The Klamath Fishery Management Council

Long-term Plan

for Management of Harvest of Anadromous Fish Populations

of the

Klamath River Basin

Prepared by:

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1829 South Oregon Street
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Final Plan

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INTRODUCTION

Purpose of this document

The purpose of this document is threefold: 1) to inform the public, particularly those with an important stake in the outcome, of the Klamath Fishery Management Council's (the Council) long-range or strategic plan, 2) to inform the stakeholders and public of the planning process used by the Council to develop its plan, and 3) to obtain and utilize the stakeholders and public's opinions on the various elements of the strategic plan.

The Council's Planning Process

The Klamath Fishery Management Council is an advisory committee authorized by Public Law 99-552 to make recommendations on harvest of Klamath River anadromous fish. Among the duties and obligations of the Council is the requirement, by law, to develop and adopt a long-range plan or strategy to guide its subsequent actions and decisions (see Chapter 1). The Council is also required to hold public hearings on its proposed plan. Accordingly, the Council adopted a planning process, developed its long-range strategic plan, and solicited public input. The Council (see Appendix C) has incorporated public comments into this second draft.

The Council adopted a planning system based on the Interactive Planning and Management System in place at the Southwest Region (SWR) of the National Marine Fisheries Service. The Planning Officer of the SWR was engaged to help design the planning process for the Council and to facilitate the planning sessions of the Council. The specially designed group planning facility at the Southwest Fisheries Science Center in La Jolla, California, was used for most of the planning sessions. One of the main features of the planning process was to increase the probability that the Council would find a consensus among its members, if one existed, notwithstanding the considerable complexity of the situation and possible conflicting objectives of the various interests represented on the Council.

The Council progressed through five major stages to develop the strategic plan (Figure 1):

1. *The review of the Council's charter under the law.*

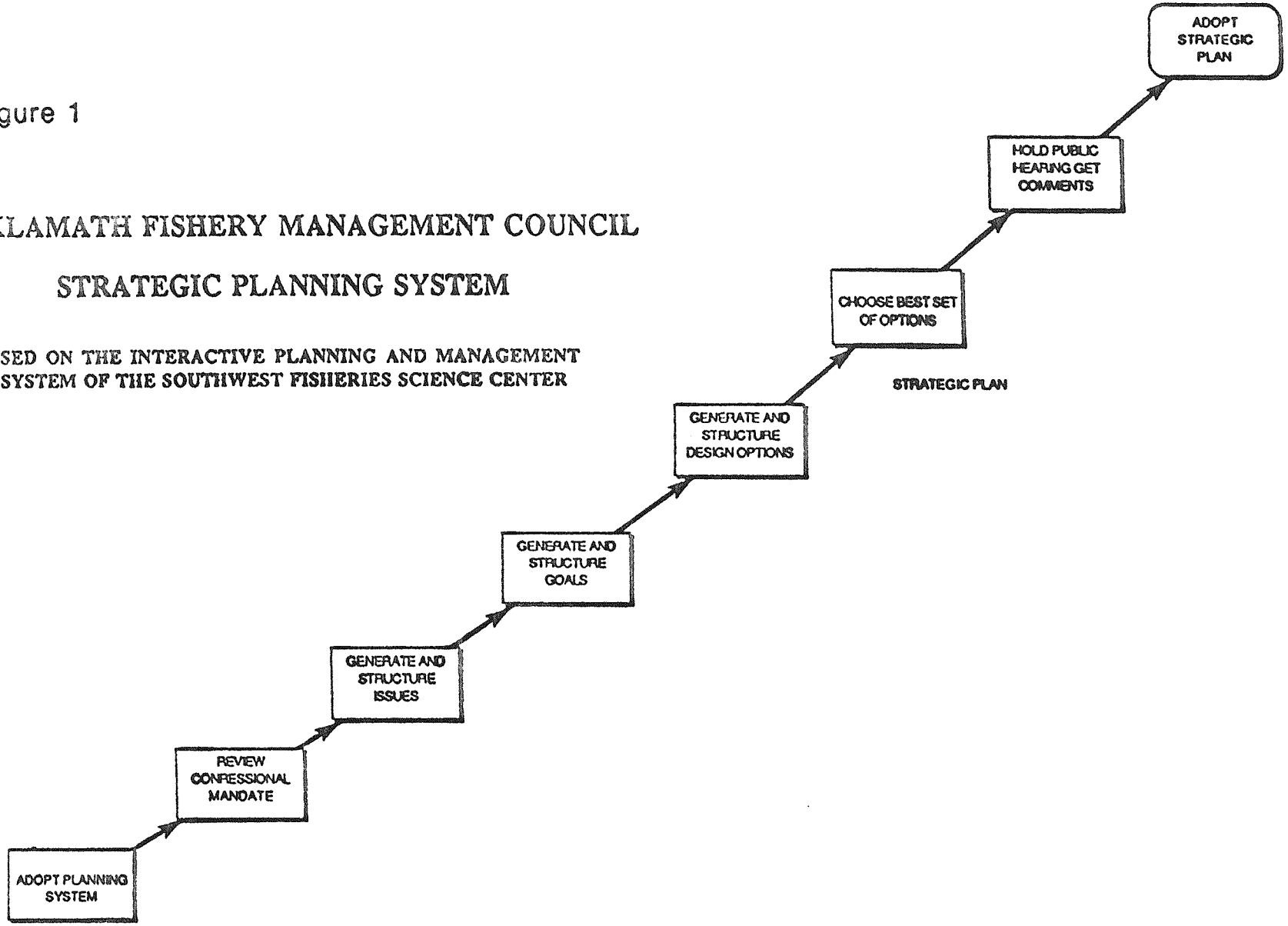
   The Council reviewed and discussed its duties and obligations under the law and summarized these for the purpose of guiding the planning operation (see Chapter 1).

Figure 1

KLAMATH FISHERY MANAGEMENT COUNCIL

STRATEGIC PLANNING SYSTEM

BASED ON THE INTERACTIVE PLANNING AND MANAGEMENT SYSTEM OF THE SOUTHWEST FISHERIES SCIENCE CENTER



2. *The identification and explanation of the important Issues.*

   The issues as seen from each Council member's perspective were discussed and structured to separate the fundamental issues from the symptomatic issues (see Chapter 2).

3. *The setting of goals.*

   Being informed by the discussion and structuring of the issues, the Council set goals for itself. These goals were structured to reveal the relationship each goal had to the others (see Chapter 3).

4. *The specification of options (activities, projects, etc.) that possibly would help to meet the goals.*

   The Council generated many options for activities, projects or policies that possibly would help in meeting the Council's goals and in resolving the fundamental issues. The options were classified into similar categories and the result was an Options Field to be used as an aid for the selection of the elements that would comprise the final plan (see Chapter 4).

5. *The designation of criteria and the choice of specific options within each category to be incorporated into the plan.*

   The Council carefully considered each option in each category of the Options Field for its possible inclusion in the strategic plan. Having considered all the options in the light of criteria for choosing good alternatives, the Council made the specific choices of the options that it thought would best define its strategic plan (see Chapter 5).

Fish Species and Harvests Considered in the Council's Planning Process

ANADROMOUS FISH OF THE KLAMATH RIVER BASIN.

Anadromous fish are those which spend some part of their lives in the sea or inshore waters, but return to fresh water to spawn. Examples are salmon, steelhead, and sturgeon. Anadromous fish are the focus of this harvest management plan. Non-anadromous fish, such as resident trout, are not treated in the plan.

THE STOCK CONCEPT.

The term "stock" is used in fishery science to refer to groups of fish which, to a substantial degree, do not interbreed with other groups. Stocks may be separated from one another by spawning in different locations, or at different times in the same location. For example, chinook salmon populations in the Klamath River basin include fall and spring stocks. Steelhead stocks include summer and fall/winter stocks.

Natural stocks of fish are those which spawn under natural conditions. For example, salmon spawning in the gravel of a streambed. Hatchery stocks are those which primarily return to a fish hatchery to spawn. Because fish of hatchery origin will spawn naturally, the terms "native stock" or "indigenous stock" may be used to identify stocks descended from local ancestral populations, and not introduced by people.

Hatchery mitigation. Anadromous fish of the Klamath River basin may be divided into numerous natural stocks, and several hatchery stocks. Most hatchery production of fish occurs at Trinity Hatchery and Iron Gate Hatchery. These two hatcheries are operated by the California Department of Fish and Game. Each is located at the upper limit of anadromous fish passage on the Trinity and Klamath Rivers, respectively. The primary goal of these facilities is mitigation, or replacement of runs of natural fish blocked by dams. Trinity Hatchery mitigates for loss of fish runs to the vast area above Trinity and Lewiston Dams. Iron Gate Dam mitigates for fish losses caused by Iron Gate Dam. No mitigation is provided for loss of fish runs to the upper Klamath basin, which has been dammed off since early in this century.

Interaction of hatchery and natural stocks. Additional artificial propagation of salmon and steelhead could be undertaken within the basin by either enlarging existing facilities or constructing new ones. Several things must be considered, however, relative to how hatchery fish impact the naturally produced segment of the population. From a biological and management perspective, these include:

1. Release time strategies may conflict with juvenile survival of naturally produced fish. The timing of large releases from hatcheries could adversely affect, through predation and competition, fish already in the river as they grow and migrate to the ocean.

2. Release location strategies may cause undesirable mixing of different populations. Straying of fish produced in hatcheries could affect run timing of natural populations and thus the diversity of populations throughout the basin.

3. Predation by hatchery steelhead on salmon fry is commonly observed.

4. Hatchery produced fish can be considered to have higher productivity than naturally produced fish because of the safe hatchery conditions where food is regularly and abundantly delivered to growing young. This higher productivity creates differences in the harvest rates that hatchery and natural stocks can support. Hatchery stocks can support a higher harvest rate than natural stocks. Harvest management based on natural stock productivity would be expected to create excess hatchery fish returning to the river as adults because of the higher productivity of hatchery stock. Absent a means of differentially harvesting the hatchery component, these excess hatchery fish could overpopulate natural spawning areas or be viewed as wasted. Short of harvest at or very near the hatchery, present harvest techniques in both ocean and river fisheries do not lend themselves to using these excess fish.

Stock productivity. Stock productivity refers to the number of progeny per spawner that may be expected to reach "recruitment": the size or age at which they become vulnerable to harvest in a fishery. Productivity is reduced by any factor that contributes to pre-recruitment mortality of the progeny. Factors could include environmental conditions in the stream or ocean, disease, or predation. Productivity is generally higher for hatchery stocks, which are somewhat protected from mortality until released from the hatchery.

Salmon

Two species of Pacific salmon, chinook and coho, occur abundantly in the Klamath basin and adjacent areas. Other salmon species, primarily pink and chum salmon, occur in only small numbers in the area. All species of Pacific salmon die after spawning.

Chinook salmon typically spawn in the fall. Young fish emerge from the gravel in late winter. Juveniles rear in the stream, migrating to the estuary and ocean in the spring or fall of the year of emergence. After a period of rapid growth in the open ocean, sexually mature chinook return to spawn at 2, 3, 4, 5, or occasionally 6 years of age. Two-year old fish are termed grilse. Most grilse are males, called jacks. Three-year old or older fish are termed adults.

Chinook salmon are a varied group, with many life history patterns. The predominate chinook stocks in the Klamath basin are fall chinook, returning to the river in late summer or early fall, and spawning in late fall; and spring chinook, returning to the river from late winter to summer, and holding in pools until ready to spawn in the fall. Spring-run fish tend to enter fresh water in better condition and to ascend higher in the watershed to spawn. Fall-run fish predominate in lower portions of watersheds.

Klamath basin chinook can be divided into a number of specific stocks, based on location of spawning. Two of the Klamath chinook stocks are hatchery stocks, being spawned at Iron Gate Hatchery on the Klamath River, or Trinity Hatchery on the Trinity River.

Other chinook stocks affected by this plan include fish spawning in adjacent watersheds and rearing in ocean areas (mid-California to mid-Oregon) where Klamath stocks are abundant. These include the very large fall chinook stocks of the Sacramento basin and the large spring and fall chinook stocks of the Rogue basin. Smaller stocks of the Eel, Smith, Chetco, Mattole, and Mad rivers, as well as Redwood Creek, are also affected by this plan.

Status and trends of Klamath chinook stocks.

Fall chinook. There is evidence that Klamath chinook stocks were once much larger than at present. Spring-run fish, particularly, were more abundant before the upper portions of the Klamath and Trinity basins were made inaccessible by dams. Rough estimates show that an average of 52,000 chinook were commercially harvested for the canneries each year between 1915 and 1928. Reliable estimates of numbers have been available only since 1978, and only for the fall run.

From 1978 through 1985, annual numbers of adult fall chinook spawners ranged from about 23,000 to 71,000. The run increased sharply in 1986 to about 146,000 adults, and remained above 100,000 through 1988. Improved ocean conditions may have also contributed significantly to increased inland returns. Numbers dropped to 67,000 in 1989, and to 20,000 in 1990. Much of the increase in the late 1980's could be accounted for by good returns to Iron Gate and Trinity Hatcheries, and to the mainstem Trinity River and Bogus Creek. The latter two groups of spawners are thought to include many fish of hatchery origin. Returns to areas where few hatchery fish spawn, such as the Salmon, Scott and Shasta Rivers, remained rather low through the period of record. Returns to the Scott and Shasta Rivers were very low in 1990, numbering only a few hundred fish in each watershed.

Another measure of abundance of Klamath fall chinook stocks is provided by estimates of ocean abundance. Ocean abundance of 3 and 4-year-old chinook is estimated annually, to provide a basis for harvest regulations. Abundance estimates in recent years have ranged from about 111,000 fish in 1990 to about 700,000 fish in 1988. The preseason estimate for 1991 was about 124,000. A postseason estimate of 1991 ocean abundance has not been made, but will probably be quite low.

Spring chinook returns to the Klamath basin consist mostly of returns to Trinity Hatchery. Returns to the hatchery have ranged from a few hundred to over 13,000 in recent years. Natural stocks of spring chinook in the Klamath basin are very small. The largest is the run to Salmon River. Adult spring chinook must hold over from spring to fall before spawning. The risks for pre-spawning mortality are significant.

Coho salmon have been reported to be abundant in the Klamath basin early in this century, but no reliable estimates of run size have been made. Coho salmon typically emerge from the gravel in late winter or early spring and rear in streams for about one year. They return to spawn in the fall, as 2-year olds. It appears that propagation at Iron Gate and Trinity hatcheries is the source of most of the Klamath coho run, and natural spawning is thought to be minor.

Pink and chum salmon are occasionally found spawning in the Klamath basin, but there appears to be no self-sustaining stock of either species in the basin.

Steelhead.

Formerly considered trout, steelhead have recently been included, by taxonomists, in the Pacific salmon genus. Steelhead return to the Klamath River at various times, holding in the river to spawn in late winter or spring. Immature steelhead also enter the Klamath River, and some nearby rivers, as "halfpounders", during their first year of ocean life. No reliable estimates of run size are available for Klamath steelhead. Steelhead are reared in both Trinity and Iron Gate Hatcheries, and natural spawning and rearing occur in many streams throughout the basin.

Green Sturgeon.

Sturgeon are long-lived fish requiring many years to mature. Adults enter the Klamath River in spring, and spawn in the Trinity and Klamath Rivers. Juveniles migrate from the river within two years. No estimates of abundance, nor of trends in abundance, are available for Klamath green sturgeon.

Other anadromous fish species occurring in the Klamath River basin include coastal cutthroat, Pacific lamprey, eulachon or candlefish, and American shad -- an introduced species. Little information is available on abundance of these species in the basin.

HARVEST OF KLAMATH FISH STOCKS.

History.

Anadromous fish have been an important resource for Indian people of the Klamath basin for thousands of years. Migrating fish have been an important food source, and significant in culture and religion. Use of these fish runs by white settlers, as well as impacts on Klamath fish habitats, became significant with the growth of gold mining, and development of a fish canning industry late in the Nineteenth Century. Commercial harvest of fish, principally salmon, was concentrated in the lower Klamath River early in this century. Fish were harvested by gillnet, and processed in local canneries.

Commercial harvest shifted to offshore waters with development of gasoline and diesel-powered fishing vessels, and with a 1930's law prohibiting commercial gillnetting in California rivers due to alleged detrimental effect of river gillnetting on anadromous stocks. Native Americans continued using gillnets to fish for ceremonial and subsistence purposes between 1934 and 1978, in some areas. Commercial gillnetting in the lower twenty miles of the Klamath River was opened under Federal regulation in 1977, and closed mid-season in 1978. Subsistence fishing only, was allowed in 1979 through 1986. Commercial fishing was resumed in 1987.

River sport angling for Klamath salmon and steelhead has been popular since early in this century. An offshore sport fishery, conducted from skiffs and charter vessels, has grown over the past several decades in northern California and southern Oregon ports.

Declining salmon landings in the KMZ and nearby ports, have occurred as a result of harvest management for Klamath stocks. For example, chinook and coho troll landings in Crescent City in the 1980's declined by about one third from what they were in the 1970's. Since the 1980's, the ocean commercial salmon communities of Brookings, Crescent City, Trinidad and Eureka have sustained significant socio-economic impacts. Other local ports such as Shelter Cove, Fort Bragg and Coos Bay, have also been significantly impacted by the recent efforts to protect the fall chinook natural spawner.

While the KMZ troll catch has decreased, the KMZ sport catch has increased. For example, the recreational catch of chinook and coho in Crescent City doubled during the 1980's as compared to the 1970's. Sport and Indian fall chinook harvest increased during the big run years of the late 1980's and decreased during recent years.

Legal Basis of Harvest.

With addition of California to the United States subsequent to the 1846 war with Mexico, and addition of the Oregon Territory through agreement with Great Britain, Indian people of the Klamath became subject to Federal law. Rights to fish, hunt, and gather have been preserved in Indian country, set aside under Federal law for Indian

use. In the Klamath basin, these lands include the Hoopa and Yurok Reservations in the lower Klamath region, established -- in several stages -- through presidential executive orders in the Nineteenth Century, and the 1988 Hoopa-Yurok Settlement Act. Such rights are also preserved on lands of the former Klamath Reservation, in the upper Klamath basin. Hoopa fisheries are regulated by the Tribe. Yurok fisheries are regulated by the Bureau of Indian Affairs, with self-regulation anticipated in the near future. Karuk fisheries, conducted on non-Trust lands, are regulated by the State of California and the Karuk Tribe in terms of location and method of fishing. Non-Federal regulations of Indian fisheries generally must be consistent with Federal regulations adopted by the Departments of Commerce and Interior.

On lands other than Indian country, and in state marine waters (to three miles offshore), fish and wildlife are considered state property. Harvest of fish by individual citizens is permitted by the state through a licensing system, under regulations promulgated by the California Fish and Game Commission and the state legislature. Licensing for commercial harvest of salmon has become quite restricted in recent years, with the objective of limiting fishing effort, and making the fishing industry more economically viable. Commercial harvests in state marine waters are regulated by state law. Regulations generally must be consistent with Federal regulations adopted by the Department of Commerce.

In the Fishery Conservation Zone of the Pacific Ocean, (3-200 miles offshore), fish and other natural resources are considered Federal property. Harvest of salmon in this ocean area, principally by larger commercial vessels, is carried out under state licensing, through delegation of powers under the Magnuson Act. Regulation is by the Department of Commerce, in consultation with the Pacific Fishery Management Council.

DESCRIPTION OF FISHERIES.

Indian fisheries on Klamath stocks are conducted in-river; that is, within the Klamath and Trinity Rivers. These fisheries have been conducted for some thousands of years. Hoopa and Yurok fisheries are conducted on the reservations of those two tribes, located in the lower Klamath basin. The Hoopa Reservation is located on the lower reaches of the Trinity River. Karuk fishing is done at traditional sites near Ishi-Pishi Falls, on the Klamath River. Fisheries are conducted for subsistence and ceremonial/religious uses and for commercial sale. Fishing in the Klamath River estuary is typically done with anchored gillnets (setnets). In upstream areas, anchored gillnets and some drift gillnets are used. Dipnets and trigger nets are used at Ishi-Pishi Falls. In 1990, the Hoopa Tribe experimentally fished a weir. Gillnets, dip nets, trigger nets, and weirs are traditional Indian fishing methods.

The largest Hoopa and Yurok harvests in recent years have been fall chinook, with annual catches ranging from about 7,000 in the poorest years to over 50,000 adult fish in abundant years. Monitoring of Karuk harvest of fall chinook began in 1990, with an

estimated take, after September 15 of that year, of about 200 fish. Fall chinook catches on the Hoopa Square have been relatively stable at 2-5,000, while catches on the Yurok Reservation were generally larger in the late 1980's than formerly. Annual spring chinook catches by Hoopa and Yurok harvesters have ranged from a few hundred to over 5,000 adult fish. Other tribal harvests include coho salmon, with recent annual catches ranging from a few hundred to about 3,000 adult fish, steelhead catches of about 200-700 adults and 30-200 halfpounders annually, and green sturgeon harvest of about 200-800 adults annually. A few white sturgeon are taken in tribal harvests, in some years. Other tribal harvests include lamprey and candlefish, for which no estimates of catch are available.

River sport harvest consists of hook-and-line capture by anglers. The Klamath River has attracted salmon and steelhead anglers since early in this century.

Presently, the largest harvest is fall chinook salmon, captured by boat and bank anglers upstream to Iron Gate and Lewiston Dams. Anglers consistently catch about 10 percent of the total fall chinook river escapement. Catches in recent years have ranged from about 3,000 to over 20,000 adult fish.

Angler harvests of other anadromous fish stocks are not well-documented for the Klamath basin, except for portions of the Trinity River basin. Annual angler harvest of spring chinook salmon in Trinity River above Junction City has ranged from a few hundred adults to over 8,000. Steelhead harvests, including adult fish and immature halfpounders, are thought by many to have declined from levels of 20-30 years ago. Daily catch limit for steelhead, formerly liberal for halfpounders, is now two fish of any size.

Ocean commercial harvest of Klamath anadromous stocks consists principally of salmon. In rare instances, steelhead and other stocks may be taken, although the commercial harvest of steelhead is forbidden. The ocean commercial salmon fishery uses hook-and-line gear, trolled behind a moving vessel. The state of California has designated ocean trolling as the appropriate means of commercially harvesting salmon. Barbless hooks are used to reduce mortality of released sublegal fish, called shakers. Ocean troll fisheries for salmon operate from the Gulf of Alaska to the central California coast, with considerable movement of vessels between areas. Larger vessels remain at sea for several days, while smaller boats conduct day fisheries. Troll fisheries formerly operated for as long as fish were available and weather permitted, but have recently been limited, in some areas, to restricted seasons. Fort Bragg, California and Coos Bay, Oregon were major troll fishery ports where many chinook salmon of Klamath origin were landed. Smaller fleets fish from Bandon, Port Orford, Brookings, Gold Beach, Crescent City, Trinidad, Eureka, and Shelter Cove.

Commercial fall chinook landings in the coastal reach including Fort Bragg and Coos Bay ranged from about 100,000 to about 800,000 during the 1980's. Fish of Klamath

origin typically make up 25-35% of this catch. This is termed the Klamath contribution rate. Other chinook stocks with high contribution rates to this portion of the troll fishery include Sacramento and Rogue Rivers. Contribution rates of the various stocks fluctuate widely from year to year.

Troll fishing effort has undergone a marked shift out of the Klamath Management Zone (Port Orford to Shelter Cove, roughly), on account of management efforts to reduce harvest of natural stocks of Klamath chinook. The overall trend in California and Oregon has been a declining number of trolling vessels, but a stable level of fishing effort (boat-days).

Based on coded-wire tag returns, ocean harvest of spring chinook from Trinity Hatchery is equal to or greater than harvest from in-river fisheries. Most ocean harvest of spring chinook is by the troll fishery.

The troll fishery in this area also lands a substantial catch of coho salmon. Landings in central and southern Oregon ports have ranged from 50,000 to over 600,000 fish in recent years. California catches have been much smaller.

Ocean sport harvest of Klamath anadromous stocks also consists largely of salmon. The sport fishing fleet consists of small, private vessels and charter boats. In recent years, sport fishing effort in the northern California/southern Oregon area has been concentrated in the ports of Brookings and Crescent City. Recently, ocean fishing has had an 8-9 month season off central California, a five month season in the Klamath Management Zone, and much shorter seasons to the north.

The sport salmon catch contains relatively more coho and less chinook than does the troll catch. Fall chinook landings through the 1980's ranged from about 20,000 to over 90,000, in the Fort Bragg - Coos Bay reach of coast. The contribution rate of Klamath stocks to the sport chinook catch is somewhat lower than for the troll catch. Sport catch of coho landed in central and southern Oregon ports has ranged from about 150,000-250,000, with landings of 15,000-50,000 in California ports. Sport catch in the KMZ tended to increase in the late 1980's, with the decline in KMZ troll effort.

Other ocean harvests of Klamath anadromous stocks include incidental catches of salmon, steelhead, and probably other stocks taken in the midwater hake fishery and the bottom trawl fisheries. Substantial numbers of salmon and steelhead are taken in the high seas squid driftnet fishery, and in illegal high seas driftnet fisheries targeting salmonids. These fish are mostly of Alaskan and Asian origin. California stocks of salmon and steelhead do not appear to be significantly impacted by these fisheries.

Illegal harvest of salmon in all fisheries is unquantified and may be an important factor in the depletion of stock.

MANAGEMENT OF KLAMATH FISH STOCKS AND HARVESTS.

(Note that many of the terms used in this section of the plan are defined in the glossary in Appendix B.)

The Concept of Maximum Sustained Yield (MSY).

The concept of "maximum sustained yield" (MSY) is an essential part of the harvest rate management program adopted by the KFMC in 1986. MSY is the long term maximum yield of salmon to the fisheries when all environmental factors are stable. MSY can be determined when sufficient data are obtained for the Ricker production model, which relates the number of spawners to the total production of adult salmon. Specifically, the relationship is between the number of adult spawners (parents) and age 2 recruits (offspring) in the ocean at the start of the ocean fishery.

The Ricker production model has been established for many populations of fish. In addition to the adult spawning escapement and number of recruits noted above, parameters needed in the model are the inherent production of age II fish per spawner (alpha) and the spawning capacity of the river basin (beta). Knowledge of these parameters at high and low stock sizes permits construction of the Ricker production model.

An idealized production curve for the model is shown in Figure 2. The straight line A-B represents the production of age 2 recruits necessary to produce just the number of spawners needed to maintain the population, with no surplus available for harvest. The curved line A-C is the production curve. The capacity of the freshwater and marine habitat is limited, thus the dome shape of the curve. The decline of production at higher stock sizes illustrates the phenomenon that biologists term "density dependent mortality". This mortality reflects competition for food, spawning habitat, and predation. The highest point on the curve A-C is the optimum spawning capacity of the freshwater habitat (point D). MSY occurs at less than the optimum spawning capacity and is the maximum divergence between the replacement line A-B and the production curve A-C and is denoted as line E-F. Point Sy is the spawning escapement necessary to produce MSY. In order to determine the yield in terms of landed catch, the recruit value, equivalent to E-F, would have to take into account all of the age-specific factors acting upon the population. These include percent legal fish offshore, shaker mortality, fishery contact rates, natural mortality, and maturity rates. Details of the harvest rate model are described in Appendix III of the 1986 report of the Klamath River Technical Team titled "Recommended spawning escapement policy for Klamath River fall-run chinook".

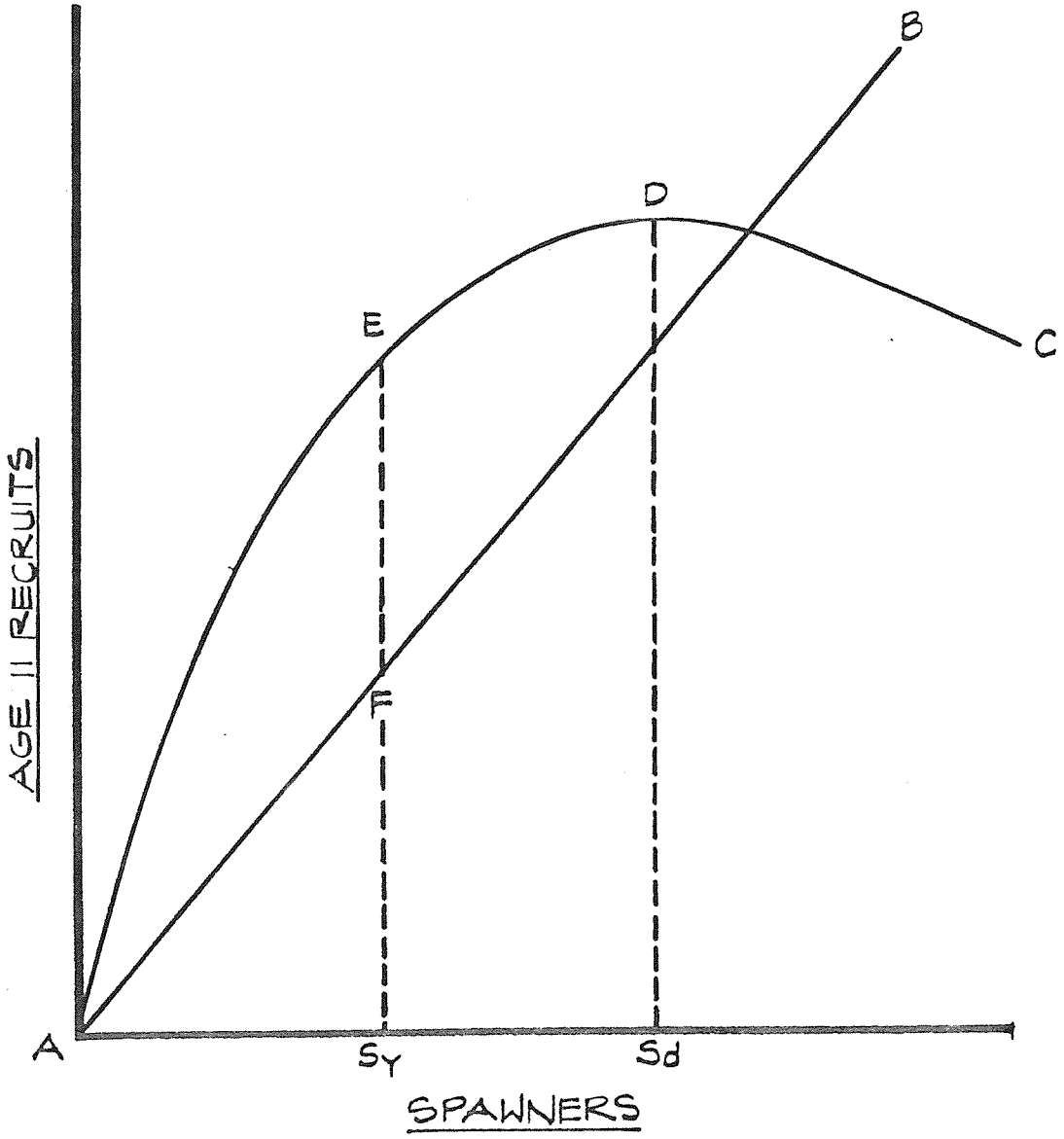


FIGURE 2. RICKER PRODUCTION MODEL (IDEALIZED)

Management of Klamath Fall Chinook.

Klamath River fall chinook mature and spawn at between 2 and 5 years of age. Those maturing at age 2 are called grilse and are predominantly males. Those maturing between age 3 and 5 are adults and are about evenly split between males and females. Fish born in several years are therefore alive at any one point in time to contribute to fishery catches or spawning escapements.

Fish spawned in a particular year are said to belong to that year's brood or cohort. For instance, adults that spawned in the fall of 1990 produced the 1990 brood or cohort of chinook. the cohort will continue to contribute to fisheries and spawning escapements until 1995, when remaining 5-year-old fish will spawn and die. Each cohort is tracked through time to determine what fraction is being harvested and what fraction is being allowed to spawn. The best information available at the present time indicates that about 33 percent of the potential adults from each brood or cohort be allowed to spawn with the remainder available for harvest. This management scheme, when carried out over many broods, will produce the maximum number of fish, given that habitat (both ocean and river) remains in good condition. This overall management scheme for Klamath fall chinook is called harvest rate management, and has been pursued since 1986.

The objective of harvest rate management is to harvest the fall-run chinook of the Klamath River at a rate that will produce maximum sustainable yield and fully utilize the productive capacity of the habitat. The current estimate of the rate that will do these things is 65% of each year class. It is important to remember that harvest rate management is based upon the productive capacity of the natural stock, which is much less than for hatchery fish. The mixing of the natural and hatchery stocks in the fishery will result, in the long-term, in production of salmon that are surplus to the brood stock needs of the hatcheries. It is also important to remember that harvest rate management is not a perfect regulatory tool -- the management models used in this system are still being refined.

In 1987 the Klamath Fishery Management Council arrived at a "Klamath River Salmon Management Long-Term Harvest Sharing Agreement". This agreement established an approximate maximum annual harvest rate of 65% per brood and an annual escapement floor of 35,000 naturally spawning adults. These management guidelines have also been adopted by the Pacific Fishery Management Council.

Harvest rate management requires that information on harvest and escapement be gathered each year so that progress of each brood can be determined. For Klamath fall chinook, this is done by marking a part of the production at each of the basin's two hatcheries. The mark used is called the coded-wire tag, a small piece of wire inserted in

the snout of the juvenile fish. To facilitate collection of these marked fish in fisheries and as they return to spawn, the adipose fin, the small fleshy fin on the back near the tail, is clipped.

Having a portion of the fish produced at the basin hatcheries marked, allows the fishery manager to estimate the distribution and contribution of Klamath River fish in ocean and river fisheries as well as those returning to the basin hatcheries and natural spawning areas. The distribution of Klamath fish in the ocean, and their contribution to ocean fisheries, is estimated by a model called the Klamath Ocean Harvest Model (KOHM). This model uses information collected over several years to show fishery impacts by month (May through September) over a large part of the ocean (northern Oregon to Mexico) and is used by the Klamath Fishery Management Council and the Pacific Fishery Management Council to structure fisheries in that area to achieve a target harvest level on Klamath fish.

Another model is used to estimate how management is doing relative to its goal of an escapement rate of about 33 percent. This model is actually a reconstruction of several cohorts or broods and estimates the escapement rate. Like the KOHM, the main source of data for this model comes from coded-wire-tagged fish.

Reconstruction of each brood takes many sources of mortality throughout the fishes life into account, such as natural mortality in the ocean and deaths caused by troll and net fisheries. Since Klamath River chinook live up to five years of age, mortalities over a long period must be taken into account.

Broods born between 1979 and 1985 can be reconstructed at the present time, but it will be several years before enough information is available to gauge the effects of harvest rate management.

Management of Klamath Coho.

Coho salmon originating within the Klamath-Trinity Basin are managed as part of the aggregate of coho stocks known as the Oregon Production Index (OPI) area. Ocean fisheries off the Oregon and California coasts are managed to meet escapement goals of Oregon coastal streams. The desired harvest rate for OPI coho is 50%. Limitations in the fisheries (generally numerical quotas based upon preseason projections of coho stock abundance) are intended to protect Klamath coho populations and allow escapements needed to protect future production. These management objectives are described in the PFMC's framework plan for salmon, adopted in 1985. The goal for coho escapement to Klamath River hatcheries (2,300 adults) has been met or exceeded in recent years, reaching a high of 23,000 in 1987. Assuming a harvest rate of about 50%, harvest of Klamath coho would be roughly equal to spawning escapement.

CHAPTER 1 THE DUTIES AND OBLIGATIONS OF THE COUNCIL

The Klamath Fishery Management Council reviewed the law to discuss explicitly the Council's functions, duties and obligations as an aid to planning its overall strategy. An outline of the Council's functions, together with an explanation of how, and under what conditions, these duties must be carried out follows.

1.1 Principal function of the Council

The principal function of the Council is to *make recommendations* to a variety of Agencies *for the management of in-river and ocean harvesting that affects, or may affect, Klamath and Trinity River Basin anadromous fish populations.*

1.1.1 Agencies to be advised

The Council must make its recommendations to five specific agencies as follows:

1. **California Fish and Game Commission** regarding in-river and offshore recreational harvesting regulations,

2. **Oregon Department of Fish and Wildlife** regarding offshore recreational harvesting regulations,

3. **Pacific Fishery Management Council** regarding ocean harvesting regulations,

4. **Bureau of Indian Affairs** regarding regulations for harvesting in the area by non-Hoopa Indians, and

5. **Hoopa Valley Tribal Council** regarding regulations for harvesting in the area by members of the Hoopa Valley Tribe.

6. **Yurok Interim Council**, regarding regulations for harvesting in the area by members of the Yurok Tribe.

1.1.2 Species to be managed

Although the Council has concentrated on the important **fall chinook** fish population it is equally responsible for all the anadromous species including **spring chinook, coho salmon, steelhead, sturgeon,** and **shad.**

1.2 Other requirements of the Council

In carrying out its principal function the Council must adhere to four Congressionally-established requirements. The Council must make recommendations that are

1. consistent with the Council's long-term plan and policy,
2. consistent with standards set by Congress,
3. given at least annually, and
4. given after public hearings have been held concerning the regulations to be recommended.

The following provides some specifics concerning these requirements.

1.2.1 Long-term Plan and Policy (Requirement 1)

The requirement for making recommendations that are consistent with the Council's Long-term plan and Policy implies that the Council must first establish such a plan and policy. That requirement is precisely the impetus behind the current strategic (long-range) planning process described in this paper.

In addition to establishing a strategic plan, the Council is obliged to make its recommendations and policies consistent with the goals of the Klamath Restoration Program. Currently the goals of that program are:

- Restore salmon production to optimum levels by a) increasing number of smolts per natural spawner and b) improving survival of smolts.
- Develop and maintain artificial salmon production programs.
- Coordinate and review projects that would adversely impact anadromous fish production.
- Conduct information and education programs and encourage community involvement.

1.2.2 Standards for recommendations (Requirement 2)

Congress has established five standards to be followed by the Council. As stated in the law the Council's recommendations must:

- be based upon the best scientific information available,

- minimize costs where practicable,
- avoid unnecessary duplication of regulations,
- take into account and allow for variations among, and contingencies in fisheries, fishery resources, and catches,
- be designed to achieve an escapement that preserves and strengthens the viability of the Area's **natural** anadromous fish populations.

Its duties and obligations thus identified, the Council began its planning to design its long-range strategy for carrying out those duties effectively and efficiently.

CHAPTER 2 THE ISSUES: FUNDAMENTAL AND SYMPTOMATIC

2.0 Identification and Structuring of Important Issues

Given the wide variety of backgrounds, experiences, and interests of the members of the Klamath Fishery Management Council, it is not surprising that a wide variety of perceived issues -- points of debate or controversy that require settlement or resolution -- were on the members' minds. In the context of designing an overall strategy, each Council member identified important issues from his or her perspective and explained their meaning. In all, about 60 issues were identified of which 31 were deemed the most important. The meaning and impact of each important issue was then fully explored by subjecting each issue to a series of one-on-one comparisons with other issues, asking the question each time "Does the non-resolution of issue X make worse the effects of issue Y?". A computer-based consensus methodology was employed to structure the issues.[1]

2.1 Fundamental and Symptomatic Issues

Those issues that, remaining unresolved, intensify or worsen the effects of other issues can be considered to be the *fundamental issues*. The others can be considered symptomatic issues. In general, treating the *fundamental* problems first can go a long way towards helping to reduce the severity of the overall set of problems. Often resolving or solving a fundamental problem will allow the absolving or dissolving of other more symptomatic problems at very little additional cost.

The issues that the Council identified, discussed and structured are given in Figure 3. Note that the issues on the left side of the diagram are the fundamental issues. Non-resolution of these fundamental issues tends to aggravate the sets of issues found on the right of the diagram.

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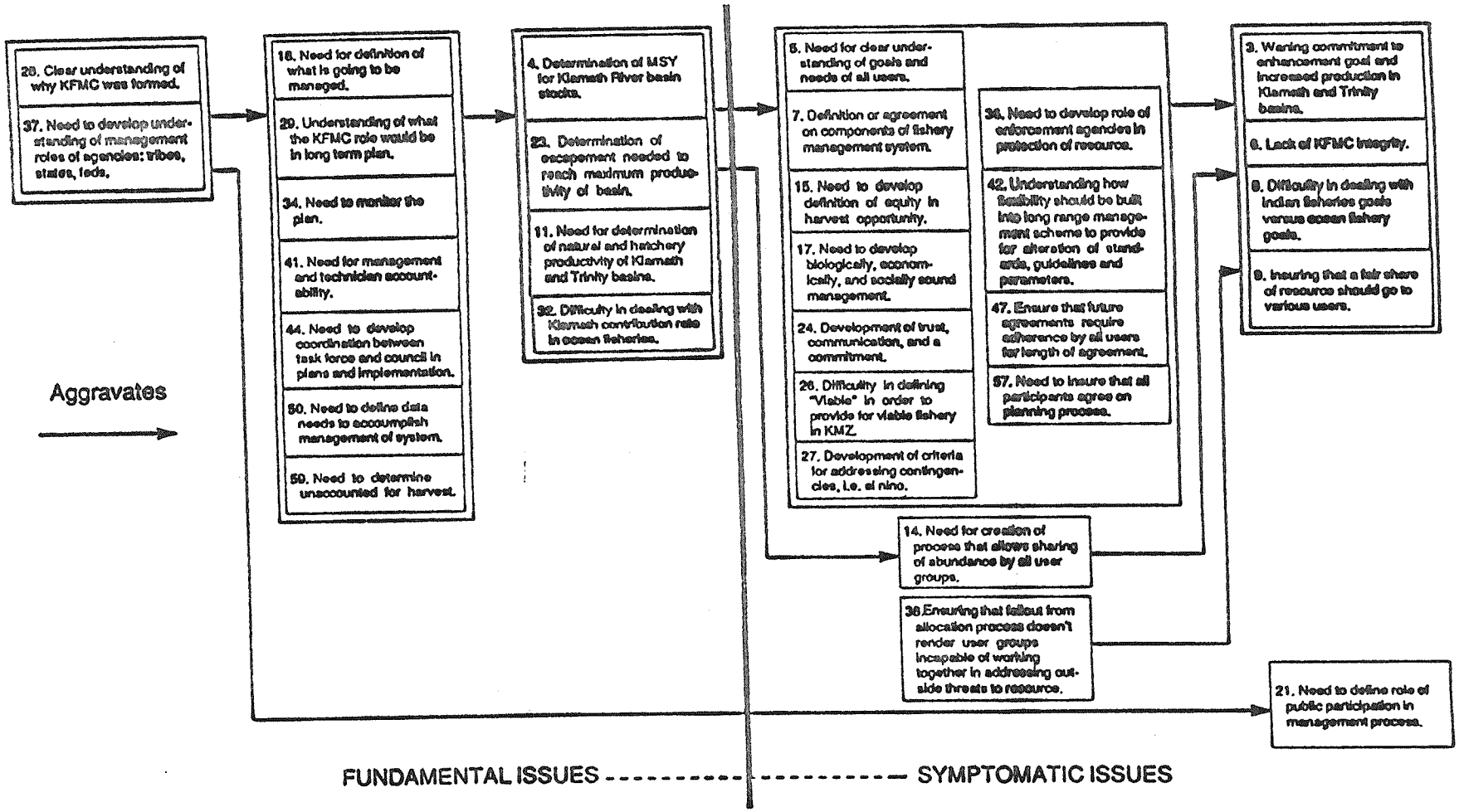
[1] The facilitated consensus methodology employed to structure the issues is known as Interpretive Structural modeling (ISM): A computer assisted learning process that culminates in the development of a structure of elements of a problem, plan, design, etc. See Warfield, John N. (1990) A Science of Generic Design: Managing Complexity Through Systems Design; Intersystems Publications, Salinas, CA

Figure 3

STRUCTURE OF THE FUNDAMENTAL & SYMPTOMATIC ISSUES OF THE KLAMATH FISHERY MANAGEMENT COUNCIL



CHAPTER 3 GOALS AND OBJECTIVES OF THE KFMC

3.0 Identification of Goals for the KFMC

Having been informed by the discussion of the issues and their relationships, the Council set out a series of goals and objectives that would, if realized, allow the Council simultaneously to carry out its functions in accord with the Congressional mandate and to resolve its important issues. Individual goals and objectives were identified and discussed by the Council. The final set of goals and objectives were structured into a "support" relationship using the same techniques applied to the issues (Figure 3).

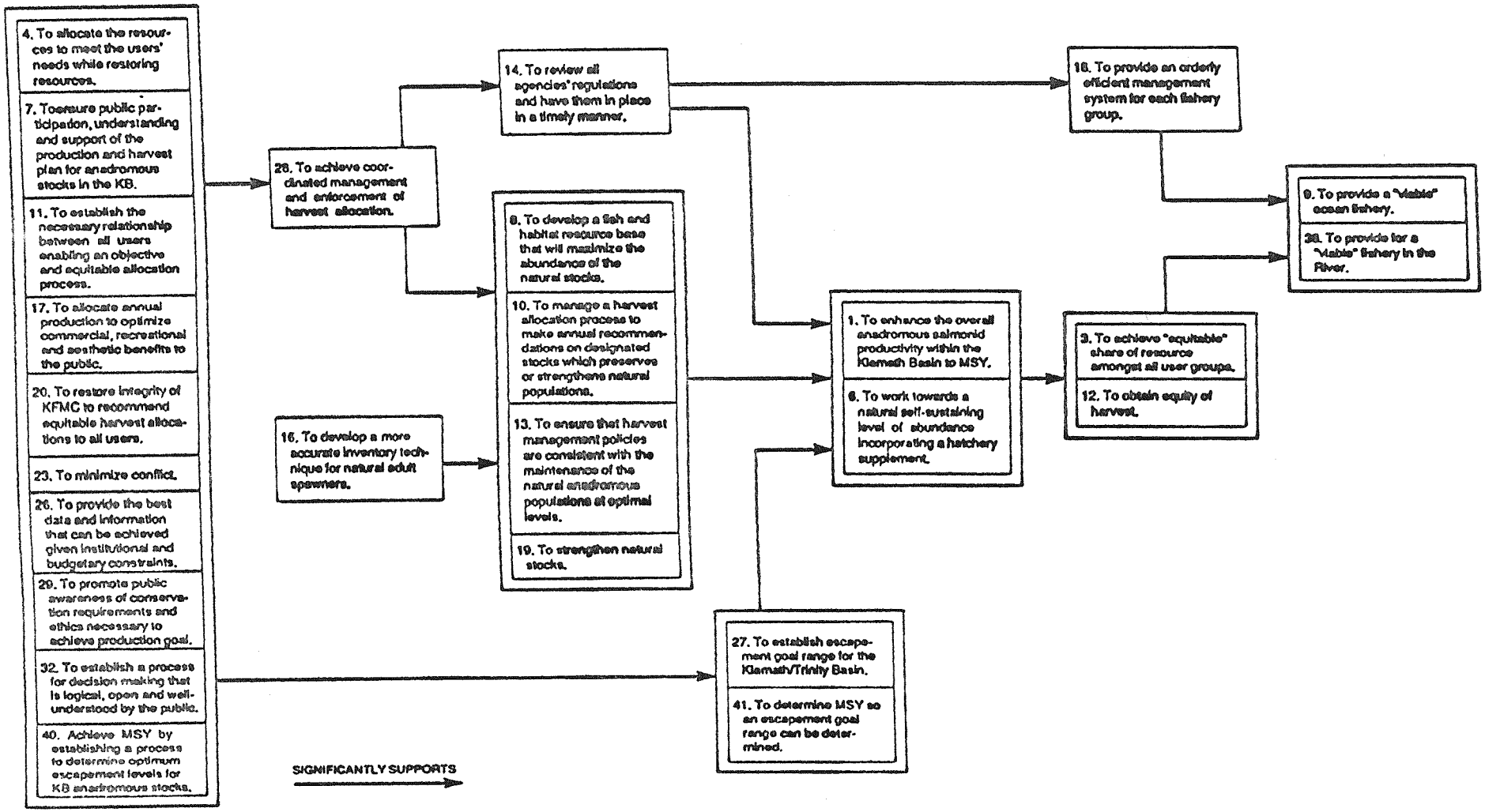
3.1 Relationships among the Goals

Figure 4 illustrates the fact that, like the issues, the goals are not independent. If certain goals were met, or if significant progress was made towards them, work towards the related goals would be supported. Taking advantage of this support relationship makes it easier to meet the goals. As an example, work towards achieving goal 16 -- *To develop a more accurate inventory technique for natural adult spawners* would significantly support the achievement of goal 8 -- *To develop a fish and habitat resource base that will maximize the abundance of the natural stocks*, goal 10 -- *To manage a harvest allocation process...*, goal 13 -- *To ensure that harvest management policies ... maintain natural populations..*, and goal 19 -- *To strengthen natural stocks.*

A study of the goal structure of the Council is valuable for two important reasons -- 1) to help in the creative definition of the activities, projects, tasks, etc. that will help meet the goals and solve the issues (see next Chapter), and 2) to help schedule the activities of implementation plans.

Figure 4

STRUCTURE OF GOALS FOR THE KFMC HARVEST MANAGEMENT SYSTEM



CHAPTER 4 THE OPTIONS FOR DESIGNING A STRATEGY FOR MEETING THE GOALS AND OBJECTIVES

4.0 Generation of Options

Having the issues and goals identified and structured, the Council was in a position to think about how to design a good strategy for meeting the goals and solving the issues. The Council set out a number of ideas for activities that could possibly become part of the overall strategy for pursuing the Council's goals and objectives. Each idea's intention and significance were carefully discussed until the meaning of the idea in the context of designing a strategy for the Council was clear.

4.1 Structuring the options into an options field

A group of proposed activities, or options, was identified and categorized into eight separate dimensions. Those dimensions are:

1. Decision Making Process
2. Harvest Management Strategies
3. Resource Assessment and Monitoring
4. Organizational Approach and Communication
5. Escapement Policy
6. Habitat
7. Allocation Strategies
8. Enhancement (Fish Production)

The entire set of options considered by the Council is displayed in Appendix A. For each option, an explanatory paragraph is provided. Note that the options are organized by category, or dimension. The set of options, organized by category, is called an options field, in planning terminology.

CHAPTER 5 THE DESIGN OF THE COUNCIL'S STRATEGY FOR MEETING ITS GOALS: THE CHOICE OF THE "BEST" SET OF OPTIONS

5.0 Specification of a Strategy from the Options Field

The design of the Council's strategic plan for meeting its goals and objectives is a matter of choosing activities (options) from each category of the Options Field (Appendix A). The set of selected options (planned activities, tasks, projects, etc.) becomes the strategy for achieving the goals. One can imagine that the selected options are the "stepping stones" (i.e.,sub-goals, objectives, or milestones) that must be reached and surpassed on the way toward achieving the goals. To produce a successful strategy, (i.e. a strategy that, if followed, will result in meeting the specified goals and objectives) the Council must select or approve options within each category. Failure to achieve a solution or improvement in any one category could mean failure of the Council to carry out its functions and overcome its problems; hence, the importance of specifying how each dimension of the problem will be handled.

Given a choice of which options to select (and which not to select) the Council was immediately faced with the question of choosing the "best" set of stepping stones so that it could reach its destination with a minimum of expense, a maximum of efficiency, and a high degree of certainty. To find the "best" strategy the Council needed criteria for determining what is "best".

5.1 Criteria for Specifying the Best Strategy

The choice of a *set* of options from each category across the options field is called an *alternative strategy*. Mathematically there is an enormous number (>15 million) of possible alternative strategies that could be specified from the Council's options field. Fortunately, all possible alternatives do not have to be specified to determine a satisfactory strategy. However, to discriminate among good and bad or better or worse alternatives that may be proposed, criteria are required. The Council specified the following criteria for evaluating proposed alternatives and for choosing the best or optimum alternative strategy:

Criteria for the Evaluation of Alternative Strategies

1. Net economic benefits to the users of the resources.
2. Cost of carrying out the program.
3. Degree to which users needs are met.

4. Preservation and strengthening of natural anadromous populations.

5. Degree to which standards of the Klamath Act are met.

6. Recognition of social values.

7. Achievable under current governmental structure.

Note: These criteria are not in order of priority.

5.2 The Specification of the KFMC Strategic Plan

The Council determined its strategy, or strategic plan, by considering each option within each of the eight categories, debating the pros and cons of including (or excluding) the option in light of the criteria and then deciding by majority vote explicitly to include or exclude the option. The set of options thus designated as the Council's strategic plan was adopted by the Council unanimously.

The strategic plan of the Council is represented by the set of selected options as listed below. The set of selected options represents the best alternative strategy that the Council could define, utilizing the specified evaluation criteria.

The Klamath Fishery Management Council's Strategic Plan:

Category 1 Decision Making Process

1.3 Maintain status quo (unanimous) decision-making process.

1.5 Establish a step-wise process for submitting harvest sharing agreement to PFMC for adoption.

1.6 Establish a step-wise process for submitting recommendations to other management authorities.

Category 2 Harvest Management Strategies

2.2 Coordinated seasonal management within the PFMC framework by time and area with quotas allowed.

2.4 Develop regulations that allow users access to the other stocks.

2.6 Design harvest regimes to achieve an appropriate balance between available natural and surplus hatchery stocks.

Category 3 Resource Assessment and Monitoring

3.1 Devise a monitoring program that enables instantaneous estimation of harvest status of all salmon stocks.

3.2 Seek funds for improved in-season data collection.

3.4 Determine potential production of each stock in the basin.

3.6 Develop a method to immediately identify hatchery fish.

3.7 Improve harvestability of hatchery fish by using methods such as altering stocks, release locations, and marking (fin clipping or other less damaging mark). See also the methods proposed in the Task Force's long-range plan pages 4-44, 4-45, 5-29 and 5-30.

3.8 Develop new sorting and harvest methods.

3.9 Institute a coast-wide Genetic Stock Identifier ocean landing sampling program to determine stock composition of ocean-caught landings.

3.10 Assess and monitor all anadromous species in the Klamath Basin.

3.11 Improve or establish cooperative resource assessment and monitoring by all the agencies involved.

Category 4a Organizational Approach

4.2 Maintain status quo organization.

4.3 Upon election of the Yurok Interim Council, the title of non-Hoopa representative will be changed to the Yurok representative.

4.4 Add seat to the Council for Karuk Representative. The KFMC will seek Congressional action to add this seat.

Category 4b Communication

4.7 Produce Newsletters and Flyers.

4.8 Vary locations of meetings.

4.9 Improve or establish communications with fishery management authorities on the Klamath in order to carry out our legal responsibilities.

4.10 Establish a coordination mechanism between the Klamath Fishery Management Council, the Klamath River Basin Fisheries Task Force and the Trinity River Restoration Task Force.

Category 5 Escapement Policy

5.1 Recommend that escapement be managed to produce maximum sustained yield for each Klamath River native stock group while protecting locally adapted stocks of any Klamath River tributary natural sub-population.

5.2 Develop optimum escapement levels for fall run chinook salmon through harvest rate management.

5.3 Recommend that all ocean and in-river fisheries that impact Klamath River stocks be managed in a manner consistent with Klamath River natural production.

5.5 Establish a threshold for natural stock productivity below which the KFMC will re-examine harvest strategies for natural stocks.

Category 6 Habitat

6.1 Require water flows adequate to achieve optimal productivity of the basin.

6.2 Mandate by law minimum habitat standards.

6.3 Seek the establishment of law that mandates minimum stream-flow standards.

6.4 Manage all ocean activities consistent with Klamath River natural production.

6.6 Council to make recommendations to task force and management authorities on habitat issues as they arise.

Category 7 Allocation Strategies

7.2 Establish an allocation system that is consistent with the legally defined harvest share allocable to tribal reserved fishing rights and allocate the remaining share among ocean (troll and sport) and in-river harvesters to optimize social and economic benefits.

7.3 All fishery management authorities will be given equal credence and co-management status by Klamath Fishery Management Council.

7.5 Explore the use of Individual Transferable Quotas (ITQ) natural Klamath Fall Chinook Equivalents to manage all fisheries (in-river and ocean).

Category 8 Stock Enhancement

8.1 Target harvest on surplus hatchery stock to strengthen depleted natural stocks.

8.2 Recommend to the Klamath River Basin Fisheries Task Force habitat and/or bio-enhancement measures for basin stocks found by Klamath Fishery Management Council to be weak relative to general basin productivity.

8.3 Assess the need for and explore methods of expanding production by hatcheries and/or other means of bio-enhancement.

5.3 Next Steps

The selected activities or projects comprising the strategy must be put into effect over the next several years if the Council is achieve its goals. When a final strategic plan is prepared following public and agency review of this draft, the major steps to accomplishing goals will be specified. The Council and its Technical Team must then set out operational plans, a budget and a program to carry out the strategy.

Appendix A

An Explanation of the Options Considered for Inclusion in the Klamath Fishery Management Council's Strategic Plan

The Options Selected for Inclusion in the Strategic Plan are Asterisked (****) and in Bold-faced Type

All other options were considered but not unanimously selected

Category 1. Decision Making Process

1.1 Mandate management dispute resolution by a mediation/arbitration process.

This option was offered as a way to make the Council more decisive on important issues. The Council has seldom been able, because of failure to reach agreement, to make recommendations on harvest allocations or similar issues for which it has legal responsibility to advise. Mediation or arbitration could be done within the Council, or it could employ the services of an outside individual.

1.2 Amend KFMC decision process to decide by 2/3 majority.

This option is intended to help the Council reach decisions and do its job of making recommendations by not requiring a unanimous vote but allowing 2/3 majority votes to rule. The 2/3 requirement still would enable either of the "sides" that typically line up in Council disputes -- in-river and ocean users -- to veto a motion.

**** **1.3 Maintain Status Quo (unanimous) decision-making process.**

The Council members decided to maintain the current procedures for transaction of business as defined in the Act 460xx-2(g)(1)(B) which states; "No comprehensive plan or recommendation referred to in subsection (b)(1)(A) or (B) of this section may be adopted by the Council except by the unanimous vote of all members present and voting."

1.4 Amend decision-making process to require 2 votes to veto.

This option is intended to encourage Council decisiveness. It was offered as middle ground between the current unanimous requirement, which is seen as working poorly, and the 2/3 majority proposed in Option 1.2. This would require an amendment to the Act.

****** 1.5 Establish a step-wise process for submitting harvest sharing agreement to PFMC for adoption.**

KFMC feels that it is essential for the successful culmination of any future agreements that the process for submitting harvest sharing strategies adopted by the Klamath Fishery Management Council be clearly defined and that the KFMC, upon adoption of the recommended agreement, enforce the provisions of the agreement.

****** 1.6 Establish a stepwise process for submitting recommendations to other management authorities.**

The KFMC is responsible for making recommendations to a variety of fishery management agencies and tribes. Prior to making those recommendations, public input will be sought. A stepwise process will be established that results in timely submission, review and discussion of the issues so that fishery management authorities can consider KFMC concerns in regulation formulation or plan development.

Category 2. Harvest Management Strategies

2.1 Coordinated seasonal management: time, area, not quota.

The intent of this option was to promote seasonal management -- by time and area -- as a replacement for quota management wherever quotas are in use, including river fisheries. Arguments against quotas include weak predictive value of data, and a tendency to promote brief, intense harvests. This option differs from Option 2.2 in that it would preclude use of quotas as a management tool.

****** 2.2 Coordinated seasonal management by time and area with quotas allowed.**

A coordinated seasonal management system by time and area would be employed to manage ocean and river fisheries to achieve an allocated harvest rate on Klamath River salmon stocks.

Time and area season openings would be designed to achieve the harvest rate through harvest impact analysis. In years of above expected abundance -- more fish than normally anticipated would be harvested and in years of less than expected abundance less fish than normally anticipated would be harvested, but in either case the harvest rate would be expected to be met by coordinating the expected KMZ, outside KMZ and in-river harvests.

2.3 Fine-tune allocations by allowing in-river fishing in all salmon spawning rivers.

The intent of the option was to shift from a management system that penalizes the ocean fishery for taking Klamath chinook -- as the present management ostensibly does -- to a system that would encourage harvest of non-Klamath chinook stocks. The option proposes to achieve this by re-establishing terminal commercial fisheries targeting strong chinook stocks in other rivers, such as the Sacramento or Rogue.

****** 2.4 Develop regulations that allow users access to the other stocks.**

Ocean users will develop good technical data that will allow them access to mixed ocean stock inside/outside KMZ. The in-river users (Indian/sport) will develop regulations that will allow them to optimize their opportunities.

2.5 Direct all river harvest to hatchery stocks only.

The intent is to spare depleted wild stocks, while allowing some in-river harvest. This is more feasible with steelhead than with salmon. Harvest methods that permit sorting live fish would be required.

****** 2.6 Design harvest regimes to achieve an appropriate balance between available natural and surplus hatchery stocks.**

The Klamath Fishery Management Council will seek to balance the harvest between natural and hatchery stocks as appropriate. Priorities should be given to situations where surplus hatchery stock can be targeted while maintaining MSY escapement levels for natural stocks. The Council shall utilize the expertise of the technical team for designing such harvest strategies.

2.7 Develop a terminal fishery.

The intent of this option is to spare depleted wild stocks, while allowing harvest of strong stocks. To be effective, most of the harvest would have to be shifted to terminal in-river fisheries -- not just in the Klamath River, but in all rivers. The ocean fishery would have to be greatly reduced owing to the inability to identify wild stocks or to target on non-wild stocks in the ocean.

2.8 Expand boundaries of the KMZ.

The intent is to decrease the contribution rate of Klamath chinook to the Fort Bragg and Coos Bay fisheries, thereby reducing ocean harvest impacts on Klamath chinook.

2.9 Open all commercial fishing to full seasonal management.

All commercial fisheries, including in-river fisheries, would be managed by seasons rather than quotas.

Category 3. Resource Assessment and Monitoring.

****** 3.1 Devise a monitoring program that enables instantaneous estimation of harvest status of all salmon stocks.**

The Council feels it is necessary to have a program in place so that fish can be easily and quickly identified by authorized persons after being landed. It is realized by the council that considerable funding must be provided by state and federal agencies to accomplish this task and that the task will require several personnel in the field.

It is the intention of the council to offer suggestions/conditions for in-season allocation adjustments.

****** 3.2 Seek funds for improved in-season data collection.**

The Council will request federal and state regulatory authorities to provide appropriated funding to accomplish in-season data collection.

3.3 Mark all Klamath fish.

The intent of the option is to improve access to non-Klamath stocks in the ocean fisheries, by permitting release of marked Klamath fish after ocean harvest allocations of Klamath stocks have been met.

**** 3.4 **Determine potential production of each species in the basin.**

Determine the maximum potential production of each anadromous species in the Klamath Basin with currently existing habitat conditions, and with enhanced habitat. Identify biological and physical "best mix," and expected potential production for each species.

3.5 Determine various potential mixes.

The intent of the option is to consider interactions between stocks in setting targets for harvest or escapement of each stock.

**** 3.6 **Develop a method to immediately identify hatchery fish.**

A fin clip, or as yet to be developed method, would be used to mark all Klamath River hatchery fish to enable harvesters to identify, at the point of capture, if a fish is or is not of Klamath hatchery origin. This would enable various fisheries to target on, or avoid, hatchery fish depending on the allocation strategy and sharing agreements currently in place. The developed method must make identification possible without fatal injury or undue stress on each fish.

Improved monitoring and assessment systems could be developed based on the capture of these marked fish.

**** 3.7 **Improve harvestability of hatchery fish by using methods such as altering stocks, release locations, and marking (fin clipping or other less damaging mark). See also the methods proposed in the Task Force's long-range plan pages 4-44, 4-45, 5-29 and 5-30.**

It is desirable to maximize both the survival and fishery contribution of hatchery fish. To do so may require changes in such things as the numbers or proportions of the various species or races currently reared in hatcheries within the basin and the places the juvenile fish are released. It may also be desirable to fin clip hatchery produced fish so that they can be identified in the various fisheries.

**** 3.8 **Develop new sorting and harvest methods.**

This proposal involves marking, taking fish alive, and then sorting and releasing non-target stocks. Methods should include incentives to encourage selectivity by harvesters, and reward additional costs and effort.

Live, unharmed capture methods for both the ocean and river would provide maximum flexibility and permit selecting of unmarked fish by species and size of fish taken, timing of the run, and area of capture.

**** 3.9 **Institute a coast-wide Genetic Stock Identifier ocean landing sampling program to determine stock composition of ocean-caught landings.**

Genetic Stock Identification (GSI) is a method of comparing protein enzyme samples taken from landed fish with baseline samples taken from juvenile salmonids from natal streams. It enables the determination of stock origin of natural fish which were not tagged. This system would provide managers with more information about the performance of natural stocks.

**** 3.10 **Assess and monitor all anadromous species in the Klamath Basin.**

Develop an information system at an appropriate level of detail to assess and continually monitor all Klamath Basin anadromous species to identify long-term trends, and provide information on species management needs and harvest availability. Monitoring would be by river sections, major tributaries, and areas of ocean harvest and use.

**** 3.11 **Improve or establish cooperative resource assessment and monitoring by all the agencies involved.**

Category 4a. Organizational Approach

4.1 Form a Klamath River producer's cooperative.

A Klamath River producer's cooperative could include fish harvesters, agencies, tribes, timber harvesters... all the groups that significantly affect, or benefit from, anadromous fish. The intent would be to give members an incentive to restore fish stocks and habitats by distributing dividends from harvest. Various types and levels of membership might be established.

**** 4.2 **Maintain status quo organization.**

The Klamath River Management Council will maintain its present organization, as required by the Act and implementing legislation, except as requested in option 4.4 to add a seat for the Karuk tribe.

**** 4.3 **Upon election of the Yurok Interim Council, the title of non-Hoopa representative will be changed to the Yurok representative.**

The Yurok Interim Council shall be invited to appoint an individual to sit on the KFMC as the Yurok Tribal representative. The incumbent will represent only the interests of the Yurok Tribe. This action will require technical amendment to the Act.

**** **4.4 Add seat to the Council for Karuk Representative.**

A new position shall be created on the KFMC for Karuk Tribal Representation. This action is consistent with current membership representation on the Klamath River Basin Fisheries Task Force. The Karuk Representative shall be appointed by the Karuk Tribal Council. The creation of this position will require an amendment to the Act.

Category 4b. Communication

4.5 Increase timely communication on agency management practices.

Policy, standards, and mechanisms will be developed and put in place by the KFMC which will define agency management practices which must be reported to the KFMC to facilitate Council deliberations. These practices shall include, but not be limited to items pertinent to harvest management such as: changes in level or methods of harvest monitoring; major changes or problems regarding hatchery practices; intent of action by agencies not represented on the KFMC which could have impacts on Klamath Basin productivity or returns.

4.6 Improve public involvement in problem solving strategies.

The council agreed that to bridge the communication gap there should be a multifaceted public information, involvement, and participation program to bring the interested public closer to the process.

**** **4.7 Produce Newsletters and Flyers.**

It is the intention of the Council to establish newsletters and flyers consistent with Department of Interior procedures. The purpose of the publications would be to inform the interested public of

1. Operations and authority of the KFMC
2. Current issues and meetings
3. Accomplishments
4. Upcoming events

The published material would be made available to all interested members of the general public and forwarded to specific groups upon request.

**** **4.8 Vary locations of meetings.**

The purpose of this action is to provide better and hopefully more participation by interested parties with the Council. Specifically, meetings would be held from time to time in areas other than Eureka such as: coastal communities in southern Oregon, Fort Bragg, the Hoopa Reservation, Yreka, Klamath and others as the Council so chooses.

**** **4.9 Improve or establish communication with fishery management authorities on the Klamath in order to carry out our legal responsibilities.**

The council will establish more formal communications with fishery management authorities as specified in the Act.

**** **4.10 Establish a coordination mechanism between the Klamath Fishery Management Council, the Klamath River Basin Fisheries Task Force, and the Trinity River Restoration Task Force.**

At present no formal coordination mechanism exists between these three federal advisory committees. In the latter part of 1992, the chairs of these committees will meet to consider policy level issues that cut across their jurisdictional boundaries.

Category 5. Escapement Policy

**** **5.1 Recommend that escapement be managed to produce maximum sustained yield (MSY) for each Klamath River native stock group while protecting locally adapted stocks of any Klamath River tributary natural sub-population.**

The Council proposes to manage escapement levels to achieve MSY for each run of anadromous fish (fall chinook, spring chinook, coho salmon, steelhead, etc.) from the Klamath Basin as a whole. The harvest, habitat, and artificial production actions will also be designed to prevent extinction of any tributary sub-population. Thus, some sub-populations may not be at maximum production but none will be managed to extinction and the whole basin will be managed for MSY.

**** **5.2 Develop optimum escapement levels for fall run chinook salmon through harvest rate management.**

It is the intent to discover the spawning escapement level which produces the maximum sustained yield for fall chinook salmon. Since that escapement level is currently not known, the Council recommends that the optimum level be determined by harvest rate management, based on the Technical Team's best estimate of stock productivity.

Harvest Rate Management allows the spawning escapement to vary over a wide range, thus defining the stock/recruit relationship and the optimum escapement level. At that point, the Council will manage by escapement level rather than harvest rate.

**** **5.3 Recommend that all ocean and in-river fisheries that impact Klamath River stocks be managed in a manner consistent with Klamath River natural production.**

The Council intends that the impact of all directed and incidental fisheries in the ocean will be managed to achieve a MSY escapement goal for Klamath River salmon stocks. This means managing all directed ocean fisheries so as not to exceed the target exploitation rates while limiting incidental impacts in trawl and other ocean fisheries to acceptable levels.

The impact of all in-river salmon fisheries will be managed not to exceed target exploitation rates such that in conjunction with properly managed ocean fisheries, the desired escapement will occur and thus maximum sustained yield for natural stocks will result in the long term.

5.4 Manage all ocean salmon fisheries consistent with natural productivity.

This option is based on changing the disparity between Klamath stock allowable catch being based on an ocean harvest of .35, while other stocks are fished on an ocean harvest rate of .7 to .8. If the overall ocean harvest rate was cut down, it might result in higher overall productivity.

**** **5.5 Establish a threshold for natural stock productivity below which the KFMC will re-examine harvest strategies for natural stocks.**

The KFMC has established a goal and escapement policy to produce MSY for the Klamath Basin as a whole. This is based on the expectation that an adequately seeded and productive habitat will produce a harvestable surplus in succeeding generations for the benefits of society.

The KFMC will direct the Technical Team to establish criteria and a regular analysis/reporting schedule to report on the productivity of the natural stocks. A serious decline in productivity caused by habitat deterioration or loss of genetic variability due to low population size or other genetic influences could jeopardize the expectation of benefits from a natural production management strategy. The KFMC will monitor natural stock productivity to ensure that the selected management strategies produce the expected benefits or to make adjustments in strategies as appropriate.

5.6 Amend escapement goal rate to include a ceiling.

The intent of this option is to modify the harvest rate management system so that if projections show high escapement, then harvest would be adjusted in-season to harvest part of the projected high escapement. This would be similar to PFMC's draft Amendment 10.

Category 6. Habitat

**** **6.1 Require water flows adequate to achieve optimal productivity of the basin.**

1) The Council must take appropriate action to ensure adequate water flows. It cannot, by law, make requirements for agencies water control, but it can review water releases and flow requirements under existing laws and regulations in the Klamath and Trinity River basins to determine their ability to achieve optimal productivity of anadromous species of fish, and

2) Work with the control agencies to effect changes in the operation schedules where optimal productivity is not now being reached.

**** **6.2 Mandate by law minimum habitat standards.**

The KFMC should identify and catalog all habitat characteristics which directly effect the production and migration of Klamath River anadromous stocks.

These characteristics should then be subjected to a qualitative analysis or assessment. The points at which any of these characteristics has degraded to the extent of causing a significant loss of salmonid production or impairment migration will be determined. These points will then be identified as minimum habitat standards.

Any party or entity which causes such habitat degradation below those minimum standards shall be required to reverse such activities and may be required to mitigate damages caused to the fishery or production.

This provision will be recommended to the appropriate law-making bodies for enactment.

**** **6.3 Seek the establishment of law that mandates minimum stream-flow standards.**

The KFMC will determine minimum stream-flow standards and seek minimum flow requirements for important streams within the basin. This will be done by any appropriate means available to the Council and its constituent groups. The Council does not have the authority to implement stream flow requirements but should be proactive within established procedures to encourage control agencies to establish flows that will protect anadromous fish populations.

**** **6.4 Manage all ocean activities consistent with Klamath River natural production.**

The KFMC must be sure that activities which could potentially depress ocean survival such as ocean dumping, pollution, mining or habitat destruction are adequately controlled and monitored. Any ocean habitat destruction could translate into depressed ocean survival for Klamath River natural as well as hatchery stocks.

A consistently depressed ocean survival would necessitate a reduction in harvest to maintain freshwater spawning escapement. The resulting reduction in harvest and productivity would cause serious social consequences. The KFMC will establish a mechanism to monitor marine habitat projects which may cause a concern for natural production.

6.5 Manage all ocean activities consistent with harvest management plans.

The intent of this option is to view the concern with ocean habitat destruction from the effect such deterioration would have on the harvest management plans.

**** **6.6 Council to make recommendations to task force and management authorities on habitat issues as they arise.**

The KFMC recognizes that harvest management issues are closely linked to habitat protection and enhancement. The KFMC has previously discussed habitat alteration and water management practices as they impact harvest plans and will continue to provide the task force and other management authorities with recommended actions deemed necessary to protect Klamath Basin anadromous fish.

Category 7. Allocation Strategies

7.1 Make four interim and one long-term allocation.

This option would require a study of the mix of each species occurring within the Klamath River Basin's different areas, inventory the allocation mixes that are possible, and then make allocations on how to get this mix. This would provide the biologically and physically best mix that emphasizes wild fish. The intent would be to set a long-term allocation target, and a series of interim allocations to get there.

**** **7.2 Establish an allocation system that is consistent with the legally defined harvest share allocable to tribal reserved fishing rights and allocate the remaining share among ocean (troll and sport) and in-river harvesters to optimize social and economic benefits.**

It is the intent of the Council to abide by the court's decision on tribal reserved fishing rights while optimizing social and economic benefits for all users.

**** **7.3 All fishery management authorities will be given equal credence and co-management status by Klamath Fishery Management Council.**

This option requires that the Klamath Fishery Management Council will give full and equal credence and co-management status to all state, federal, and tribal management authorities.

7.4 Institute an Individual Transferable Quota (ITQ) system for KMZ troll salmon.

This option was based a management tool that might be used in the future -- the concept of Individual Transferable Quotas (ITQ's). ITQ's consist of an allotment of fish -- Klamath chinook for example -- to a group or individual for a particular

zone that could be transferred to another party in another zone. Additional characteristics could be added; for example, when used in an area outside the original zone, the ITQ could be "worth" a different number of fish. In the KMZ, ITQ's would be "worth" more fish when used outside the KMZ than when used inside the KMZ (based on the expected lower contribution of Klamath fish when trolling outside the KMZ.

**** **7.5 Explore the use of Individual Transferable Quotas (ITQ) natural Klamath Fall Chinook Equivalents to manage all fisheries (in-river and ocean).**

KFMC should investigate the possible use of an ITQ system for all entitled fishery participants, ocean and in-river. In this system an individual would be annually issued a quota of fall chinook equivalents based on some (to be determined) qualification standard. They could then choose to sell it or exercise it as they saw fit.

For example: a fall chinook equivalent quota of 100 FCEQ's used in the KMZ in June would allow the landing of 200 salmon based on a Klamath Ocean Harvest Model Klamath contribution rate of 50%. 100 FCEQ's used off San Francisco in July would allow 1000 fish to be landed if the contribution rate in that area was 10%.

Successful fisherman could purchase FCEQ's as needed from other fishermen. There would be no time/area closures in this system.

7.6 Regulate effort shifts to reserve KMZ allocation for local fishermen.

This option intends to prevent effort shifts that cause KMZ quotas to be caught within a week. It addresses the problem, described to us by local people from KMZ ports, that outside trip boats can, at times, catch the KMZ quota in a few days. Small, part-time fishermen would support this idea (minor component of industry), the full time fishermen (the ones that are more mobile) would not like it as much. Area licensing to prevent boats from changing ports would limit a full-time fleet... and this is currently prohibited by the Magnuson Act.

7.7 Establish a minimum 50% split between Indian and non-Indian harvestable fish.

Indian harvest should be at least one-half the annual harvestable fish. This would be the opposite of the Boldt decision because Indian fishing rights on the Klamath are established by executive order, rather than by treaty. This option would apply to all Klamath fish stocks.

7.8 Establish .50 ocean harvest rate.

The effect of this option would range from the ocean fishery taking all the Klamath chinook harvest in a year of low projected abundance, to something not too different from what we have seen in years of high abundance.

7.9 Status quo (1989-90) percent shares among all users until agreement of all parties to modify or new legal direction occurs.

This option is to maintain status quo (1989-90) harvest shares (on percentage basis) among users until there is agreement of all parties to modify them, or seek new legal direction. Status quo would be defined as the actual shares among users of the past two years. The intent of this option is to use the PFMC's range of shares as a starting point, then work on modifying that to an agreeable percentage share.

7.10 Maintain status quo agreement .525/.325.

This option would consider the status quo as that situation existing in the 1987 agreement with harvest rates of .525 and .325.

7.11 Based on potential combinations of productions of the six species, develop a sharing agreement among all users for all six species.

This option is an attempt to establish a holistic decision-making process for the six anadromous species of fish. This option proposes to allocate harvests of all species at once so there can be trade-offs among species.

Category 8. Stock Enhancement

****** 8.1 Target harvest on surplus hatchery stock to strengthen depleted natural stocks.**

Naturally produced fish can accommodate less harvest than those nurtured in hatcheries. By shifting harvest strategies to the more productive hatchery component, depleted natural stocks could be allowed to rebuild at a faster rate. This would be particularly desireable if the natural stock was depleted by poor habitat conditions that had been corrected.

**** **8.2 Recommend to the Klamath River Basin Fisheries Task Force habitat and/or bio-enhancement measures for basin stocks found by Klamath Fishery Management Council to be weak relative to general basin productivity.**

Weak production units within the basin, when identified, should receive special consideration by the Klamath Fishery Management Council and the Task Force. This will insure that the basin's most critical enhancement needs receive a high priority and that harvest strategies will not be unnecessarily constrained by stock declines so severe that stocks are listed as endangered species under the Endangered Species Act.

**** **8.3 Assess the need for and explore methods of expanding production by hatcheries and/or other means of bio-enhancement.**

The KFMC will assess the need for and explore methods of expanding fish production with the use of hatcheries and/or other means of bio-enhancement. Assessing the need for enhancement will be accomplished pursuant to the stock status and fish production potential assessments (see Category 3). Care will be given to assessing any negative impacts that could be caused to existing natural fish populations by particular enhancement activities. Interactions between hatchery and wild juveniles (inter- or intra-specific competition or direct predation), genetic changes due to interbreeding, habitat degradation due to such activities as effluent discharges, and creation of mixed-stock harvesting dilemmas. The full spectrum of enhancement techniques and rearing strategies will also be explored.

Appendix B

GLOSSARY

ALPHA PARAMETER: A term of the Ricker production model that expresses the inherent productivity of the fish stock, when density-dependence is absent. See: stock productivity, density-dependence.

ANADROMOUS: Fish born in fresh water, migrating to the ocean during adult phase but returning to fresh water to spawn.

ARTIFICIAL CULTURE (PROPAGATION): Any human assisted spawning and rearing of fish in any type of hatchery facility.

CDFG: California Department of Fish and Game.

CODED WIRE TAG (CWT): Microscopic pieces of metal implanted in nose of salmon or steelhead with code indicating origin of fish (all coded wire tagged salmon must have an adipose fin clip).

COHORT: A group of fish all spawned in the same year.

CONSERVATION: The preservation, or wise use of, natural resources, as forests, fisheries, etc., for recreational or economic use.

CONTRIBUTION RATE: The contribution to harvest made by fish of a given stock, expressed as a proportion or percentage of that harvest.

DENSITY-DEPENDENCE: Decreased survival of fish caused by high population concentrations resulting in increased competition for food and space.

DENSITY-INDEPENDENCE: Factors influencing survival of fish that are not related to high population concentrations.

DRIFT NET: A gill net supported upright in water by floats attached to the upper edge and sinkers along the bottom so as to be carried by the current or tide.

ESCAPEMENT: Number of fish which escape harvest or natural mortality and return to spawn.

ESTUARY: The mouth of the river where fresh water and salt water mix; influenced by tides.

EXPLOITATION RATE: The proportion of available fish exploited by a fishery. Exploitation includes harvest and other causes of fish mortality, such as shaker mortality or gillnet dropout mortality.

GILL NET: A net suspended vertically in the water used to catch fish by the gills, preventing them from backing away and escaping. Different sized mesh are used for different species or size classes of fish.

GRILSE: A young salmon in the sea or which returns to the river to spawn after only one year in the ocean. Males are also known as "jacks".

HABITAT: The native environment of an animal or a plant providing food, water and shelter; the kind of place that is natural for the growth of an animal or a plant.

HALF-POUNDERS: Immature steelhead that have spent less than one year in the ocean and accompany adults on their spawning run; may be of either summer or fall/winter stock group; exist in only the Rogue, Klamath, Eel, and Mad Rivers.

HARVEST RATE: The proportion of available fish taken by harvest.

HARVEST RATE MANAGEMENT: Management of a fishery to achieve a desired harvest rate.

HATCHERY FISH: Fish originating from a hatchery or other artificial culture facility.

INDIAN COUNTRY: As defined in Federal law, all lands identified for Indian use, including: tribally-owned lands; trust lands outside reservations but held for tribal use; dependent Indian communities, such as Alaska native communities; allotted lands, meaning reservation lands allotted to individual tribal members; and ceded lands -- lands sold by tribes, but with certain rights retained by the tribe, such as hunting and fishing.

KFMC: Klamath Fisheries Management Council; allocates harvestable surplus of anadromous fish from the Klamath River between user groups.

KLAMATH MANAGEMENT ZONE (KMZ): A reach of ocean between approximately Shelter Cove, California, and Port Orford, Oregon. Salmon fisheries within the KMZ are regulated to protect naturally-spawning stocks of chinook salmon in the Klamath River basin.

MAXIMUM SUSTAINABLE YIELD (MSY): The greatest number of fish that can be taken without reducing the number of individuals necessary to propagate the species.

MITIGATION: To make less severe; fish planted at hatcheries to offset losses of salmon and steelhead production in areas blocked by dams.

MIXED STOCK FISHERY: Any fishery conducted on fish stocks from several river basins, or from hatchery and native populations, as they intermix in a lake or in the ocean.

OPTIMUM SUSTAINABLE YIELD: The biological concept of maximum sustainable yield modified to take into account social, economic or ecological factors.

PARAMETER: A variable -- or a constant -- appearing in a mathematical expression.

PFMC: Pacific Fisheries Management Council.

POPULATION: Group of interbreeding individuals of a specific kind, in a given area, at a given time.

QUOTA: A fixed upper limit on harvest, usually expressed in numbers or pounds of fish.

RECRUIT: A fish that is just large enough to become vulnerable to a fishery. For chinook salmon, recruitment is considered to occur at age 2, when fish become vulnerable to catch as "shakers".

SALMONID: Any fish belonging to the family Salmonidae which includes all trout, char, salmon, and whitefish.

SEASONAL MANAGEMENT: Control of a fishery by manipulation of "open" and "closed" time periods.

STOCK: A species or population of fish that maintains itself over time in a defined area.

STOCK PRODUCTIVITY: The number of progeny expected to be produced from a given number of spawners of a given stock. For Klamath salmon modeling purposes, progeny numbers are estimated at the two-year-old "recruit" age.

SUBSISTENCE FISHERY: A fishery where harvest is intended for personal use, rather than commercial sale.

TROLL: To draw a fishing line with baited hook or lure through the water from the stern of a moving boat.

WEIR: A structure spanning a stream; used by Indians to temporarily block spawning migrations to enable harvest. Also used by fishery managers to allow counting of migrating salmon or steelhead.

YEAR CLASS: All fish arising from the hatch of a given year; syn. cohort.

Appendix C
KLAMATH FISHERIES MANAGEMENT COUNCIL
MEMBERSHIP

Name and Address	Representing
Mr Dave Bitts 1485 Virginia Avenue Arcata, CA 95521	California Commercial Salmon Fishing Industry
Ms Virginia R. Bostwick Kamp Klamath RV Park P.O. Box 128 Klamath, CA 95548	Klamath In-River Sport Fishery
Ms Susan M. Masten P.O. Box 910 Klamath, CA 95548	Non-Hoopa Indians Residing in the Klamath Conservation Area
Dr Gary Matlock Regional Operations Director National Marine Fisheries Service 501 W Ocean Blvd, Suite 4200 Long Beach, CA 90802-4213	National Marine Fisheries
Mr Pliney McCovey, Sr P.O. Box 1348 Hoopa, CA 95546	Hoopa Valley Tribal Council
Mr Donald McIsaac P.O. Box 59 Portland, OR 97207	Oregon Department of Fish and Wildlife
Mr Al Petrovich California Dept of Fish and Game Inland Fisheries Division 1416 Ninth Street Sacramento, CA 95814	California Department of Fish and Game
Dr J. Lisle Reed Minerals Management Service Pacific OCS Region 770 Paseo Camarillo, MS7000 Camarillo, CA 93010	U.S. Department of the Interior

Mr Jim Walters 3205 N Street Eureka, CA 95501	California Offshore Sport Fishery
Mr Frank Warrens Automotive and Marine Services 50 N.W. 20th Avenue Portland, OR 97209	Pacific Fishery Management Council
Mr Keith Wilkinson H.C. 83, Box 278 Coquille, OR 97423	Oregon Commercial Salmon Fishing Industry