Klamath Salmon:

understanding allocation

Background, policy
of the procedures of the
harvest allocation process
for Klamath River Fall Chinook Salmon

February 1998

Klamath Salmon:
Understanding Allocation

by

Ronnie M. Pierce

February 1998

Funding Provided by the
Klamath River Basin Fisheries Task Force
United States Fish and Wildlife Service
(Cooperative Agreement # 14-48-11333-98-G002)

Readers are reminded that salmon management is a dynamic process; the information provided in this document on harvest rate management and allocations is continually changing. Current information can be obtained from the agency, Tribal, and industry contacts listed on page 5.

Table of Contents

Introduction 4

Who to Contact 5

An Historical Perspective 6

- Klamath River Tribal Fishing
  - *Aboriginal Fishing*
  - *First Indian Commercial Fisheries*
- Ocean Commercial Fishing
  - *Early Ocean Fisheries*
- *Ocean Recreational Fishing*
- River Recreational Fishing
  - *Zane Grey Visits the Klamath*

Tribal and Non-Tribal Allocation 10

- Principles of Tribal Fishing Rights
  - *Doctrine of Reserved Rights*
  - *Basics of Treaty Interpretation*
- Review of Local Fishing Rights Legal History
  - *Reservation Status Confirmed*
  - *Federal Jurisdiction Confirmed*
  - *Parravano v. Babbitt*

The Harvest Managers 13

- Ocean Fisheries
  - *Pacific Fishery Management Council*
  - *State Management of Ocean Fisheries*
- River Fisheries
  - *Tribal Management*
  - *River Recreational Management*
- Cooperative Management
  - *Klamath Fishery Management Council*
  - *Typical Management Schedule*
  - *Salmon Management Regulatory Flow Schematic*

Harvest Rate Management 18

Protecting Natural Stocks

Salmon Life History

Natural Stock Policy

Harvest Rate Management

Maximum Sustainable Yield

Fixed Goal vs. Harvest Rate Management

Escapement Rate Goals

Allocation Calculations

Harvest Rate Model

Tribal Process

Monitoring Harvest and Escapement

Ocean Harvest Estimates

Tribal Harvest Estimates

River Recreation Estimates

Escapement Estimates

Klamath River Escapement (Figure 6)

Annual Management Process 23

Preseason Predictions

Technical Teams

Information Sharing and Negotiations

Status of the Resource 24

Numeric Distribution of Harvest and Escapement (Figure 7)

What is Being Done 25

Harvest Management

Habitat Restoration

Appendix 26

I. Sample Harvest Rate Parameters

II. Contribution Rates

III. Glossary

IV. Bibliography

Introduction

The Klamath River fall chinook salmon, *Oncorhynchus tshawytacha*, are vital to the economies and culture of Northern California and Southern Oregon. In recent years, there have been many changes in the management of this important stock of fish. The reaffirmation of Tribal fishing rights have created new guidelines for the allocation of harvest. The reallocation of harvest combined with a harvest rate management policy designed to protect the spawning escapements, have increased restrictions on many segments of the fishing community.

It is the purpose of this document to give the reader a basic understanding of the history and development of Klamath River fall chinook management and allocation policies. It includes the background of the various fisheries, the legal background and basis of Klamath River Tribal fishing rights, and the background and current principles of Harvest Rate Management.

Due to space constraints, this document purposefully understates, the long and arduous process that representatives of the management agencies and segments of the fishing community have gone through to reach today's level of management. If a dedication were to be included in this type of document, it would be to all those who participated in the first Klamath River Harvest Sharing Agreement that were represented by:

Nat Bingham	***California Commercial Fishermen***
Virgina Bostwick	***In-river Sport Fishery***
Bob Hayden	***California Ocean Recreation***
Robert Fletcher	***California Dept. of Fish and Game***
James Martin	***Oregon Dept. of Fish and Wildlife***
Susan Masten	***Yurok Tribe***
Clifford Lyle Marshall	***Hoopa Tribal Council***
Richard Schwartz	***Pacific Fishery Management Council***
J. Gary Smith	***National Marine Fishery Service***
Keith Wilkinson	***Oregon Commercial Fishermen***
J. Lisle Reed	***U.S. Department of the Interior***

Who to Contact

PFMC / Admin. Salmon Issues (Mailing List)	Dr. John Coon (503) 326-6352	Pacific Fishery Management Council 2130 SW Fifth Ave. Suite 224 Portland Oregon, 97201
KFMC Administration (Mailing List)	Dr. Ron Iverson (530) 842-5763	United States Fish and Wildlife KRFRO P.O. Box 1006 Yreka, California 96097
KFMC / Calif. Commercial Salmon Fishing	Mr. Dave Bitts (707) 443-0537	1485 Virginia Avenue Arcata, California 95501
KFMC / River Recreational Fishing	Ms.Virginia Bostwick (707) 465-5535	4101 Highway 101 N. Crescent City, California 95531
KFMC / Yurok Tribe	Mr. Troy Fletcher (707) 482-2841	Yurok Fisheries Program 15900 Hwy 101 North Klamath, California 95548
KFMC / Hoopa Valley Tribe	Mr. Pliney McCovey (530) 625-4211	P.O. Box 1348 Hoopa, California 95546
KFMC / NMFS	Mr. Rod Mc Innis (562) 980-4005	National Marine Fisheries Service 501 W. Ocean Blvd, Suite 4200 Long Beach, California 90802-4213
KFMC/ Oregon Ocean Fisheries	Mr. Keith Wilkinson (541) 572-2911	1112 Spruce Street Myrtle Point, Oregon 97458
KFMC/ Oregon Dept. Fish and Wildlife	Dr. Don Mc Isaac (503) 872-5252	Oregon Department of Fish and Wildlife P.O. Box 59 Portland, Oregon 97207
KFMC/ Calif. Dept. of Fish and Game	Mr. L B Boydstun (916) 653-6281	California Department of Fish and Game 1416 Ninth Street Sacramento, California 95814
KFMC/USFWS Ecological Services	Ms. Cynthia Barry ((503) 231-6151	United States Fish and Wildlife Service 911 N. E. 11th Avenue Portland, Oregon 97232-4181
KFMC/ Calif. Ocean Recreation	Mr. Paul Kirk (707) 677-0840	P.O. Box 849 Trinidad, California 95570
KFMC / PFMC	Mr. Nat Bingham (707) 937-4145	P.O. Box 783 Mendocino, California 95460

An Historical Perspective

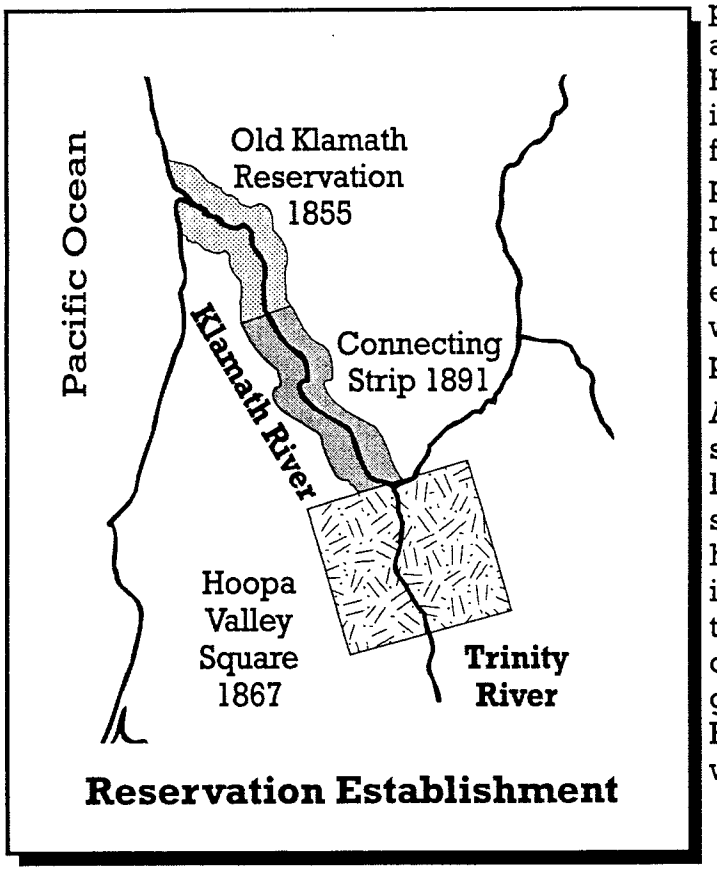
Klamath River Tribal Fishing

Aboriginal Fishing

The Native People of the Klamath River Basin have depended on the salmon of the River since time immemorial. The awesome cyclical nature of the salmon's yearly migrations over the centuries influenced almost every aspect of their lives. Religion, lore, law, and technology all evolved from the Indians' relationship with the salmon and other fish of the Basin. The Supreme Court recognized the importance of salmon to Northwest Tribes such as these, when it concluded that access to the fisheries was "not much less necessary to the existence of the Indians than the air they breathed."

Such dependence on salmon required conservation measures to assure the productivity of the resource. Traditional fishing methods for salmon included the use of gill nets and dip nets made from Iris leaf fiber, spear fishing, and communal fish dams. Traditional fishing sites were, and to a great extent still are, considered privately owned. The right to fish at a particular site was transferable and governed by complex rules and laws. To ensure adequate subsistence for all, communal fish dams were temporarily built at selected sites. Possibly the most advanced accomplishment of California Indians was the annual construction of the fish dam at Kepel. Several hundred people were involved in the construction, using log frames and a latticework of slats and poles to temporarily impede upstream migration. Every aspect of its construction and use were highly ritualized to ensure that the subsistence needs of all would be met and the salmon runs perpetuated.

Figure 1



Reservation Establishment

Aboriginal fishing people faced the same basic fishery management problems of today: how to cope with natural salmon population fluctuations, and how to control harvest while maintaining a viable economy. As evidence of their success, after thousands of years of harvest, when the first major immigration of non-Indians arrived at the Klamath in 1850 the River was "alive with the finny tribe."

The Indian people of the Basin signed treaties with the Government in 1852, but due to public pressure the treaties were never ratified. Instead, the lower 20 miles of the River was set aside by Executive Order as the Klamath Indian Reservation in 1855. The administration of the Reservation was severely disrupted five years later by the flood of 1860-61.

First Indian Commercial Fisheries

After the flood, due to local perception that the Reservation had been abandoned, Messrs. Richardson and Jones, two early settlers of Crescent City, started the first commercial fishery on the Klamath in 1876. They were evicted as trespassers from the Klamath Reservation by orders of the Federal Government in 1879. Amid a flurry of politics and confusion over the status of the Reservation, R. D. Hume of Oregon successfully challenged the ban on non-Indian fishing in the River. In a case known as "Forty-Eight Pounds of Rising Star Tea, Etc." The judge found, that although the land was still the property of the Federal Government, the Reservation had been abandoned after the flood. This decision, in 1888, allowed the unimpeded development of commercial fisheries on the Klamath, and led to a misinterpretation of the jurisdictional status of the Reservation and its fisheries that lasted for almost a century.

The commercial fishing operations, while owned by non-Indians, primarily employed the resident Yurok people as fishermen and cannery workers. In the early years, the remoteness of the location and attendant transportation problems kept the commercial efforts from expanding, but the fishery continued to provide a beneficial income for the People until the early 1930s.

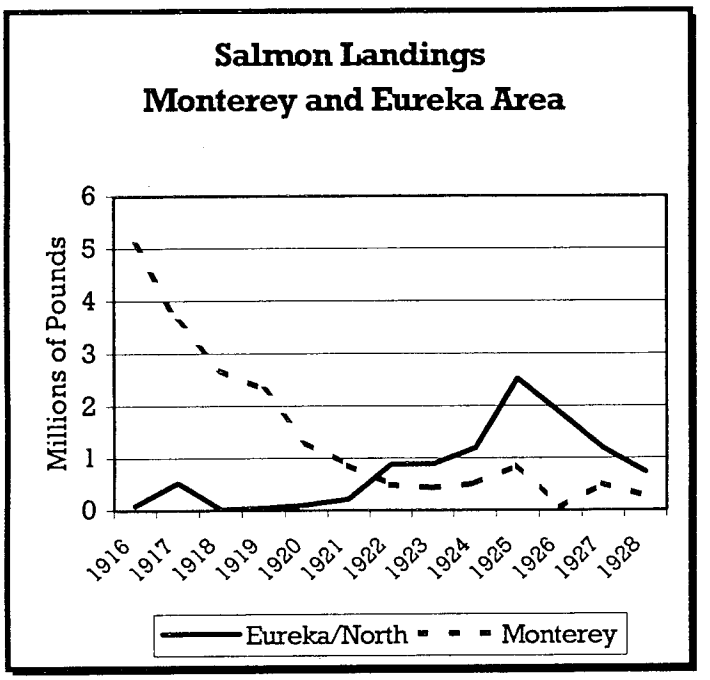
On January 1, 1934, primarily due to political efforts of the recreational fishing community, all commercial fishing on the River, and the use of Indian gill nets on the lower twenty miles for subsistence fishing, was banned by the State of California. Tribal commercial fishing rights were not to be reaffirmed until the late 1970s.

Ocean Fisheries

Early Ocean Fisheries

Salmon fishing by non-Indians in California started in the early 1850s, coincidental with the massive inflow of miners into the "gold country". By the 1860s commercial fisheries were well established on the Sacramento system, and on the Eel River in Humboldt County. It was not until the early 1900s, with the proliferation of internal combustion engines, that serious salmon fishing started in open water. The ocean salmon troll fishery began in earnest in Monterey Bay; by 1910 there were 200 boats fishing out of that port (McEvoy, 1986).

The terminal fisheries in the rivers gradually gave way to the ocean fisheries in importance; by 1915 ocean harvests exceeded California terminal harvests, and the last cannery on the Sacramento closed in 1919. By 1923 the ocean troll fleet had expanded its fishing grounds north from Monterey to Crescent City (Figure 2).



Source: Snyder, 1931

Figure 2

The fishery remained somewhat static until the mid-1940s when, with the end of the War, improved transportation, and a rebound in the salmon populations there was a dramatic expansion of effort. In 1935 the salmon fleet had consisted of 570 trollers, by 1947 that number had increased to 1,100 (McEvoy).

The ocean troll fisheries operated basically without restrictions through 1948. In 1947 the Pacific Marine Fisheries Commission (PMFC, not to be confused with PFMC) was formed by the Western States to: "promote the better utilization of fisheries...which are of mutual concern,...and to develop a joint program of protection and prevention of physical waste of such fisheries..."(Article I). This Compact led to more coordinated seasons and size limit considerations for the ocean troll fleet. The season for salmon fishing in the ocean was generally open from May 1st of each year through September 30th. The salmon fishery flourished, and in the years between 1947 and 1970, "some one-half million to one million Chinook salmon" were landed annually off California (Bearss, 1983).

Under the management regime of a new Pacific Fishery Management Council created in 1976, open fishing seasons began to change. Beginning in 1979, in the area known as the Klamath Management Zone (KMZ) off Northern California and Southern Oregon, seasons have become increasingly restrictive in order to reduce impacts on Klamath River origin Chinook salmon. Commercial troll fishing in the KMZ, (from Point Delgada, north of Fort Bragg, to Cape Blanco near Port Orford) was completely prohibited in 1985. Subsequent commercial seasons in the KMZ have been extremely limited, and only allowed under limited quotas.

Ocean Recreational Fisheries

In1860 the *Humboldt Times* gave its first report on "Party Boat" fishing, but offshore sport fishing did not expand until the 1950s with the advent of modern glass, metal, and plastic boats. Of the total chinook harvest in California, the ocean sport harvest went from less than one percent in 1947 to 22 percent in 1953. In the KMZ recreational fisheries have been increasingly restricted since 1989 for protection of Klamath chinook and Oregon coastal natural coho stocks. The higher contribution rate of Klamath chinook in catches in the KMZ have led to strict harvest regulations in the Northern California and Southern Oregon area resulting in severe economic impacts to those communities.

In-River Recreational Fisheries

Zane Grey Visits the Klamath

Recreational fishing on the Klamath River depended on access. In the summer of 1894 the first through road from Eureka to Crescent City, using a ferry at the Klamath, was completed. With the advent of the automobile the area was ready for tourists. By the end of 1923 the new Redwood Highway, still bridge-less, was complete. The new highway included among its travelers the author Zane Grey, who stopped at the Klamath, and was fortunate enough to land a 57-pound salmon on light tackle. Grey reported in a January 1924 article in Outdoor America, that it was "the most thrilling and fascinating place that I have ever seen."

In the mid-1920s several small canneries opened to cater to the hundreds of sportsmen lining the banks and trolling the waters of the estuary. A fisherman's catch could be canned, including personalized labels, and saved for future use. The Bridge across the Klamath was finally completed in 1926, and in 1936 the California Chamber of Commerce reported that "some 30,000 families vacationed that year in the Klamath-Trinity Basin, where they were served by eighteen private resorts and campgrounds, and another five operated by the U.S. Forest Service." (McEvoy)

In the mid-1950s recreational fishing in the Klamath had only increased in popularity; anglers in 1956 landed 15,000 fish in the estuary alone. In 1955 - 56 from 1,200 up to 3,200 salmon per day were landed by sportsmen in the estuary. Then, intensive logging that was initiated in the 1950s, and the construction of dams and diversions on the system in the early 1960s, began to have serious impacts on the salmon populations. By the late 1970s the number of adult Chinook taken by hook and line in the estuary dropped to a low of only five to eight hundred fish per season(Bearss). Since 1986, the river recreational fishery has been regulated by a quota system based on predicted populations.

Photo by Ary-Ray Co. courtesy Peter Palmquist

Figure 3. Sport fishing at the mouth of the Klamath, ca: 1955

Principles of Tribal Fishing Rights

Doctrine of Reserved Rights

People often mistakenly consider that "Indian Rights" are special rights that have been granted to Indian people by the United States Government. The fact is that these rights, such as Tribal fishing rights and the right to self-governance, are rights that the Indian People as sovereign nations had prior to conquest, and they retained these "Reserved Rights" when they gave up their land by Treaty or Agreement.

The United States Constitution in Article VI, Section 2 states:

> ***"...and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, any Thing in the Constitution or Laws of any State to the contrary notwithstanding."***

In what is now Washington State, in the mid-1850s, the Government negotiated treaties with the Tribes. "The principle purposes of the treaties were to extinguish Indian claims to the land and to allow a peaceful transition to occur between Indians and non-Indians in the area." The language reflected in most of these treaties with regard to the issue of Indian fishing rights stated in part:

> ***The right of taking fish, at all the usual and accustomed grounds and stations, is further secured to said Indians in common with the citizens of the territory..." (Treaty of Medicine Creek, Art. 3, 10 Stat. 1132 (1855).***

Basics of Treaty Interpretation

Under the treaties, Tribes of the west gave up millions of acres of land in exchange for small reservations set aside for their exclusive use. While they gave up their land, they reserved their right to fish. "The treaties were 'not a grant of rights to the Indians, but a grant of rights from them, a reservation of those not granted.' United States v. Winans, 198 U.S. 371 (1905)." (Madson and Koss, 1988)

It is the language "in common with" that led to Court decisions in the late 1970s which reaffirmed that the Treaty Tribes were entitled to fifty percent of the harvest.

In 1871 the Government stopped signing Treaties, and moved to a process using formal Agreements. The only real difference was that while Treaties only had to be approved by the Senate, Agreements needed to be ratified by both houses of Congress. In addition, Reservations, such as the Hoopa Valley and Yurok Reservations, could also be created under statutory authority by Executive Order of the President. The Reservations in the Klamath Basin were created pursuant to a statute of March 3, 1853 authorizing the President to create Indian reservations in California "for Indian purposes".

The words "for Indian purposes" are important here, for as the Department of Interiors' Solicitor explained in 1993:

A specific, primary purpose for establishing the reservations was to secure to the Indians the access and right to fish without interference from others....the Indians' reserved fishing rights were of no less weight because they were created by executive orders pursuant to statutory authority rather than by treaty. Courts have uniformly rejected a 'treaty vs. non-treaty' distinction as a basis for treating Hoopa and Yurok fishing rights differently from the treaty-reserved fishing rights of tribes in other areas of the United States.

Review of Klamath Fishing Rights Legal History

The flood of 1861, which left the Klamath Reservation decimated, led to the Forty-Eight Pounds of Rising Star Tea case, which found that the Reservation had been abandoned. This event, followed by the allotment of Reservation lands to non-Indians, led the State of California to assume it had jurisdiction over all fishing on the lower Klamath River. The State strictly controlled Indian fishing in that area, and in closing the in-river commercial fishery in 1934 banned the use of gill nets in the lower 20 miles of the River even for the Indians' subsistence fishing.

Reservation Status Confirmed

The State's jurisdiction over Indian fishing was not challenged until 1969. In September of that year, Raymond Mattz, a Yurok fisherman, had his gill nets confiscated by the State from the banks of the lower River. Mattz contended that he was an enrolled member of the Yurok Tribe, fishing in "Indian Country", and that State law did not apply. He lost his case in two lower courts, but the Supreme Court in Mattz v. Arnett reversed the lower courts' decisions and found in 1972, that the 1892 Act opening the Reservation to allotment and non-Indian settlement had not terminated the Reservation. The land within the Reservation boundaries was still "Indian Country." Based on that decision the First District Court of Appeals, in Arnett v. 5 Gill Nets (1975) found that the right of an Indian to fish on reservation was created by presidential executive order which was derived from a statute and thus not subject to state regulation;..."

Subsequently, the Bureau of Indian Affairs (BIA) took over management of the Indian fishery, and under regulations issued in 1977 reopened the lower 20 miles of the River to Indian gill net fishing for subsistence and commercial harvest. Due to public pressure the BIA closed the fishery, for "conservation" purposes, in 1978. The closure, protested by the Indians, was effected by a heavily armed "strike force" of 35 Federal Special Agents supplemented by U.S. Park Service and BIA officers. The Conservation Moratorium on Indian commercial harvest remained in effect until 1987.

Federal Jurisdiction Confirmed

During the Moratorium in September of 1980, Walter McCovey, Jr., a Yurok fisherman, was charged with a felony violation of the California Fish and Game code; Mr. McCovey had been intercepted in San Jose while attempting to sell salmon he had gill net harvested on the Reservation. Once again, the court found that the State lacked jurisdiction

and held that the comprehensive federal regulation of Indian fishing rights preempted the State from criminally prosecuting Yurok fishers for the commercial sale of salmon harvested on the Reservation. (People v. McCovey, 36 Cal. 3d 517, 1984)

In 1987, with an allocation of approximately 30 percent of the allowable harvest under a Five Year Agreement with a newly established Klamath Fishery Management Council (KFMC), and with the completion of the Environmental Impact Statement on commercial fishing, the BIA opened the first uncontested commercial fishery in 54 years. Stock abundance predictions allowed for Indian commercial harvest in 1987, 1988, and 1989.

The Five Year Agreement instituted by the KFMC ended after 1991, and due to depressed salmon populations and predictable harsh closures on all fisheries, a new allocation agreement could not be reached.

Through the fall of 1993, according to the Department of the Interior, the PFMC ocean harvest regulations had failed to meet conservation requirements and was adversely affecting the Tribes' reservation fisheries. The Secretary of Commerce and the Secretary of the Interior met to coordinate regulations for the 1993 harvest and concurred that the Tribes were entitled to a 50 percent share of the available harvest. During the 1993 season setting process the PFMC recommended ocean harvests that would fail to meet the resource rights of the Tribes. The Secretary of Commerce suspended the PFMC's regulations, and under emergency regulations set a lower allowable harvest for ocean fisheries and allowed for a higher predicted in-river run and spawning escapement. Interior adjusted the Tribal allocation to near fifty percent.

In October of 1993, the Department of the Interior's Solicitor issued a Memorandum (M-36979) concluding that:

> "***...when the United States set aside what are today the Hoopa Valley and Yurok Reservations, it reserved for the Indians of the reservations a federally protected right to the fishery resource sufficient to support a moderate standard of living or 50% of the harvest of Klamath-Trinity basin salmon, whichever is less.***"

Parravano v. Babbitt

Ocean commercial fishermen charged that the Secretaries of Commerce and Interior had violated the Magnuson Fishery Management and Conservation Act by reducing the allowable ocean harvest rate for 1993. The U.S. 9th Circuit Court of Appeals, in 1995, disagreed; finding that under the Magnuson Act, Commerce may issue regulations affecting coastal fishing to protect against violations of "other applicable law." The Court concluded that the Secretary of Commerce "is a trustee of tribal interests as well as the administrator of the Magnuson Act; (and that he) properly considered the Tribes' fishing rights (as other applicable law) in issuing emergency regulations reducing ocean harvest limits of Klamath chinook."

The Harvest Managers

Salmon know no jurisdictional or political boundaries. They are hatched in rivers and tributaries, then emigrate downstream to the ocean, and spend the majority of their life freely feeding and growing in vast areas of the open ocean. Upon reaching adulthood, generally three or four years of age, they return to the river of origin and migrate upstream to spawn and die. During the course of their life they are subject to harvest by fishermen who are regulated by a variety of agencies, all of which must be carefully coordinated to prevent over harvest in any one area.

Ocean Fisheries

The Pacific Fishery Management Council

The Pacific Fishery Management Council (PFMC) and seven other regional councils were created by the Magnuson Fishery Conservation and Management Act of 1976 with the primary role of developing, monitoring and revising management plans for fisheries conducted within the 3-200 mile limit of the U.S. coast.

The PFMC develops plans for ocean fisheries off California, Oregon, and Washington. The Council is not a federal agency, but is a regional body funded through the Department of Commerce. It has fourteen voting members, including the Regional Director of the National Marine Fisheries Service, chief fishery officials of Oregon, Washington, California and Idaho, eight knowledgeable private citizens chosen by the Secretary of Commerce from lists submitted by each state governor, and since 1997, one Tribal seat. Non-voting members include the Director of the Pacific States Marine Fisheries Commission, the Regional Director of the U.S. Fish and Wildlife Service, and one representative each from the Alaska Governor's office, the U.S. Department of State, and the Pacific Area Commander of the U.S. Coast Guard. (From PFMC "Form and Function", 1988)

The PFMC has a professional staff headquartered in Portland, Oregon; a Scientific and Statistical Committee (SSC); and three separate Technical Teams including a Salmon Technical Team, and several citizens' advisory panels including a Salmon Advisory Sub-panel (SAS). (See Process Flow Chart, page 17)

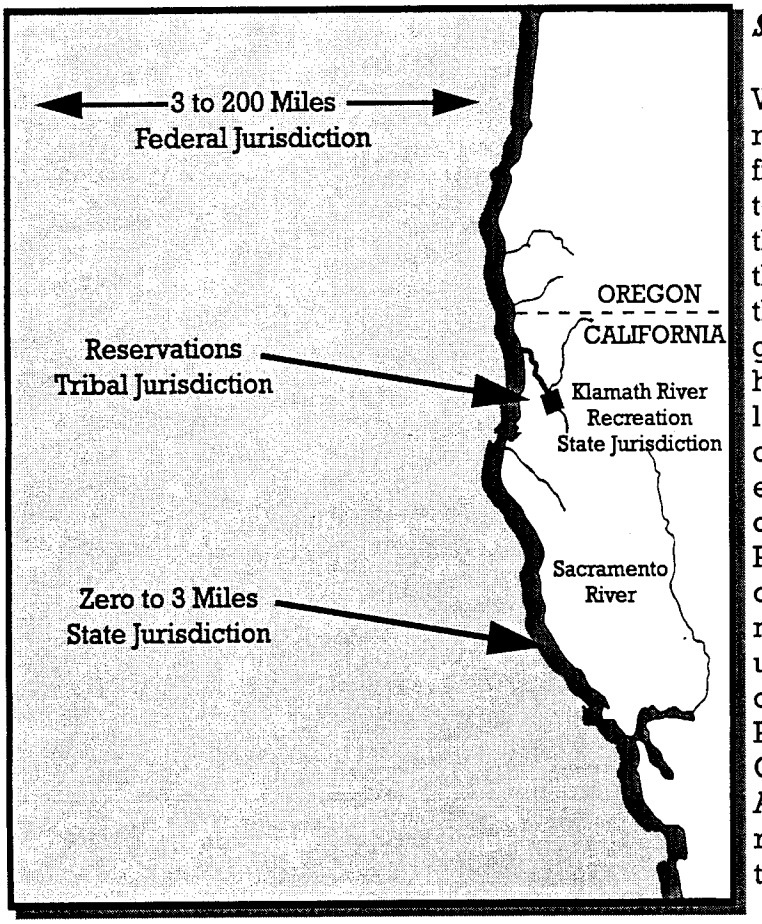
When the PFMC was formed in 1976, it recognized that the salmon resources off the Pacific Coast required immediate attention because of conservation and allocation problems. Consequently, the first fishery management plan (FMP) prepared by the Council dealt with commercial and recreational fisheries for Chinook and Coho salmon. Federal and complementary State regulations implemented that plan in 1977.

The PFMC now has a basic "Framework Plan for Managing the Ocean Salmon Fisheries off the Coasts of Washington, Oregon and California". Certain principles of the Plan are fixed, such as a river's spawning escapement goal, in order to provide a long-term management system that cannot be altered without a plan amendment.

Other elements are flexible, such as season regulations, and are determined before each season according to fixed guidelines and time frames contained in the Framework Plan.

Under the Framework Plan, the coast from the U.S. Canadian border to the U.S. Mexican border, is divided into four major geographic areas for management of chinook salmon stocks. The principal chinook stocks in these areas are: Central Valley, Klamath River, Northern California Coastal Stocks, Oregon Coastal stocks, and Colombia River and Washington Coastal stocks. Coho salmon management objectives in the plan regulate harvest of the California, Oregon, and Washington Coastal Stocks, and Columbia River and Puget Sound stocks.

Figure 4



State Management of Ocean Fisheries

While the Federal Government has regulatory jurisdiction over salmon fishing regulations from three miles to two hundred miles off the coast, the jurisdiction over the area from the shore to three miles out falls with the States. Thus, the States of Oregon, Washington and California have primary jurisdiction for regulations concerning near shore ocean commercial and recreational fisheries, but generally manage based on harvest levels stipulated by the PFMC. The California Department of Fish and Game confirms their annual ocean commercial fishing regulations in April of each year subsequent to recommendations from the PFMC. The California Fish and Game Commission also meets in April to establish proposed ocean recreational fishing regulations for the season.

River Fisheries

From 1934 until 1977 the State had prohibited all Indian gill net fishing on the lower 20 miles of the River. State regulation of the Indian fisheries ended in 1977 after two court cases, Mattz v. Arnett and Arnett v. 5 Gill Nets. These two cases determined: first, that the old Klamath Indian Reservation had not been abandoned and that it was still "Indian Country", and as a consequence, that the State of California did not have the jurisdiction to regulate Indian fishing on the Klamath.

Tribal Management

Regulation of Indian fisheries on the Hoopa Valley Reservation, which at that time included what is now the Yurok Reservation, was taken over by the Bureau of Indian Affairs in 1977. Through a 1978 Memorandum of Understanding between the Assistant Secretaries of Indian Affairs and Fish, Wildlife and Parks, the U.S. Fish and Wildlife Service (USFWS) provided yearly evaluations of the salmon runs into the River and monitored the Indian net harvest.

Hoopa Valley Tribe took over monitoring programs for their Tribal fisheries on the Trinity River portion of the Reservation in 1983. On the lower 43 miles of the Klamath River the USFWS continued monitoring the Yurok fishery until 1994 when the newly authorized Yurok Tribal Council, through their Fisheries Program, took over management of their fisheries on the Yurok Reservation.

Both Tribes now have full management authority over regulation of their fisheries. Harvest levels are set according to run predictions and allocation limits and regulations for quotas, closures, and gear are developed annually by the Tribes.

River Recreational Fisheries Management

The State of California, through the California Fish and Game Commission, retains full regulatory authority over the Klamath River recreational fishery. The Commission now convenes in early March of each year for a policy decision on the upcoming season's in-river recreational allocation. The expected harvest allocation is then forwarded to the KFMC and the PFMC for their consideration in setting ocean seasons.

Cooperative Management

Klamath Fishery Management Council

Due to an unprecedented closure of ocean fisheries in 1985, a Klamath River Salmon Management Group (KRSMG) was formed under the PFMC to discuss Klamath River Fall Chinook issues. This Group set its own precedent by bringing together, for the first time, Federal, State, Tribal, and commercial and recreational fishing representatives for the negotiation of management and allocation issues. After arduous negotiations they arrived at consensus recommendations to the PFMC for a new method of managing harvest to meet the River's spawning escapement goal, and an Agreement on how to divide the predicted harvestable salmon in 1986. It was this group which initiated Harvest Rate Management for the Klamath River fall chinook, and the first formal allocation of a portion of the harvest to Tribal fisheries.

Congress adopted the Klamath Basin Restoration Act (PL 99-552), in October, 1986. The Act created a new 11 member Klamath Fishery Management Council (KFMC) to supersede the original Management Group. The KFMC's advisory function is to make harvest management recommendations to the various management agencies including the PFMC. All recommendations passed forward to agencies or to the PFMC must be with the consensus of all members.

Typical Schedule for

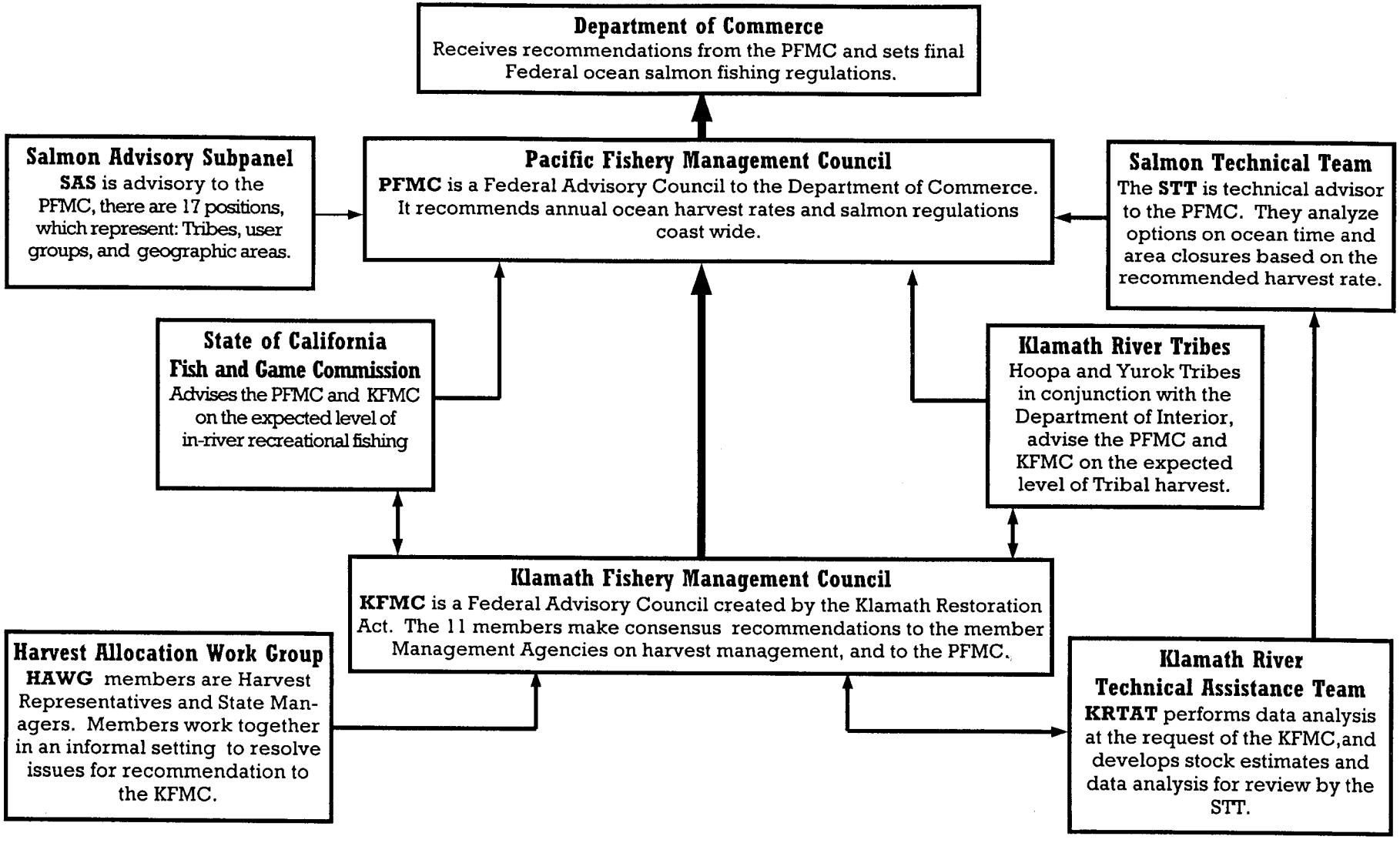
Developing Ocean Management Measures

January Third Week	The Salmon Technical Team (STT) and the PFMC's Economist draft the review of the previous season summarizing harvests, quotas, escapements, and socio-economic data. The review is available to the public in early March.
February Third Week	STT prepares the *Preseason Report I Stock Abundance Analysis* which provides information on the stock status of the upcoming year. To aid in developing options for regulations, it includes an analysis on what impact the previous year's regulations would have on the current year's salmon populations. The report is available in early March.
Late Feb.- Early March	State Agencies, Tribes, and fishers review the preseason stock abundance and meet with constituents. **The KFMC meets*** to develop option recommendations on Klamath Salmon harvest for consideration by the PFMC.
March Second Week	**PFMC and Salmon Advisory Subpanel (SAS) meet*** for four days to adopt regulatory options for public review. This meeting is usually in Portland or San Francisco.
March Third Week	PFMC mails a brief notice of options and hearing schedules to the public.
Late March- Early April	PFMC conducts **Public Hearings*** on the options for ocean harvest. These hearings are held in major ports of landing (Westport, Coos Bay, Tillimook, Eureka, Sacramento, and Portland).
Late March	PFMC distributes *Preseason Report II Analysis* of the Options which includes socio-economic impacts of the proposed options.
Early April	**KFMC meets*** prior to the next PFMC meeting to attempt to reach consensus on final recommendations to the PFMC.
April Second Week	**PFMC and SAS meet*** for four days to adopt final regulatory measures. This meeting is held in Portland or San Francisco.
April Third Week	The STT completes the *Preseason Report III Analysis of the Adopted Regulatory Measures.*
May First	National Marine Fisheries Service implements ocean fishing regulations which are published in the Federal Register.
May - July	Tribes hold community meetings for Tribal Member input on recommendations for Fall Chinook season regulations.

*** Provides opportunity for public comment**

Note: All meeting dates are approximate and may vary. Get placed on mailing lists for accurate and timely information.

OCEAN SALMON MANAGEMENT AND THE FEDERAL REGULATORY PROCESS



Harvest Rate Management

Protecting Natural Stocks

Salmon Life History

Salmon harvest management in general is difficult due to the life cycle and migratory habits of the species. Chinook salmon are an anadromous fish, that is they spawn in the fresh waters of the River, emigrate to the ocean in their first year, grow to maturity in the ocean, and return to their home river to spawn and die. Fall chinook generally reach sexual maturity at three or four, and sometimes five years of age. There are some precocious individuals, generally males, who mature at age two and participate in the spawning migration. These young males are called "Jacks" and are not accounted in the spawning escapement or allocations. During their residence time in the ocean, salmon are subject to harvest by commercial and recreational fisheries, and upon returning to the River at maturity they are harvested by in-river recreational and Tribal fisheries.

Natural Stock Policy

The Klamath River, as with other managed rivers, has populations of both natural spawning and hatchery reared salmon. To protect the long-term genetic integrity of the fall chinook salmon, it is the natural component of the stock towards which conservation management is directed. One of the primary fishery management objectives of the PFMC's Framework Plan is to allow "Escapements of viable natural spawning of salmon...sufficient to maintain or restore the production of such stocks at optimum levels."

Harvest Rate Management

Maximum Sustainable Yield

The ultimate goal of harvest management is to allow a defined number, or percentage, of a salmon population to escape harvest, and return to the river to spawn, in numbers sufficient to assure the future reproductive capacity of the species while allowing for future harvest. This management concept, which is termed "Maximum Sustainable Yield" (MSY), evolved through the need to protect fish populations from over harvest. Technically, MSY is defined as "An average (yield) over a reasonable length of time of the largest catch that can be taken continuously from a stock without reducing its long-term reproductive potential."

Ideally, under the concept of MSY, one would know how many spawning fish a river system could support (the carrying capacity), the reproductive potential of the species, and the survival rate of the off-spring. Then one could simply calculate how many spawners were required (the spawning escapement), and what portion of the population could be harvested. The real biological and political world is not that simple.

In the early management of the Klamath River, based on data of past escapements, the PFMC set a goal for the number of adult fish escaping from the ocean to the River mouth to be 115,000 adult fall chinook.

This figure included both Trinity and Klamath stocks and hatchery and natural fish. This "ocean escapement" goal policy, rather than a "spawning escapement" goal, was put in place because of the separate jurisdictional areas. The PFMC, under the Department of Commerce, regulated the ocean fisheries, but the Department of the Interior regulated the in-river Tribal fisheries. As a result, the final responsibility for the spawning escapement was left with Interior and the State of California who regulated the in-river recreational fishery.

In addition to the disjointed management jurisdictions, there was a problem with determining the proper spawning escapement goal for the system. Having a fixed escapement goal is fine, if you know the carrying capacity of the system. In the case of the Klamath, however, there had been radical changes since the 1960's. Dams had blocked many stream miles previously available for spawning, and diminished flows and poor land management led to degraded spawning and rearing habitat. The carrying capacity of the system was not defined.

Fixed Goal versus Harvest Rate Management

In 1987, based on recommendations of the KFMC, the PFMC changed the spawning escapement goal for the Klamath Basin. Instead of having a fixed numerical ocean escapement goal they adopted a policy of "Harvest Rate Management." Under Harvest Rate Management, whether the overall stock populations are high or low, the management goal is to allow a fixed percentage of all salmon from each brood year to spawn. This management method provides two advantages. First, it allows the spawning escapement to fluctuate; in high population years the escapement would be larger than if the stock was fished down to a fixed numerical escapement, and in low years fisheries would not be closed to meet an escapement that was not attainable. Second, having the wide range of escapements allowed under Harvest Rate Management may allow the eventual determination of the carrying capacity of the system. To protect the stock in years of very low abundance, an escapement "Floor" of 35,000 natural spawners was put in place.

Equally important is the fact that the KFMC process committed all management agencies to the Harvest Rate Management policy, so all Federal, State, and Tribal agencies are managing to achieve the same stated overall harvest rate and escapement goals.

Management of ocean salmon fisheries is complex. When fishing in the ocean, a fisherman's catch can include any one of the from two to five year old age class fish, and it will also include salmon from other river systems. All of these components have different levels of vulnerability to the fishermen's efforts depending on size limits, age class strengths, relative population abundance, and seasonally fluctuating patterns of distribution throughout the fishing grounds. All of these parameters must be taken into account when designing regulations.

Escapement Rate Goals

Under Harvest Rate Management the ocean and river fisheries are managed to meet harvest rate combinations (total percent of harvest) that will allow approximately 33 percent of the potential natural adults from a given brood year to escape all fisheries and spawn.

To allow for the proper percentage of mature Klamath salmon to escape all ocean fisheries, and to allow the Tribes the opportunity to have 50 percent of the harvest, it has been calculated that each year ocean fisheries should restrict their take to approximately 20 percent of the four year old age class. Of course, ocean fisheries while harvesting at that .20 harvest rate in a "mixed stock fishery" will also catch two, three, and five year old Klamath salmon, and salmon from other systems. But, the .20 harvest rate on "fully vulnerable" four-year-olds, over the long term, is the current management goal.

In the River, Tribal and recreational fisheries only harvest mature Klamath salmon that have returned to the River to spawn. The only "mix" of the fish to be considered is whether they are hatchery or natural, other stocks and maturity factors do not confound the accounting. For harvest rate management purposes Trinity and Klamath salmon are all considered Klamath stocks, and the desired long-term harvest rate is .66 on the four-year-old component.

These combined harvest rates on mature fish, .20 for ocean fisheries and .66 for river fisheries, which over the long term will allow for the 33 percent escapement rate and 50/50 sharing, are termed "full fishing." They can only be applied when the resultant escapement of natural spawning fish is calculated to be greater than 35,000. If those combined "full" harvest rates result in an escapement of less than the 35,000 floor, then they have to be modified downward to protect the escapement floor, and ocean and river fisheries are restricted accordingly.

Allocation Calculations

Harvest Rate Model

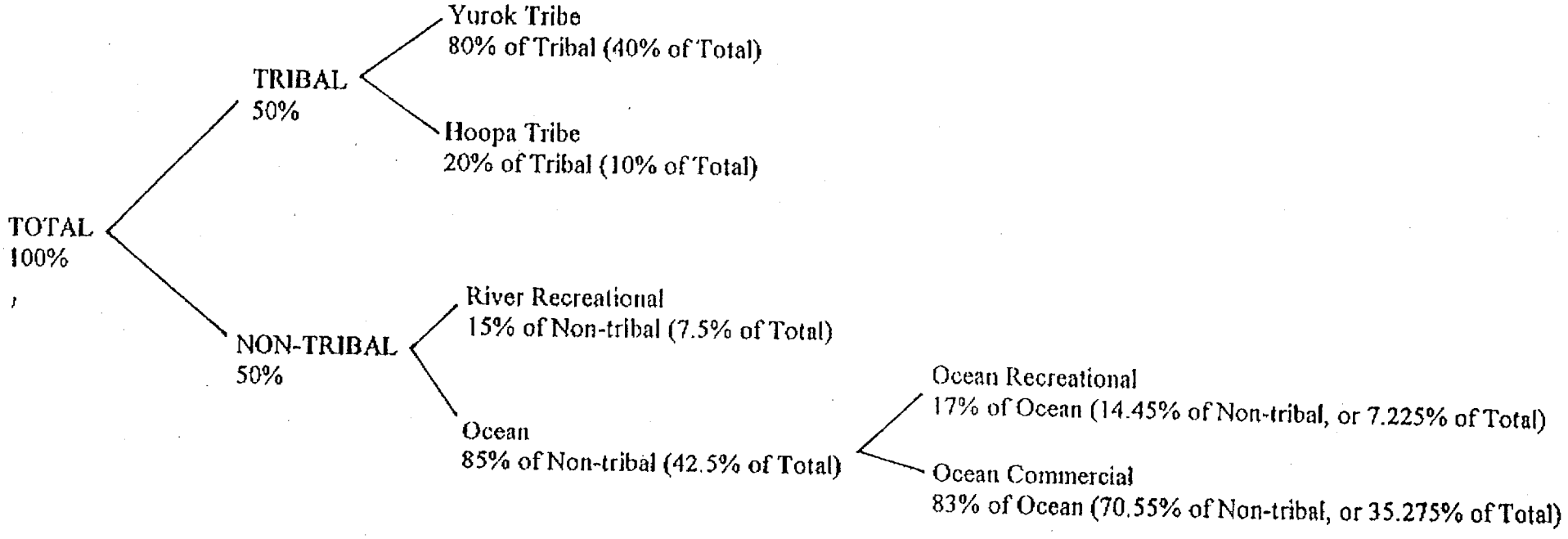
The spawning escapement is the driving factor in Klamath fall chinook management. Each year the long-term allowable combined harvest rates are mathematically applied to the predicted pre-season ocean stock abundance using a "Harvest Rate Model" (HRM). The HRM then calculates what the spawning escapements would be under full fishing harvest rates. If the resultant natural spawning escapement number is above 35,000, it is fixed as the goal for that year. The HRM can then be used to determine the numeric value of each fishery's allocation of the harvestable surplus. The first division is between Tribal and non-tribal fisheries; each are allocated fifty percent of the available harvest. Then, based on prior negotiations, the in-river recreational allowable harvest is set as a percentage of the total non-tribal allocation. The end calculation results in a slight modification of the base harvest rates. During the annual PFMC regulation process, the revised allowable ocean harvest rate is then applied to a Klamath Ocean Harvest Model (KOHM) to design season options of various time and area closures, which will meet the allowable harvest rate on age four fish within the total number of Klamath salmon allocated for ocean harvest (see Appendix II). The options must also consider the division of the ocean allocation between Oregon and California commercial trollers and ocean recreational fisheries. For details of the HRM see Appendix I.

CORRECTION

In Table 1 on page 21, the percentages shown as allocated to the ocean recreational and ocean commercial fisheries are incorrect. The table should appear as shown below:

Tribal Share 50% of Total	Non-Tribal Share 50% of Total
Yurok Tribe 80%	Ocean Commercial 70.55%
Hoopa Tribe 20%	Ocean Recreational 14.45%
	River Recreational 15%

The pre-season 1997 allocation of Klamath salmon is shown in more detail in the diagram below:



Tribal Process

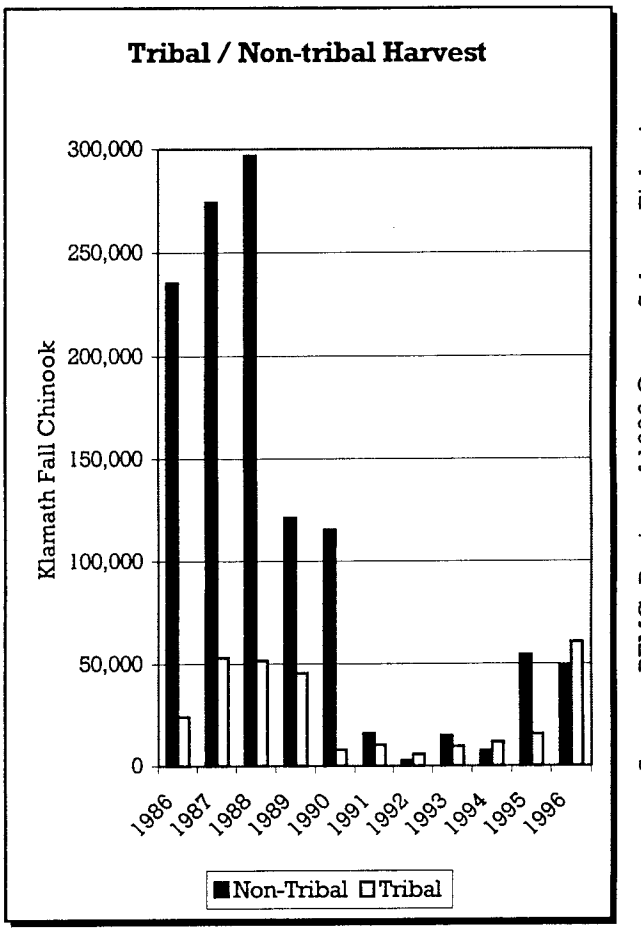
After confirmation of their total allowable harvest, the Tribes hold community meetings fort their Member input on regulations for the time and area closures required to adhere to harvest quotas. The Tribal Councils also make the determination as to whether there is sufficient harvest opportunity to consider Tribal commercial fisheries, or whether fishing should be limited to subsistence harvest.

Table1. below shows how fish were allocated pre-season in 1997.

Figure 5 shows the post season distribution of Tribal and non-tribal harvests.

Tribal Share 50% of Total	*Non-Tribal Share 50% of Total*
Yurok Tribe 80%	*Ocean Commercial 68%*
Hoopa Tribe 20%	*Ocean Recreational 17%*
	River Recreational 15%

Table 1



Source: PFMC, Review of 1996 Ocean Salmon Fisheries

Figure 5

Monitoring Harvest and Escapement

Ocean Harvest Estimates

Between 10 to 20 percent of the juvenile fish reared in hatcheries have microscopic size "Coded Wire Tags" (CWT) implanted in their snout prior to being released. They also have the small fatty adipose fin from their back clipped off, denoting them as CWT fish. When these marked fish are harvested, or return to the hatcheries as adults, the CWT's are extracted and decoded. The tags provide information on where they were reared and released, when they were released, what size they were, and how many were in the release group. Based on calculated ratios between the number of marked hatchery fish and unmarked and natural fish, biologists can then determine the contribution of a stock of fish to the total harvest and estimate overall harvest impacts on specific stocks.

During the fishing season the States of California and Oregon monitor the harvest of salmon. Port samplers examine a portion of all ocean landed commercial and recreational fish and recover coded wire tags, and record length weight ratios of a portion of the catch and harvest time and area information. This data is then applied to the total sales receipts of the commercial catch and the total harvest estimates of the recreational fisheries. Post-season estimates of the total number of Klamath fall chinook harvested in the mixed-stock ocean fisheries can then be calculated.

Tribal Harvest Estimates

In the River, the Hoopa Valley and Yurok Tribal fisheries' staff monitor Tribal harvests. Total harvests are calculated based on estimates or counts of total nets and average catch per net for each area, time period, and net type. During past commercial fisheries on the Yurok Reservation the total commercial harvest was counted and sampled at a single on-Reservation buying station. All harvest is sampled to collect CWT and biological information.

River Recreation Estimates

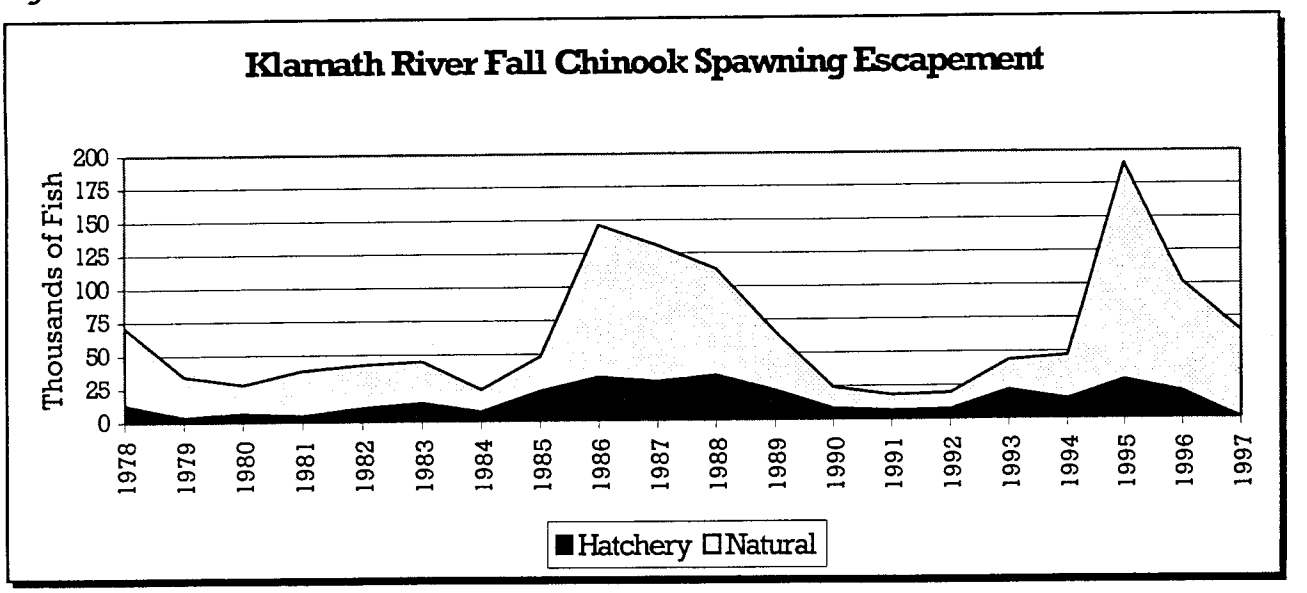
California Department of Fish and Game monitors recreational fisheries in-river. Samplers are stationed to conduct a "creel census" at access points along the lower six miles of the River. Scale samples and CWT's are collected, and total lower-river harvest is estimated. In the upper reaches of the Klamath, monitoring of the widely dispersed and remote angler effort is cost prohibitive. Harvest estimates are based on a ratio with down-river catches based on past data. The Trinity River harvest is monitored through creel census and mark and recapture data.

Scale samples are also taken from all in-river harvests and spawned carcasses to assist in estimating the age composition of the in-river run. This analysis provides for the calculation of how many three, four, and five-year-old fish escaped ocean fisheries.

Escapement Estimates

One of the unfortunate aspects of salmon management is that you don't know how you're doing until it's all over. Each year ocean fisheries start in the spring or early summer, the in-river fisheries reach maximum effort during late summer and fall, and the final runs of the fish to their natal streams and to the hatcheries are not complete until late November or December. Finally, at that point in time, an estimate of what the total population of adult fish was for that year can be computed and compared to what was predicted. Based on hatchery returns, spawning ground surveys, and harvest data, the total distribution of the population to the harvest sectors, and natural and hatchery spawning components can be enumerated. The California Department of Fish and Game summarizes all information in a "Mega-Table" in January of each year.

Figure 6



Source: CDF&G "Mega-Table, 1997

Annual Management Process

Preseason Predictions

Technical Teams

To determine annual allowable harvests and the required spawning escapement, biologists must first estimate the pre-season ocean stock abundance of how many Klamath Chinook will be in the ocean prior to the start of any fishing. The Klamath River Technical Advisory Team (KRTAT) initially handles this task. Following receipt of the previous year's data on the age composition of the run, the Team runs a regression analysis on the two and three year age components of the past year's run of fish. In essence, what they are doing is calculating how many three-year-old fish are left in the ocean based on how many of that brood's population came into the River as two-year-old fish, and how many four-year-olds are left in the ocean based on how many three-year-olds came in to spawn. These predictions are then sent to the PFMC's Salmon Technical Team for review and then distributed to managers and the public.

Information Sharing and Negotiation

In February of each year the California Department of Fish and Game holds a Salmon Informational Meeting to inform the public of the past year's management results, and the upcoming season's estimated populations and management concerns. The KFMC also usually meets during this time frame to begin developing recommendations for harvest allocation and regulations for the PFMC. (See typical schedule page 16)

The Department of the Interior, through the Tribes, confirms at the KFMC and PFMC level, that they will be putting in place regulations and quotas for Tribal fisheries that will target 50 percent of the available harvest while protecting the escapement.

The California Fish and Game Commission informs the PFMC by early March what the targeted in-river recreational fishery harvest will be based on a percentage of the overall non-tribal allocation.

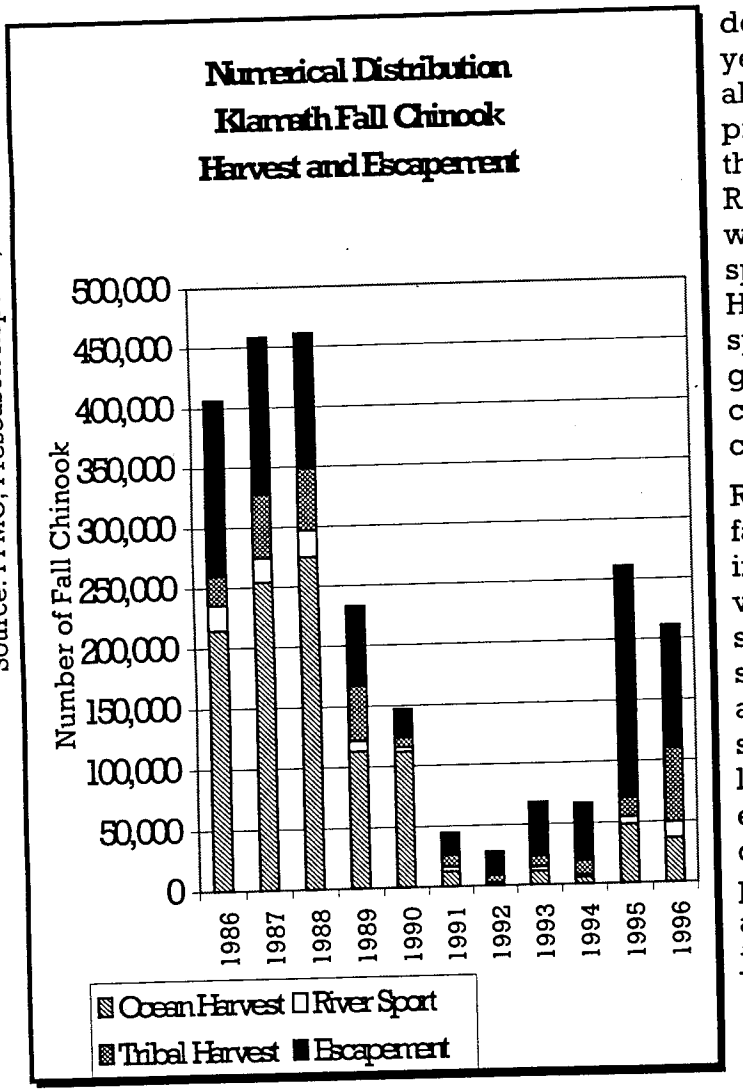
The PFMC meets for four days in the early part of March to develop various regulation options for ocean commercial and recreational fisheries based on the number of fish available. The Salmon Advisory Subpanel provides input into the development of options for the season which would best meet socio-economic needs, while still meeting the spawning escapement and allocation requirements. The options are then sent out for public review and the PFMC meets again in early April to adopt recommended options for regulation of ocean fisheries for the year, which they submit to the Department of Commerce for final approval for the season opening in May (See flow chart page 17)

Status of the Resource

In recent years, despite some years of low stock abundance, the percentage of fish allowed to escape all fisheries and spawn has been on the increase. This has been primarily due to restrictive harvest regulations aimed at protecting Klamath stocks. However, there are other factors that greatly influence the vigor and size of spawning populations.

After the drastic decrease in salmon populations and poor spawning escapements in 1990 through 1992 (Figure 6-7), the failure to meet the 35,000 floor triggered an evaluation of the causative factors. In their conclusions, the Klamath River Fall Chinook Review Team arrived at five broad categories that had contributed to the poor spawning escapements. First and perhaps the most pronounced, are conditions of the marine environment. Poor ocean survival conditions, often caused by large scale changes in weather patterns, can have severe impacts on the survival of salmon populations. The in-river flows, depressed by drought and diversions, are often inadequate to meet the biological needs of the salmon; prior to the stock decline the area had experienced six years of drought. Hatchery operations also played a part when, due to public pressure, they radically increased their output of juvenile salmon into the River creating a system overcrowded with hatchery fish competing for space with the natural juveniles. Habitat conditions in the Basin, such as spawning and rearing areas degraded by siltation, and lack of shade cover to maintain temperatures, also contribute to poor survival.

Figure 7



Source: PFMC, Preseason Report I, 1997

Ranked second on the list of causative factors for the decline, was the most important element of the current harvest rate management methodology; specifically the inaccuracy of the preseason predictions of ocean stock abundance. Stock populations are sometimes higher than predicted, leaving the river fisheries with unnecessarily restrictive quotas; and years of very low abundance have been predicted to be better than they actually were, putting the escapement in jeopardy.

What Is Being Done

Harvest Management

Harvest management is a dynamic process. As new data and knowledge about the different life stage survival rates of salmon are learned, management methods must be fine-tuned. In response to the below floor escapements of 1990-92, the PFMC made modifications to the regression analysis used for predicting stocks to correct a bias towards the underestimation of stocks in low years. They also modified the method of calculating the ratio of hatchery versus natural fish in the escapement. Both of these changes created more restricted fishing seasons for all sectors, and improved escapements.

Currently, the KRTAT is reviewing the spawning escapement floor, investigating better methods of predicting pre-season abundance, and updating the Klamath Ocean Harvest Model which analyzes ocean time and area closures. Ocean fishermen continually seek gear types and areas which would lessen impacts on Klamath salmon while allowing the harvest of healthier stocks, and Tribal fisheries modify their season structure to try to balance their impacts on Trinity and Klamath stocks. Salmon management is an imperfect science at best, and natural fluctuations in population size and migratory routes combined with data gaps exacerbate the problems, but efforts for conservative management continue.

Habitat Restoration

There are restoration programs in place for both the Klamath and Trinity River, but the total funds allotted to these efforts seems by many to be inadequate. The Basin has experienced extremely severe habitat degradation since the 1950s, and the construction of dams and diversions of water has decreased productivity in some portions of the Basin by as much as 80 percent. The search for additional funds, and the implementation of effective restoration projects, are ongoing through the coordinated efforts of the Basin's agency managers, and interest groups.

The goal of the Klamath River Restoration Program is to restore, by the year 2006, the biological productivity of the Basin in order to provide for viable commercial and recreational ocean fisheries, and in-river Tribal (subsistence, ceremonial, commercial) and river recreational fisheries. The Trinity River Restoration program goal is to restore natural spawning escapements to a pre-dam level of 63,000 adult fall chinook.

The Tribes of the Basin: Yurok, Hoopa Valley, Karuk Tribe of California, and the upper Basin Klamath Tribes are currently very involved in Tribal water rights issues, and are aggressively seeking adequate flows for fishery restoration.

Harvest Rate Model Sample Calculations
Hypothetical Ocean Harvest Age 3 Salmon

Beginning Stock Size **(A)** *134,500*

Estimated number of three year old fish in the ocean at the start of the season.

Potential Contacts *118,360*

Age 3 fish are contacted at 88% **(B)** of the harvest rate on 4 year old fish (vulnerability rate). Potential contacts are: 134,500 x .88 = **118,360**

Projected Ocean Contacts **(D)** *11,754*

Fisheries regulated for a .0993 **(C)** Harvest Rate on 4 year old fish will have 11,754 potential contacts with three year old fish (118,360 x .0993 = **11,754**)

Projected Ocean Harvest **(F)** *9,403*

Of the 11,754 three year old fish contacted, 80% **(E)** will be legal size and retained: (11,754 x .8 = **9,403**)

Shaker Mortality **(H)** *588*

Of the 11,754 fish hooked 2,351 (11,754 - 9,403) will be illegal size and be released. Of the fish released 25% **(G)** will die (2,351 x .25 = **588**)

Projected Ocean Impacts **(I)** *9,991*

The total impact of the fishery on three year old fish is the harvest plus the shaker mortality: (9,403 + 588 = **9,991**)

Remaining Stock Size **(J)** *124,509*

Of the total three year olds that were in the ocean on May 1st, 9,991 have been removed and 124,509 remain alive (134,500 - 9,991 = **124,509**).

Three Year Old Adult River Run **(L)** *41,960*

Of the remaining 124,509 three year old fish in the ocean 33.7% **(K)** will mature and migrate to the River to spawn (124,509 x .337 = **41,960**).

QHRM: Klamath Quick Harvest Rate Model (ver. 1.00) 27 Jan 1998 at 15:05
By Michael Prager and Michael Mohr, NMFS Tiburon.
Based on a spreadsheet by USFWS, Arcata.

Run title: Klamath Quick Harvest Rate Model - Test Data (H95FF_1)

USER INPUT PARAMETERS

Age	Ocean vulnerab rate	Prop legal size	Prop mature	Shaker mort rate	Tribal dropoff rate	Rec dropoff rate	Prop natural spawners
3	*(B)*0.880	*(E)*0.800	*(K)*0.337	*(G)*0.250	0.080	0.020	0.620
4	1.000	1.000	0.936	0.000	0.080	0.020	0.620
5	1.000	1.000	1.000	0.000	0.080	0.020	0.620

PROJECTED OCEAN IMPACTS (* = input data)

Age	* Begin stock size	* Take in prev fall	Ocean harvest rate	Proj ocean contact	Proj ocean harvest	Proj shaker deaths	Proj ocean impact
3	*(A)*134500.	0.	*(C)*0.099	*(D)*11754.	*(F)*9403.	*(H)*588.	*(I)*9991.
4	37600.	175.	0.099	3717.	3892.	0.	3892.
5	1600.	5.	0.099	158.	163.	0.	163.
Sum	173700.	180.	.	15629.	13458.	588.	14046.

PROJECTED RIVER IMPACTS (* = input data)

Age	Remaining ocean stock	Adult river run	* River vulnerab rate	River impact rate	Proj river harvest	Proj river dropoffs	Proj river impact
3	*(J)*124509.	*(L)*41960.	0.59	0.19	7343.	586.	7930.
4	33708.	31551.	1.00	0.32	9359.	747.	10106.
5	1437.	1437.	1.00	0.32	426.	34.	460.
Sum	159654.	74947.	.	.	17128.	1367.	18496.

FINAL HARVEST AND ESCAPEMENT PROJECTIONS (ADULT FISH)

Total harvest	30586.	
Ocean harvest	13458.	
River harvest	17128.	
Tribal harvest	15293.	(50.0% of total harvest)
Non-tribal harvest	15293.	
River recreational harvest	1835.	(12.0% of non-tribal harvest)
Total spawning escapement	56452.	
Spawning escapement in nat areas	35000.	

For documentation of this computer program, see NMFS Southwest Fisheries

Harvest Rate Model Sample Calculations
Hypothetical River Harvest Age 3 Salmon

River Impact Rate *.19*

Regulations will set a 32% **(M)** harvest rate on four year old fish that enter the River. Three year olds will be vulnerable to harvest at 59% **(N)** of the rate of 4 year olds: .32 x .59 = **.19** Impact Rate **(O)**.

Projected River Impact **(P)** *7,930*

The 19% Impact Rate on three year old fish that enter the River is the percent netted or hooked: .18889* x 41,960 = **7,930** total impact.
(*The model round off, i.e. .18889 to.19)

Combined River Dropoff Rate *.074*

Of the total fish contacted 89% will be by net, 11% by hook. Nets lose 8% **(Q)** of fish caught, hooks loose 2%**(R)**. The combined drop-off rate on the total harvest is: (.89 x .08) + (.08 x .02) = **.074**

Projected River Dropoffs **(S)** *586*

Of the 7,930 total fish contacted 7.4% will be lost from the hook or net: 074 x 7,930 = **586**

Projected River Harvest **(T)** *7,343*

Of the total fish contacted by net or hook a total of 7,343 will be retained. (7,930 - 586 = **7,343**)

Projected Three Year Old Escapement 34,030

Of the total number of three year old fish that entered the River 7,930 were removed. The number of fish allowed to escape and spawn is: 41,960 - 7,930 = **34,030**

Projected Natural Escapement *21,099*

Of the 34,030 spawners, 62% **(U)** will spawn in natural areas: .62 x 34,030 = **21,099.** This number is included in the total spawning escapement in natural areas **(V)**

QHRM: Klamath Quick Harvest Rate Model (ver. 1.00) 27 Jan 1998 at 15:05
By Michael Prager and Michael Mohr, NMFS Tiburon.
Based on a spreadsheet by USFWS, Arcata.

Run title: Klamath Quick Harvest Rate Model - Test Data (H95FF_1)

USER INPUT PARAMETERS

Age	Ocean vulnerab rate	Prop legal size	Prop mature	Shaker mort rate	Tribal dropoff rate	Rec dropoff rate	Prop natural spawners
3	0.880	0.800	0.337	0.250	*(Q)*0.080	*(R)*0.020	*(U)*0.620
4	1.000	1.000	0.936	0.000	0.080	0.020	0.620
5	1.000	1.000	1.000	0.000	0.080	0.020	0.620

PROJECTED OCEAN IMPACTS (* = input data)

Age	* Begin stock size	* Take in prev fall	Ocean harvest rate	Proj ocean contact	Proj ocean harvest	Proj shaker deaths	Proj ocean impact
3	134500.	0.	0.099	11754.	9403.	588.	9991.
4	37600.	175.	0.099	3717.	3892.	0.	3892.
5	1600.	5.	0.099	158.	163.	0.	163.
Sum	173700.	180.	.	15629.	13458.	588.	14046.

PROJECTED RIVER IMPACTS (* = input data)

Age	Remaining ocean stock	Adult river run	* River vulnerab rate	River impact rate	Proj river harvest	Proj river dropoffs	Proj river impact
3	124509.	41960.	*(N)*0.59	*(O)*0.19	*(T)*7343.	*(S)*586.	*(P)*7930.
4	33708.	31551.	1.00	*(M)*0.32	9359.	747.	10106.
5	1437.	1437.	1.00	0.32	426.	34.	460.
Sum	159654.	74947.	.	.	17128.	1367.	18496.

FINAL HARVEST AND ESCAPEMENT PROJECTIONS (ADULT FISH)

Total harvest	30586.	
Ocean harvest	13458.	
River harvest	17128.	
Tribal harvest	15293.	(50.0% of total harvest)
Non-tribal harvest	15293.	
River recreational harvest	1835.	(12.0% of non-tribal harvest)
Total spawning escapement	56452.	
Spawning escapement in nat areas	*(V)*35000.	

For documentation of this computer program, see NMFS Southwest Fisheries Science Center Administrative Report T-97-01, available free from Librarian, SW Fisheries Science Center, 3150 Paradise Drive, Tiburon, CA 94920.

Contribution Rates

How many salmon are in the ocean, and where are they going to be at any one point in time, are the confounding questions of fisheries management. Coded-wire-tag data from past ocean fisheries show that the average number of Klamath salmon in a fisherman's total catch of salmon, the contribution rate, varies greatly depending on where and when fishing occurs. Biologists must try to estimate ahead of time what the contribution rate of Klamath salmon will be during certain months and within certain areas in order to regulate ocean fishery impacts.

The Klamath Ocean Harvest Model (KOHM) is used for "shaping" the season's regulations. Once the Harvest Rate Model has determined the number of salmon allocated to ocean harvest, and the approximate harvest rate; various fishing scenarios with different areas and times opened or closed are examined to find regulation options that will meet allocation and ocean escapement goals.

As a general rule, those areas far removed from the mouth of the Klamath have a very low contribution rate of Klamath salmon. As shown in the table below, in the Southern Cell (SOC) from Pigeon Point to Point Arena in May, on an average only one and one half fish per one hundred (1.5%) landed is a four year old Klamath salmon. As a consequence, in years of low abundance, if closures are put in place to protect Klamath stocks in these "outside" areas, the opportunity to harvest all of the other salmon in that area and time period is lost. Fisheries are most heavily restricted in the KMZ area of high Klamath contribution rates to inhibit closures and loss of harvest of other stocks in outside areas.

Unfortunately, the data used are only average distributions (1986-1990). During any single year the stocks may migrate in unexpected numbers to the north or south, depending on ocean conditions, and unexpected high or low impact rates on Klamath salmon can occur despite pre-season expectations and regulations.

AREA	AGE	MAY	JUNE	JULY	AUG	AVG
Northern Cell	3	0.2	0.7	4.4	7.6	3.1
Northern Cell	4	2.2	0.7	2.7	1.9	2.6
Coos Bay Cell	3	2.5	6.3	16.5	28.6	14.8
Coos Bay Cell	4	10.8	8.2	9.8	6.6	9.0
KMZ Troll Cell	3	8.9	28.0	6.8	25.4	19.6
KMZ Troll Cell	4	10.2	9.0	0.7	2.5	5.6
KMZ Sport Cell	3	22.1	16.9	12.2	20.1	15.1
KMZ Sport Cell	4	6.3	4.2	10.5	7.9	8.2
Fort Bragg Cell	3	13.9	18.8	22.4	7.6	17.2
Fort Bragg Cell	4	6.8	6.6	6.1	3.9	5.9
Southern Cell	3	2.7	9.2	9.0	3.5	6.0
Southern Cell	4	1.5	2.9	1.5	0.7	1.8

Cape Falcon
(NOR Cell)
Heceta Head
(CSB Cell)
Humbug Mtn
(KMZ Cell)
Horse Mtn
(FTB Cell)
Point Arena
(SOC Cell)
Point Sur

Source: CDF&G

Glossary of Terms

Anadromous	Fish born in fresh water that emigrate to the ocean to grow to adult stage and return to fresh water to spawn.
Brood Year	All of the salmon resulting from a specific year's spawning escapement.
Carrying Capacity	The maximum number of organisms a habitat can support throughout a year without damage to organisms or habitat.
Escapement Floor	In Klamath Management, the minimum number for escapement of natural spawning salmon.
Full Fishing	In Klamath Management, when fisheries are regulated to harvest at the total allowable combined long term equilibrium harvest rates.
Gill Net	Large mesh nets hung in the water column, which capture fish by entangling their gills when they attempt to pass through the net.
Harvest Rate	Percentage of individual fish that may be removed from a segment of the population by regulated fisheries.
Indian Country	As defined by Federal Regulations, all the land within the boundaries of a Reservation regardless of ownership or trust status.
Mixed Stock Fishery	Fishing which concurrently harvests salmon originating from different river systems, brood years, and natural or hatchery origins.
Ocean Escapement	Mature salmon allowed to escape ocean fishing and return to the river mouth to begin their spawning run.
Spawning Escapement	Total salmon population allowed to escape all fisheries to spawn in the river system or return to the hatcheries.
Stock	A species or population of fish that maintains itself over time in a defined area.
Subsistence Harvest	The customary and traditional taking of fish for direct personal, family, or community consumption as food.
Terminal Harvest	In salmon management, fishing that occurs after the salmon have escaped from the ocean and are entering, or are in, the rivers.
Troller	Fisherman who uses hook and line pulled behind a slow moving boat.
Quota	Set pre-season, the numeric value of the total harvest allowed for a fishery.

Bibliography

Bearss, Edwin C., "History Resource Study, Hoopa-Yurok Fisheries Suit, Hoopa Valley Indian Reservation, Del Norte and Humboldt Counties, California." Prepared for the U.S. Department of the Interior, Bureau of Indian Affairs, 1981.

California Department of Fish and Game, Klamath - Trinity Program. "Klamath Basin Fall Chinook Salmon Run-size, In-river Harvest and Spawner Escapement - 1997 Season." *"Mega-Table,"* 1998.

Klamath River Technical Team. "Recommended Spawning Escapement Policy for Klamath River Fall-run Chinook." Unpublished Report, 1986.

Madson, Pamela K., and William Koss. *Washington Salmon: Understanding Allocation.* Washington State, House of Representatives, Office of Program Research,1988.

McEvoy, Arthur F., *The Fisherman's Problem: Ecology and Law in the California Fisheries 1850 - 1980.* Cambridge, Cambridge University Press,1986.

Pierce, Ronnie M., *The Klamath River Fishery: Early History* in *California's Salmon and Steelhead,* ed.Alan Lufkin. Berkeley, University of California Press,1991.

Snyder, John O., "Salmon of the Klamath River, California". California Department of Natural Resources, Division of Fish and Game. *Fish Bulletin 34,* 1931.

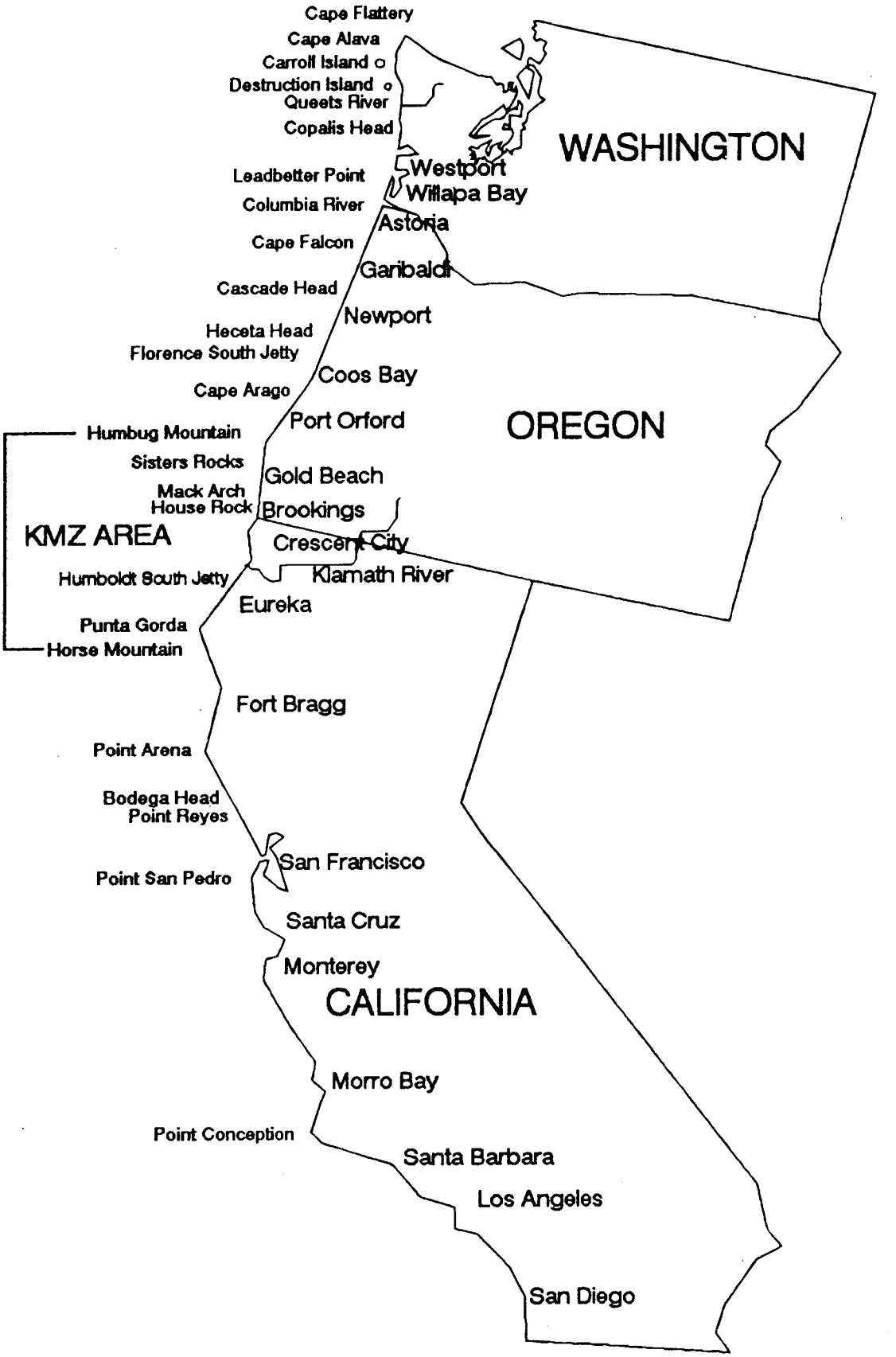
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Pacific Fishery Management Council, "Preseason Report I",1997.

- - - , - - -, Pacific Fishery Management Council, "Review of 1996 Ocean Salmon Fisheries, 1997.

- - - , - - - , Pacific Fishery Management Council "Form and Function," 1988.

U.S. Department of Commerce, National Marine Fisheries Service: Southwest Fisheries Science Center. "An Improved Implementation of the Harvest Rate Model for Klamath River Chinook Salmon." Administrative Report T-97-01, 1997.

U.S. Department of the Interior, Office of the Solicitor. Memorandum M-36979 on the subject of "Fishing Rights of the Yurok and Hoopa Valley Tribe", 1993.


Cape Flattery
Cape Alava
Carroll Island
Destruction Island
Queets River
Copalis Head
WASHINGTON
Leadbetter Point
Westport
Willapa Bay
Columbia River
Astoria
Cape Falcon
Garibaldi
Cascade Head
Newport
Heceta Head
Florence South Jetty
Coos Bay
Cape Arago
Port Orford
OREGON
Humbug Mountain
Sisters Rocks
Gold Beach
Mack Arch
House Rock
Brookings
KMZ AREA
Crescent City
Humboldt South Jetty
Klamath River
Eureka
Punta Gorda
Horse Mountain
Fort Bragg
Point Arena
Bodega Head
Point Reyes
San Francisco
Point San Pedro
Santa Cruz
Monterey
CALIFORNIA
Morro Bay
Point Conception
Santa Barbara
Los Angeles
San Diego