged between 500 and 800 cfs, from August to mid October (Figure C8). However, increased flows were evident in late September 1973, late September and early August 1981, early September 1991 and late August 2001. Flow increases in late September and October of 1973 and 1981 at TRH, probably reflected early storm events, because they were also apparent at KAO (Figure C7). Flow spikes in September 1991 and August 2001, are not apparent at KAO and likely represented upstream releases at Trinity and Lewiston dams for the Hoopa Tribe Boat Dance. All four increases in flow at TRH were evident in the Klamath River below the confluence with the Trinity River (Figures C9 and C10).

Unimpaired flows modeled by Hardy and Addley (2001), for the period of 1974 to 1997, at various percent exceedence values, were always higher than the actual flow exceedence values at KIG (1961-2002), KSV (1952-2002) and KAO (1951-2002) (Table C3). Unimpaired flows at KIG ranged from nearly 470 cfs higher at a ten percent exceedence level, to 114 cfs higher at a 90% exceedence value, when compared with actual flows (Table C3). The average flow release at KIG in September 2002 was 760 cfs. This flow was nearly 150 cfs less than the actual 90% exceedence value for the period of 1961 to 2002, and 312 cfs less than the modeled unimpaired 90% exceedence value for the period of 1974 to 1997.

III. C. 4. Findings

Average flow from September 1 to September 26, 2002, consistently fell within the lowest tenth percentile and ranked between the second and sixth lowest flows for all USGS gaging stations on the Klamath River downstream from Iron Gate Dam. September 2002 flows were consistently lower than the 90% exceedence values for these same gaging stations. Higher September flows have occurred in over 90% of years over the past half-century, than occurred in 2002 at all lower Klamath River gaging stations. These results compared favorably with USGS (2003), in which they concluded, September 2002 stream-flows in the Klamath Basin were low, and in most cases, were among the four lowest for the period of record since 1960. Average September flows for 1992 were the lowest for the period of record at all the Klamath River stations, except KNK. At KNK, the 1992 flow was the forth lowest, but only 30 cfs or about 1.5% higher than the lowest reported flow of 1,977 cfs in 1991.

Each Klamath River gaging station, showed three to five years in which the lowest average September flows were between 6% and 8% of the lowest flow. Since flow record accuracy at these gaging stations ranged from less than 5% to >15% (USGS 2003), these low-flow years were essentially the same for comparative purposes.

Average September flow records for KIG were lower in 1973, 1991, and 1992 than those observed in 2002. KIG records showed in 93% of the years since 1961, flow releases from Iron Gate Dam were higher than flows during the September 2002 fish-kill.

Although KNK data showed similar average flows in 1988, 1991, 1992, and 1994 compared to September 2002 (2002 data is provisional), these low-flows occurred in only 10% of years for the period of record since 1951. These low-flow years mostly coincided with the prolonged drought of the early 1990's. In 98% of the years since 1951, average September flows were higher at KNK than during 2002. Prior to 1988, average September flows never approached the low levels observed during 2002.

A comparison of September flow conditions in the Klamath River below the confluence of the Trinity River between 2001 and 2002 is important, because 2001 had a larger run of salmon than 2002, and a fish-kill did not occur. When flow data from KNK were used to represent flow in the river throughout the fish-kill reach, river flow was about 600 cfs greater in September 2001 than in 2002. This suggests there was more flow in the river for the greater number of fish in 2001. When combining KAO with TRH data to represent flow in the river throughout the fish-kill reach, river flow was slightly greater in September 2002 than in 2001. This suggests there was slightly less flow in the river supporting a larger run of fish in 2001.

In further analysis, DFG compared average September flows from KNK to the combined flows of KAO+TRH for low-flow years of 1973, 1981, 1988, 1991, 1992, 1994, 2001, and 2002. In five of these years (1973, 1988, 1991, 1994 and 2002), KAO+TRH flow was within 15% of the flow reported at KNK. For the other three years (1981, 1992 and 2001), reported flows at KNK were 26% to 30% greater than KAO+TRH. Since average September TRH flows were very similar in these three years (608 cfs in 1981, 699 cfs in 1992, and 633 cfs in 2001), major differences in flows must be attributed to differences at KAO.

USGS (2003) did not use KNK data for 2001 and 2002 in their analyses because accuracy was considered "poor". They instead used combined flows from KAO+TRH to characterize flows in the fish-kill area. The KAO+TRH data showed average flows in 1981, 1991, 1992, 1994, and 2001 that were less than September 2002. These low-flow years, including 2002, all fell in the lowest tenth percentile for the period of record since 1951. Notable in the KAO+TRH data, was that 2001 fell in the lowest tenth percentile for September flows, but did not at KIG, KSV or KNK.

The decision, by USGS (2003), to discard KNK data in 2001 and 2002, may be well founded due to potential inaccuracies at the gaging station, particularly for 2001 when flows were estimated. However, DFG would question whether addition of flows from two gaging stations, one with a less than 10% margin of error (KAO) plus one with a less than 5% margin of error (TRH) and both being over 50 miles above KNK, were more accurate than a single gage with a 15% margin of error (KNK). Using either method raises concerns with the accuracy of flow estimates in the fish-kill area.

KAO represents the only individual Klamath station, where 2001 fell into the lowest tenth percentile for average September flows since 1951. Average flow in September 2001, ranked as the third lowest flow year at KAO. At other Klamath River gaging stations, 2001 ranked between the seventh and ninth lowest average September flows and never fell in the lowest tenth percentile for the period of record.

Comparing KAO with the next gaging station up-river (KSV), showed a difference of 154 cfs of accretions to the river between the two sites during September 2001. This low accretion rate for September 2001 seems reasonable, because the combined inflow was only 105 cfs for the two gaged tributaries (Salmon River and Indian Creek) entering the Klamath River between KSV and KAO. Lower September accretions than in 2001, are not unprecedented, and have also occurred in 1985 (152 cfs) and 1987 (47 cfs). Past September accretions between these two gages, however, have more often been substantially higher, averaging 517 cfs since 1952, 442 cfs since 1985, and 493 cfs over the last ten years, since 1992. Average accretions to this area of the Klamath River, during other low-flow Septembers, were also higher at 627 cfs in 1973, 316 cfs in 1981, 400 cfs in 1988, 355 cfs in 1991, 186 cfs in 1992, 296 cfs in 1994, and 425 cfs in 2002. Low accretions of flow between KSV and KAO in September 2001 may be accurate, but does represent an unusual circumstance when compared to other years.

Although Klamath River flows were among the lowest on record in September 2002, Trinity River flows at Hoopa were near the long-term average of 639 cfs for the period of 1951 to 2002. September 2002 flows were 636 cfs, which was between the 40% and 50% exceedence values for TRH since 1951. These results compared favorably to USGS (2003) findings that characterized average flows from September 1-24, 2002 as being slightly less than average (96 percent) for a period of record since 1960.

Comparing unimpaired flows, as modeled by Hardy and Addley (2001), for the period of 1974-1997, with actual flow exceedence values and actual September 2002 flow at KIG (1961-2002), indicated higher flows could have been provided to the Klamath River in September 2002. Unimpaired flows at Iron Gate ranged from nearly 470 cfs higher at a ten percent exceedence level, to 114 cfs higher at a 90% exceedence value, when compared with actual flows (Table C3). Average flow releases at KIG in September 2002 were 760 cfs, which was nearly 150 cfs less than the actual 90% exceedence value for the period of 1961 to 2002, and 312 cfs less than the modeled unimpaired 90% exceedence value for the period of 1974-1997. Therefore, more flow was potentially available from above Iron Gate Dam. Increased releases at Iron Gate in September 2002, would clearly have affected deliveries to upstream water users. Increased discharge to the Klamath River below Iron Gate could also have come from other sources such as the Shasta, Scott and Trinity rivers. However, any potential benefits of increased flow in the mainstem Klamath River would be lost between Iron Gate Dam and the mouths of these respective rivers.

In summary, September 2002 flows in the Klamath River were atypically low, which led DFG to reject the null-hypothesis that flows in the Klamath River during 2002 were not out of the ordinary and should not have contributed to the fish-kill. DFG, therefore, accepted the alternative hypothesis that flows in 2002 were atypical and could have contributed to the fish-kill. Klamath River flows in September 2002 were among the lowest recorded in the last half-century. September 2002 flows always fell in the lowest tenth percentile for the period of record at all gaging stations in the lower Klamath River during September. Depending on the gaging station, there were three to five years where average September flows were similar or less than those recorded in 2002. From this analysis, DFG identified seven other potential low-flow years for further analysis, in which fish-kills did not occur. Therefore, low-flows in the river may have been an important factor in creating conditions that facilitated the outbreak of disease, and culminated in the fish-kill.

In contrast to the Klamath River, Trinity River flows during September 2002 were near the long-term average for the period of record from 1951 to 2002. Lower flows at TRH have occurred in more than 50% of the years over the past half-century than occurred in September 2002. This led DFG to accept the null-hypothesis that flows in the Trinity River during 2002 were not out of the ordinary and should not have contributed to the fish-kill.

The data and analyses in this report and by Hardy and Addley (2001), indicated that unimpaired flows in the Klamath River would have been higher in September 2002. In addition, USBR directed Pacificorp to increase flows, from Iron Gate Dam in late September and early October 2002, to abate the fish-kill. Pacificorp also took independent steps to extend those higher flows for several days after USBR directed had directed them to reduce the flows in October. This information led DFG to reject the null-hypothesis that there was no additional water available to increase flows in the lower Klamath River during September 2002. We accepted the alternative hypothesis that there was additional water available to increase flows in the Klamath River during September 2002. The Klamath Project is one, but not the only potential source of increased flows in the Klamath River. Our analysis of these competing hypotheses showed more flow could have been available in September 2002, but did not address if more flow would have created better conditions for downstream resources. Hypotheses related to the benefits or detriments of increased flows for fishery resources in the Klamath Basin during 2002, will be addressed in later sections of this report.

VI. Conclusions:

The September 2002 fish-kill was unprecedented, and the first major mortality event of adult salmonids in the Klamath River ever recorded. Fall-run Chinook salmon were the primary species affected, but coho salmon, steelhead, and other fish species were also lost. At least 33,000 adult salmonids died during mid to late September 2002, in the lower 36 miles of river. Although a larger number of Klamath River fall-run Chinook died, a greater proportion of the Trinity River run was impacted by the fish-kill, because the Trinity run is substantially smaller than the Klamath run on an annual basis, and the peak of the Trinity River Chinook salmon run in 2002, coincided with the height of the fish-kill.

The primary cause of the fish-kill was a disease epizootic from the ubiquitous pathogens ich and columnaris. However, several factors contributed to stressful conditions for fish, which ultimately led to the epizootic. An above average number of Chinook salmon entered the Klamath River between the last week in August and the first week in September 2002. River flow and the volume of water in the fish-kill area were atypically low. Combined with the above average run of salmon, these low-flows and river volumes resulted in high fish densities. Fish passage may have been impeded by low-flow depths over certain riffles, or a lack of cues for fish to migrate upstream. Warm water temperatures, which are not unusual in the Klamath River during September, created ideal conditions for pathogens to infect salmon. Presence of a high density of hosts and warm temperatures caused rapid amplification of the pathogens ich and columnaris, which resulted in a fish-kill of over 33,000 adult salmon and steelhead.

Flow is the only controllable factor and tool available in the Klamath Basin (Klamath and Trinity rivers) to manage risks against future epizootics and major adult fish-kills. Increased flows when adult salmon are entering the Klamath River (particularly during low-flow years such as 2002) can improve water temperatures, increase water volume, increase water velocities, improve fish passage, provide migration cues, decrease fish densities, and decrease pathogen transmission between fish.

The total fish-kill estimate of 34,056 fish was very conservative. Analysis of Trinity River spring-run to fall-run Chinook returns in 2002 compared to historic returns, indicate the fish-kill estimate may have underrepresented actual fish losses by 45,000 individuals. If fish-kill numbers were indeed substantially underestimated, more fall-run Chinook salmon could have been used in the PFMC modeling efforts. This would have led to increased harvest opportunities for ocean and in-river Klamath fisheries during 2003. In addition, Klamath Basin tribal net and sport anglers may have lost the opportunity to harvest roughly 4,000 to 14,600 fall-run Chinook salmon in 2002 because of the fish-kill. This impact was more pronounced in the Trinity River than the Klamath River, because the fish-kill occurred below the confluence of the Trinity and Klamath, before there was substantial opportunity for fall Chinook to be harvested from the Trinity River.

BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON

In the Matter of the Request of	)	UE-170
	)	
PACIFIC POWER & LIGHT	)	Certificate of Service
(dba PACIFICORP	)	
	)	
For a General Rate Increase in the	)	
Company's Oregon Annual Revenues	)	
(Klamath Rate Case Portion of this Proceeding	)	

CERTIFICATE OF SERVICE

I hereby certify that on this 17th day of January I have sent the "Direct Testimony of James V. McCarthy on behalf of Oregon Natural Resources Council, Pacific Coast Federation of Fishermen's Associations and WaterWatch of Oregon" dated January 17, 2006, to each person on the Service List in this proceeding attached below, as follows: (1) for all those with email addresses, by email with attached file; and, (2) a printed copy by first class U.S. mail, postage prepaid, to the listed address of each. I also mailed the original and requisite copies to the PUC Filing Center for immediate filing.

January 17, 2006 /s/______________________________
Glen H. Spain

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