ATTACHMENT 12

A PROPOSED STRATEGY TO RECOVER ENDEMIC SPRING-RUN CHINOOK SALMON POPULATIONS AND THEIR HABITATS IN THE KLAMATH RIVER BASIN'

Prepared by
John R. West*
USDA-FOREST SERVICE
Klamath National Forest
1312 Fairlane Road, Yreka CA USA 96097

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*-Klamath National Forest Fisheries and Earth Science Staff Officer; Am. Fish. Soc. Certified Fisheries Scientist No. 1912

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Reference of the above individuals participation in the review of this strategy is not intended to imply that they agree with or support all proposed actions.

INTRODUCTION

Spring-run chinook salmon (Oncorhynchus tshawytscha) were once abundant in the Klanath River system as well as other northern California river systems. Habitat loss and degradation, fish harvest, and other natural and human influenced factors have contributed to dramatic declines in the number of adult spring-run chinook remaining in those systems today. The Klamath River spring-run chinook was designated a sensitive species by the USDA -Forest Service (fall, 1990) due to significant declines in adult escapement. Nehlsen, et al (1991) places this stock in the category "at high risk of extinction". Risk of stock extinction is very high within the next several decades and will accelerate with each succeeding generation assuming present average survival and exploitation rates remain unchanged (Figure 1). If survival rates are increased and/or exploitation rates are decreased, potential of this stock surviving will increase. Present adult population levels place this stock group at high risk of irretrievable genetic loss from randomly occurring natural or man induced events.

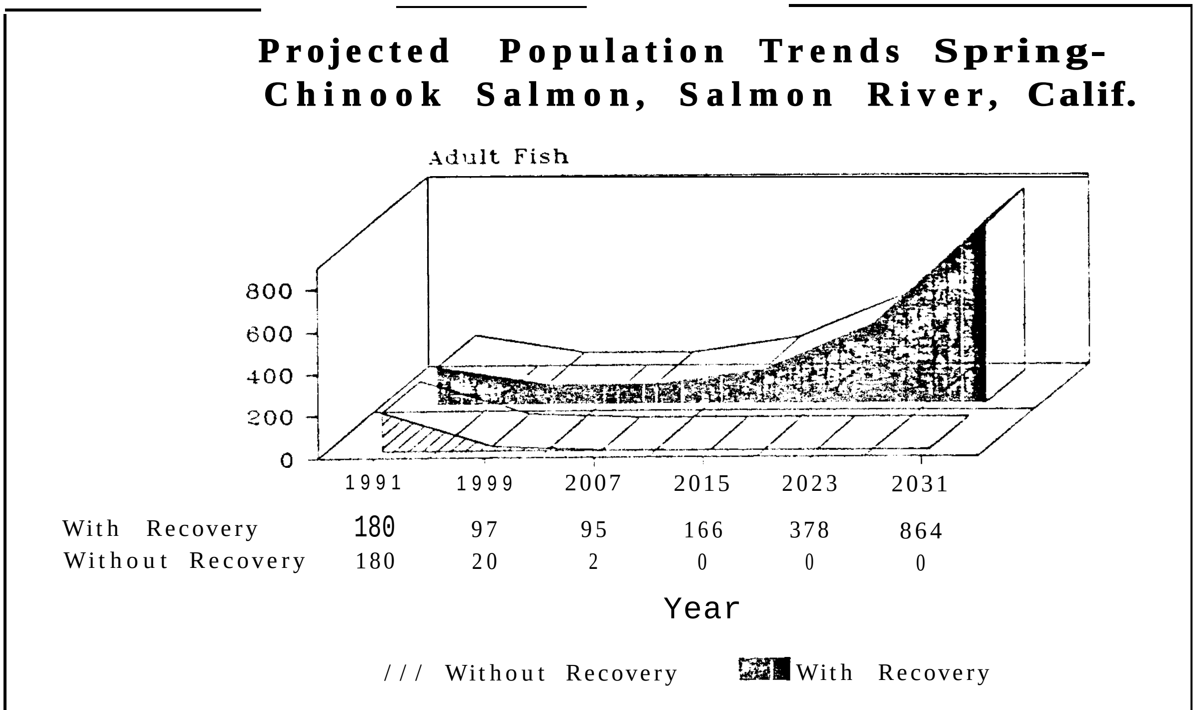

Figure 1. Projected population trend of Salmon River (CA) spring-run chinook salmon based on present average lifestage survival rates. Projections shown represent population trends with and without implementation of recovery strategy.

The Salmon River, tributary to the Klamath (Figure 2), provides habitat for the largest wild run of spring chinook in the entire Klamath River system. This run is possibly the largest remaining wild spring chinook run left in California (Campbell and Moyle, unpublished).

The purpose of the following strategy is to explore options available to reduce the risk of stock extirpation thus allowing this stock to recover to a stable population level. The following strategy is formulated based on the best information available (planning level information) and will be modified based on more detailed project level information as it becomes available. Some factors which influence population levels of spring-run chinook salmon are within the authority of the Forest Service to affect (eg: freshwater habitat condition), and other factors are beyond Forest Service authority (fish harvest, water withdrawal, ocean conditions, etc.). This strategy focuses on those elements which can be influenced by the Forest Service, while at the same time recognizing that many critical factors are beyond the Forest Service's scope of authority.

A key ingredient to the degree of success ultimately realized by this effort is the recognition that adequate protection of existing high quality salmon habitat is an essential and first priority.

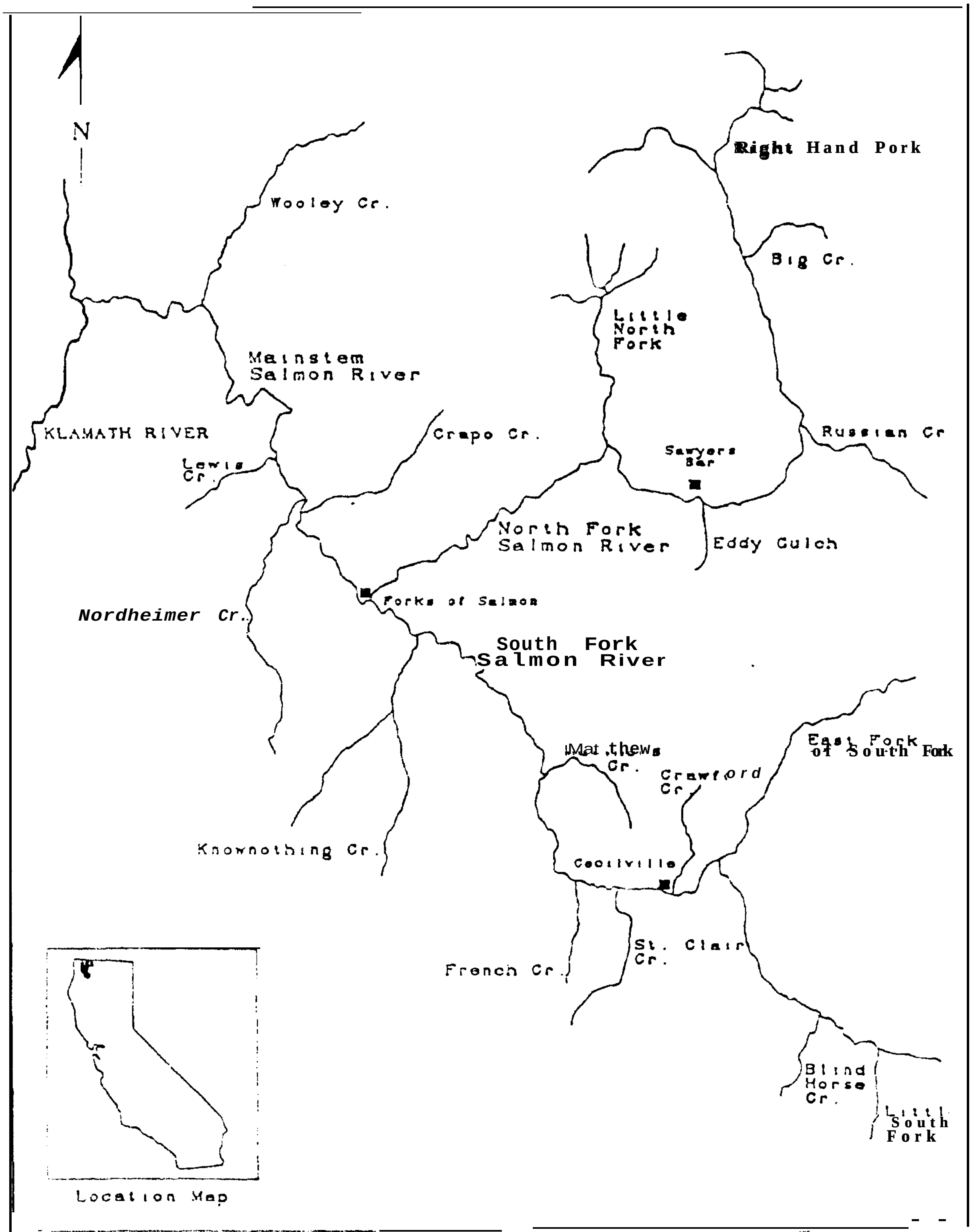

Figure 2. Location of spring-run chinook habitats, Salmon River and tributaries.

EXISTING CONDITIONS

Population status and lifestage survival

Escapement of Salmon River spring-run chinook to summer holding areas has fluctuated from an estimated 1200 to fewer than 200 adult fish during the period 1980 - 1991. "Holding escapement" (those adult fish which survive to return and hold over in river habitat the summer immediately prior to spawning) has fallen near or below the critical level of 200 adult fish for the past 3 consecutive years (1989, 1990, and 1991), indicating that stock viability may be jeopardized. The NMFS (1987) estimated that at least 200 adult Sacramento River winter chinook salmon were needed to avoid irretrievable genetic loss. Though little definitive information is available on stock viability, evidence is clear that effective populations of more than 500 fish may be necessary to reduce a stock's vulnerability to environmental stochasticity (Nehlsen, et al. 1991). An effective population size of at least 50 reproducing adult fish is the minimum necessary to avoid genetic problems associated with inbreeding (Nelson and Soule, 1987).

Estimated holding escapement of Salmon River spring-run chinook has fallen below 500 adult fish in six of the past twelve years (Figure 3). Holding adult escapement into Wooley Creek, a Salmon River tributary, is also at a very low level (Figure 4).

Ranges of survival from one lifestage to another (Figure 5) are based on literature reports as cited in the following discussion, or on more specific information from recent studies of spring-run chinook in the Salmon River (DesLaurier and Olson, personnal communication). Ranges of survival in the natural habitat are extremely variable for a variety of reasons, so applying an average survival rate herein is for discussion purposes only and should be considered hypothetically. Lack of definitive, stock specific information is a serious deficiency, however declining adult population trends will not reverse unless immediate prudent action is taken. During the next decade, it is imperative that stock specific information be gathered and incorporated into future actions designed to reverse declining trends. Waiting another 5-10 years until stock specific information may be available would increase the probability that this population would have fallen below the critical 50 fish effective population level.

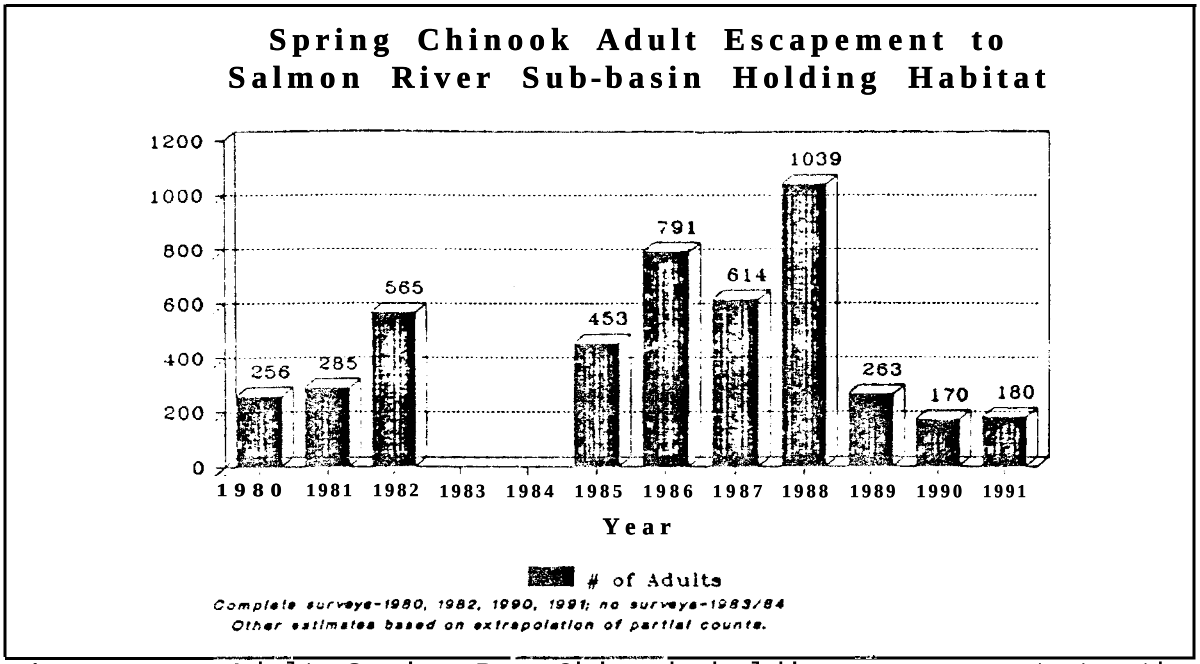

Figure 3. Adult Spring-Run Chinook holding escapement to the North Fork, South Fork, and Mainstem Salmon River,Ca. 1980 - 1991.

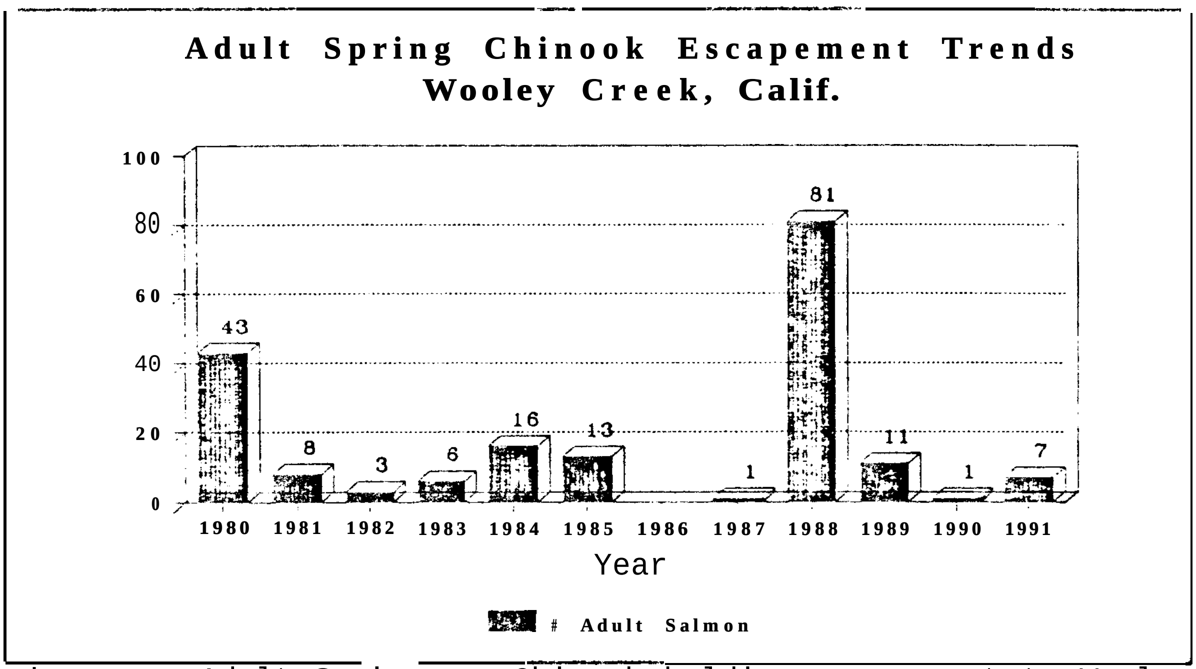

Figure 4. Adult Spring-run Chinook holding escapement to Wooley Creek, **CA. 1980 - 1991.**

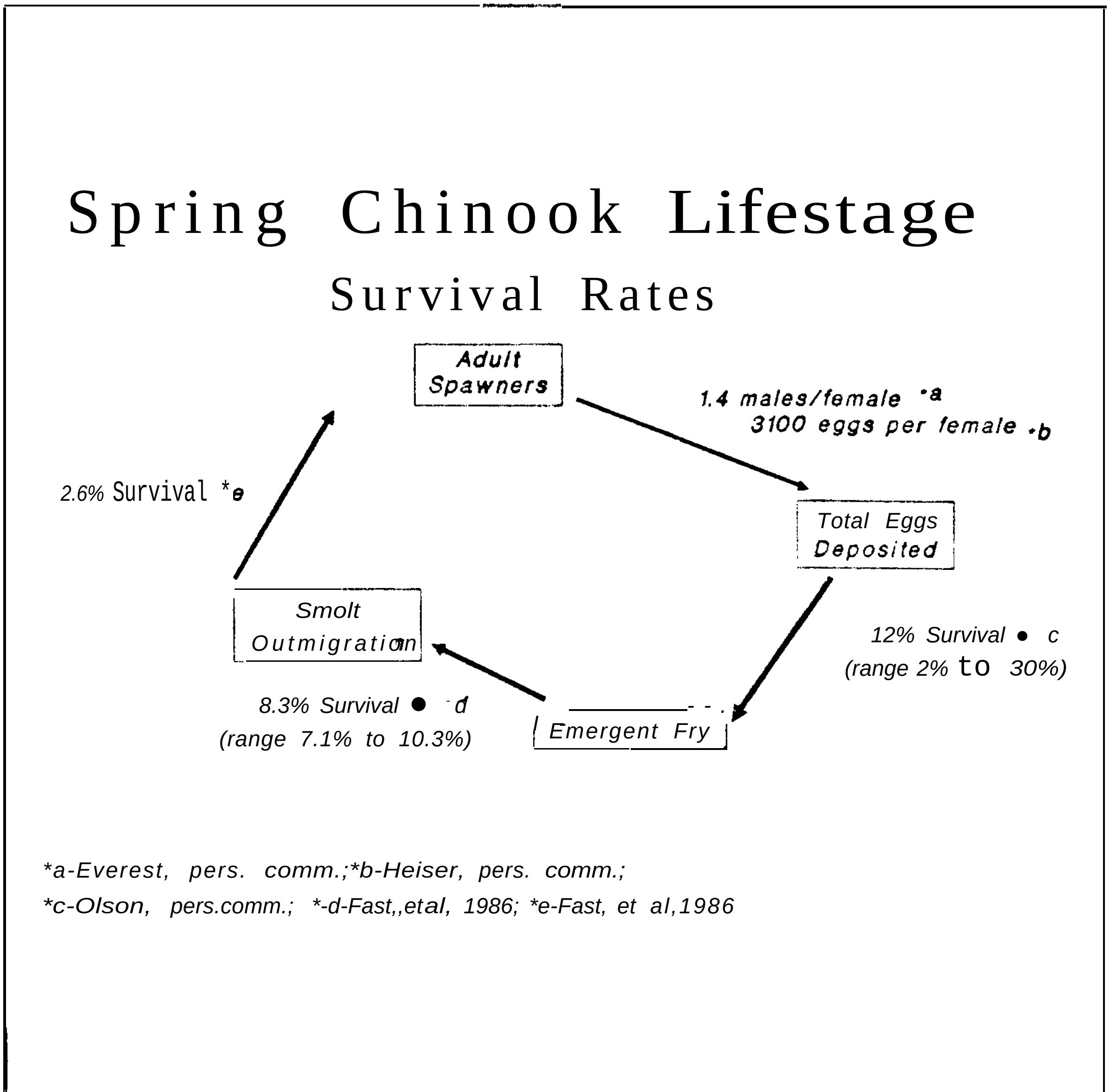

Figure 5. Ranges of survival by lifestage for spring-run chinook salmon in the Klamath River basin, based on site specific and research information.

Survival rates from "holding escapement" to successful spawning probably vary from year-to-year depending on flow conditions in holding and spawning areas and vulnerability of adult fish to poaching and predation. Radio telemetric tracking of adult spring-run chinook in summer 1990 indicated that survival from mid-summer tagging to spawning was about 75% (DesLaurier, personal communication; Figure 3). The effect tagging had on survival is unknown, but carcass examinations indicated that approximately 80% of the mortalities were a consequence of natural predation. The remaining 20% were suspect as being caused by illegal poaching. Fish behavior observations suggest that fish carrying implanted transmitters were not adversely affected and mortality rates were not significantly different from untagged adults.

There is little specific information regarding fecundity of spring-run chinook endemic to the Salmon River. Klamath River fall chinook spawned at Iron Gate Hatchery average approximately 3,100 eggs per female (Heiser, personnal communication). There is no information available on fertility of wild native spring-chinook stocks. Assuming all fish counted in 1991 survived to spawn and the sex ratio was 58% males and 42% females (Everest, personnal communication) approximately 233,000 eggs would be spawned in fall 1991.

Spring-run chinook spawning begins in mid-September and is completed by late October in the Salmon River. West, et al. (1990) found that spring-run chinook in the North and South Fork Salmon River selected low gradient riffles for spawning.

Water temperature can significantly affect fertilization and egg incubation success. Egg incubation is lengthy as a result of cold winter water temperatures typically found in Salmon River habitats. First emergence is not observed until March (Olson, personnal communication) and extends until early June. Fast et al. (1986) found similar emergence patterns for September-spawning Yakima River spring chinook, where emergence was first observed in early April and continued until the end of May. Conversely, Leidy and Leidy (1984) felt that emergence began in December and continued through February for spring chinook in the Klamath system.

Salmon egg-to-fry survival is variable depending on localized habitat conditions, discharge fluctuations, water temperatures, and other factors. Olson (personnal communication) found Salmon River spring chinook survival to emergence ranged from 2% to about 30%, averaging 12% during the 1990 brood year. Other research on salmon survival to emergence indicates that there is extreme variability, even within a single system. Koski and Phillips (as cited by Chapman, 1966) found coho survival to emergence averaged about 23% in Oregon streams. Bjornn (1978) found that chinook egg to migrant survival ranged from 15% to 52% in the upper Lemhi River, Idaho. Six Yakima River spring chinook redds had egg-to-fry survival rates ranging from 29% to 85% (Fast et al., 1986). Assuming egg-to-fry survival for the 1991 brood year averaged 12%, approximately 27,900 fry would emerge in 1992.

There is a considerable difference of opinion regarding length of freshwater rearing period for spring chinook. Leidy and Leidy (1984) believe that smolt outmigration was the same for the entire Klamath system and occurred between February and mid-June. Sullivan (1989) believes that Klamath River chinook demonstrate three distinct juvenile life history patterns:

-Type I fish begin smolt outmigration immediately after emergence, entering the estuary in spring:

-Type II lifehistory is represented by juvenile salmon who reside in freshwater from emergence until the following fall:

-Type 111 fish spend an entire year in freshwater habitat, entering saltwater in the spring following emergence.

Sullivan (1989) also found Type II and III fish were most common to Salmon and Scott Rivers, possibly indicating the presence of spring-run chinook in either or both of those systems. Spring-run chinook were reportedly present in Scott River until at least the early 1960's (Farrington, personnal communication), however Snyder (1931) reported that spring-run chinook were present only in upper Klamath tributaries (Oregon), Shasta River, and Salmon River until at least 1850. Recent investigations (West, et al. 1990; Olson, personnal communication: Olson and West, 1990) have found juvenile chinook salmon in Klamath tributaries (Salmon River, Elk Creek, and Scott River) as late as November. Reimers (1973) found that freshwater residence time played an important role in survival to adulthood of some Oregon coastal chinook salmon stocks. Juvenile spring-run chinook have been observed in the Salmon River system as late as January (Olson, personnal communication) , confirming Sullivan's findings (1989) which indicate the presence of Type III fish in the system. Where similar life history patterns are exhibited, Fast et al. (1986) found Yakima River spring chinook fry to smolt survival ranged from 7.1% to 10.3% (average 8.3% in the period 1981-1983). If survival from fry to smolt averaged 8.3% for the Salmon River 1991 brood year, about 2300 fish would survive to smolt.

Records from Trinity River hatchery at Lewiston indicate that two-year old hatchery spring-run chinook survive at rates from less than one percent to more than 30% in a single decade. Highest survival occurred from brood years 1983 and 1.984 (Tuss et al., 1990) which returned to the Trinity River in 1986, 1987, and 1988. Reasons for variability of survival rates of spring-run chinook from smolt to holding adult are not clearly understood. Average survival from tagged hatchery smolt t-o two-year-old return was estimated at about 2% in the same study. Historic ocean harvest rates have been reduced since 1984 for fall chinook, however the effect of those rate changes on spring chinook escapement to the Salmon River is unknown.

Yakima River 1983 brood year spring chinook returned as three and four year-old adult spawners at a rate of 2.6% (Fast, et al. 1986). Interestingly, that is the same brood year that survived at a very high rate to age two in the Trinity River system. Applying above cited ocean survival rates to the 1991 brood year, approximately 60 adults would survive to return to the holding habitat. Roughly 45 of those adult fish would survive the summer months in the holding habitat to spawn in the fall of 1995.

Survival rates for each lifestage are variable from year to year, influenced by a number of climatic and human affected factors. In 1987, 614 adult spring-run chinook were censused in the Salmon River holding habitat. Applying the average lifestage survival rates cited herein (Figure 5), 460 of those fish would have spawned, producing an estimated 154 adult fish to the holding habitat in 1991. Comparing the 1991 census results (180 adult fish) with the calculated estimate of fish which should have returned (154 fish), indicates that the lifestage survival rate estimation was conservative for that brood year. Comparison of other estimated and actual survival rates in the past decade indicate that there is considerable variability in actual survival in any year.

Available Habitat Suitability

Spring-run chinook habitat in the Salmon River is presently distributed between Wooley Creek, North Fork Salmon River, South Fork Salmon River, East Fork of South Fork Salmon River, and mainstem Salmon River. Approximately 177 km (106 miles) of habitat is typically accessible to spring-run chinook in this system.

Compared to Wooley Creek, North Fork, East Fork of South Fork, and mainstem Salmon River, the South Fork Salmon consistently holds the majority of the basins' spring-run chinook spawning population. The high frequency of primary pools and relatively low level of human disturbance are in part responsible for this distribution. Wooley Creek, designated wilderness, provides habitat conditions largely unaffected by human influence.

Sedell, et al.(1988,unpublished) defined six habitat elements critical to optimum survival of anadromous salmonids in third to fifth order Columbia River basin streams, east and west of the Cascade mountain range. Those elements are:

* Summer water temperature not to exceed 16° C;
* Fine sediments not to exceed 15% in spawning areas;
* Substrate embeddedness not to exceed 25% in riffles;
* Primary pools (over 1 meter deep) occurring at a rate that exceeds one per six channel widths:
* Riparian canopy composed of deciduous and coniferous vegetation, with a minimum basal area of 250 ft^2 per acre:
* In-channel key pieces of large woody debris present at a frequency equivalent to one piece per 15 lineal meters of channel.

Even though these elements require local modification for every basin in which they are applied, they represent conservative habitat conditions necessary for survival and production of salmon and steelhead anywhere on the Pacific coast (Sedell, personnal communication).

Spring-run chinook adult holding areas are characterized by low velocity pool or run habitats greater than one meter deep with cool summer water temperatures, substantial day-long shade, absence of human disturbance, and available cover near the pool bottom provided by bedrock ledges, boulder accumulations, or submerged large woody debris. Often adult fish can be found in areas where one of these features is absent, however cool water temperature and overhead cover seem to be critical to habitat use. When cool water is not readily available, adult and juvenile fish seek out cool tributaries or spring inflow as refugia.

The North and South Forks Salmon River have about 14939 m^2 of spawning habitat available in traditional spring-run chinook holding and spawning areas (1988 inventories). This amount can accommodate approximately 3248 spring-run chinook redds without superimposition (West, et al. 1990). An additional 5440 m^2 of spawning habitat is available in East Fork of South Fork Salmon River, enough to accommodate 1182 chinook redds (West, et al. 1988). Wooley Creek and other major tributaries to the Salmon River which could potentially support spring-run chinook (Little North Fork, Knownothing Creek, and Nordheimer Creek) have an unknown amount of suitable habitat available. Some streams outside the Salmon River system have suitable spring-run chinook habitat. Surveys indicate that these streams may be used by small numbers of fish or go unused each year (Surveys on file, Klamath National Forest).

Use of available spawning habitat by spring-run chinook spawners does not appear to be directly related to habitat availability. During fall 1988, 80% of the observed spring-run chinook spawning occurred in South Fork Salmon River, where only 35% of the available habitat is located. Conversely, the East Fork of the south Fork Salmon River contains 27% of the availabie habitat, but received only 8% of the total observed spawn (West et al. 1988, West et al. 1989).

Variability of habitat condition may be responsible for the range in survival of eggs to emergent fry. Habitat in East Fork of South Fork Salmon River produced the highest observed rate of survival-to-emergence (30%) in 1990/1991 water year (Olson, personnal communication). This was probably due to the low volume of fine sediment found in spawning gravels (avg. 6% by volume: West et al. 1988). Survival to emergence was poorest in the South Fork Salmon River (2%; Olson, personnal communication) where spawning area fine sediment volumes were higher (avg. 14% by volume; West et al. 1989). Survival to emergence information is unavailable for the remainder of the basin habitats.

Fine sediments in the South Fork Salmon River are a result of extensive deposits of weathered granitic rock upriver from Petersburg and in the Trinity Alps Wilderness. Results of an intensive watershed condition inventory conducted in summer 1991 (report_ in preparation) indicate that the river channel between Petersburg and Big Flat campground contains significant quantities of granite sand "dry ravel" and numerous granitic debris slides which deliver sediment directly into the stream system. Historic damage from mining activities and subsequent major floods continue to contribute significant quantities of fine sediment and sand.

Other factors which potentially affect egg to fry survival (discharge, gravel stability, and water temperature) vary substantially on an annual basis. Spawning gravel stability has been positively affected by instream habitat structure placement in the South Fork Salmon River since 1982 (West, personnal observation). Winter low water temperatures may negatively affect survival in habitats where formation of anchor ice is an annual threat.

Observed use of available rearing habitat (glide habitat types) ranged from 0.84 fish/m^3 in East Fork of South Fork Salmon (West, et al. 1988) to 0.001 fish/m^3 in North Fork Salmon River (West, et al. 1990). Juvenile spring-run chinook rearing appears to be influenced by water velocity, as evidenced by observed high fish densities associated with slow velocity habitat types. Other factors including presence of vegetative or woody cover, thermal refuge, and proximity to sediment-free interstices may play a role in rearing habitat importance (Olson, personnal communication).

Maximum summer water temperatures frequently exceed 20° C in rearing and summer holding habitat, and may result in reduced survival of fry and holding adults, especially under drought-flow conditions. High summer water temperatures have long plagued the Salmon River system and were first documented in 1934 by Taft and Shapovalof (1935). Orientation of the North Fork and South Fork Salmon River channels may aggravate high summer water temperatures. Riparian area damage suffered in the 1955 and 1964 floods was severe and most heavily damaged areas are still in poor vegetative condition (West et al., 1990).

Based on the previous summary of holding, spawning, incubation, and rearing habitat, it appears that none of the available habitat in the Salmon River basin meets the criteria recommended by Sedell, et al (1988, unpublished) for optimum anadromous salmonid production (Table 1).

Table I. Suitability of Spring-run Chinook Habitat in Salmon River (CA) basin.

Available Habitat Condition Suitability Summary; Criteria from Sedell, et al.(1989)

HABITAT ELEMENT	SOUTH FORK SALMON	NORTH FORK SALMON	EAST FORK/SOUTH FORK SALMON
H2O TEMP	NO	NO	NO
% FINES	NO	YES	YES
%EMBED.	YES	YES	YES
POOL FREQ.	NO	NO	NO
RIPARIAN VEGETATION	N O	NO	YES
KEY WOOD PIECES	NO	NO	NO

Yes = Meets Criteria; No ı Does nof M*eet Criteria*

Manaqement Policies

Present land management policies on National Forest administered lands provide the opportunity to adequately conserve existing high quality habitats. Pertinent policies include designation of minimum riparian management zones and conditions, and do not limit the opportunity of managers to increase the width or activities allowed within those areas. Width and managment activities within specific riparian management and adjacent zones should be prescribed by qualified fisheries and hydrology professionals to result in a net long-term benefit to riyarian dependent resources. Avoidance of ground disturbing activities on extremely unstable lands (landslides) and highly erosive soils is a "Best Management Practice" which is implemented on those areas.

DESIRED FUTURE CONDITIONS

Overview

The overall desired future condition is to allow natural processes to recover which will rebuild spring-run chinook stocks of the Salmon River in the next 5 decades. Management activities within the Salmon River basin should emphasize recovery of habitat condition and avoid activities which increase the risk of habitat degradation. The spring-run chinook population will probably continue to decline over the first decade following implementation of this strategy, however that declining trend will be slowed and eventually reverse after about 15 years. A stable viable population (representing the natural age structure) will be attained within twenty years. The strategy for achieving this desired future condition will require carefully setting implementation priorities and making adjustments in the implementation schedule as new information dictates. It is imperative that all portions of the strategy be implementated and closely monitored to ensure eventual long-term success. Positive or negative aberrations in the population level during the recovery period should be carefully studied before any adjustments are made in the implementation schedule.

Twenty Years - 2011

Spring-run chinook salmon adult spawning escapement will recover and stabilize at a population level ensuring viability of the stock group. Short-term strategies to increase the population will prevent further gene pool depletion and reverse the declining trend. Salmon River habitats will be more favorable for maintenance of this naturally spawning population, however conditions will still not be optimal (as described by Sedell, et al. 1988). Other potentially suitable habitats in the Klamath basin will be identified and restored as necessary providing options for rebuilding historic populations and increasing overall fish production for future generations of commercial, subsistence, and sport harvest. Riparian vegetation will be composed of a suitable mix of native deciduous and coniferous trees, but their growth during the period will still not provide adequate thermal regulation, or meet minimum basal area requirements. Channel features necessary for spawning and rearing will be improving through reduction of fine sediment input. Increased instream habitat complexity will be provided by addition of key woody debris features (Figure 6) and adequate frequency of primary pools. Trends of juvenile and adult populations will be monitored annually and habitat recovery trends will be tracked using standardized monitoring procedures. Composition of the stock group will be well understood as a

result of intensive research to differentiate between local populations and life history strategies they utilize. Predictive models will provide resolution necessary to allow harvest of some adults, maintain a strong gene pool, and increase spawning escapement.
Local citizens and involved agencies will cooperate to perform watershed restoration, monitoring, and to ensure that illegal harvest is recognized as socially unacceptable. Much of the restoration strategy will be implemented by local citizens, providing an opportunity for diversifying the local economic base. Results of citizen involvement in the strategy will increase public understanding of and appreciation for endemic salmon and steelhead stocks and their habitats.

Fifty years - 2041

Spring-run chinook salmon adult spawning escapement will stabilize at a population level allowing substantial sport, commercial, and subsistence harvest which significantly contributes to stability of the regional economy. Short-term strategies employed in the first decade of recovery will no longer be necessary to maintain the stable level of natural production, but will be employed in other Pacific Coast watersheds where similar stock groups are at risk. Salmon River habitats will be optimal, meeting or exceeding well understood production criteria. Other suitable habitats in the Klamath basin will be in advanced stages of recovery providing conditions suitable for healthy populations of spring chinook well distributed throughout the Klamath basin. Riparian vegetation will be composed of a suitable mix of native deciduous and coniferous trees providing adequate thermal regulation, meeting density and size requirements. Channel features necessary for spawning and rearing will be resilient enough to withstand natural fluctuations of sediment input and flooding without impairing fish productivity. Complex instrean and riparian habitats will be maintained through natural processes and the agency roles will focus on stewardship, education, and public involvement. Habitat and watershed restorations effected in earlier decades (1991-2011) will be replaced by natural processes allowed to operate within the managed landscape. Trends of juvenile and adult populations will continue to be monitored annually and become the focus of community involvement. Salmon River and other Klamath basin habitats will be nationally recognized for their excellent water quality, fisheries, and related recreation opportunities which will generate significant tourism revenue for the local communities.

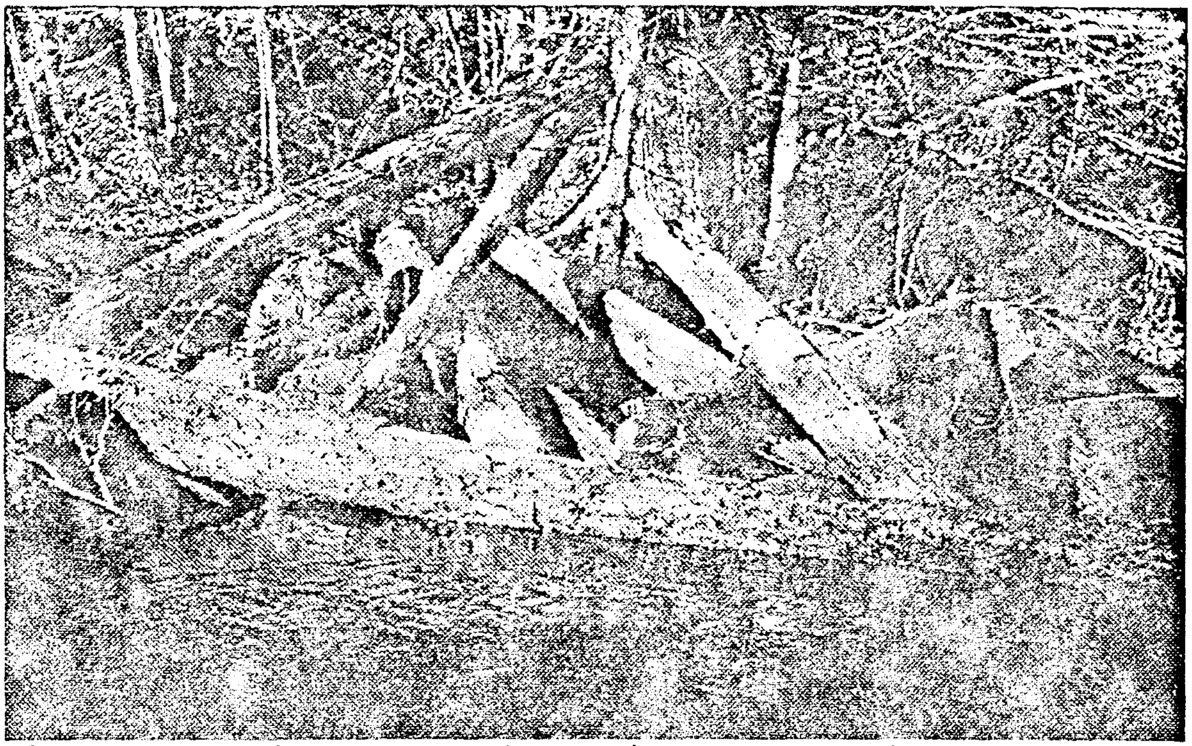

Figure 6. Typical Key woody debris structure placed to restore salmonid adult holding and juvenile rearing habitat complexity (Elk Creek, **Calif.)**

MANAGEMENT OBJECTIVES

Fish Population and Lifestage Survival

1991-2011: Stock Viability -

SV-1 - Adult spawning population will continue to decline until year 15 when it will begin to increase. Population may fall below 100 adult spawners during the period. Increasing escapement after 2003 will be reflected **by** more than one adult fish returning to spawn from each parent spawner.

sv-2 - Average annual egg to fry survival rate will equal 23% by the year 2001.

SV-3 - Minimum annual smolt production will exceed 5,000 fish **by** 2011.

SV-4 - Average fry to smolt survival rate will equal or exceed 10% by the year 2001.

sv-5 - Average annual smolt-to-adult spawner survival rate will equal or exceed 3% by the year 2001.

SV-6 - Genetic composition of stock group within the Salmon River basin will be well understood. All actions will allow natural genetic selection to operate unimpaired.

SV-7 - Average fecundity of endemic spring chinook by age class will be understood. Population age structure will return to historic condition, adequately representing age 2, 3, 4 and 5 spawners.

SV-8 - Site specific lifestage survival rates, juvenile life history types, frequency of lifehistory type occurrence, and relationship of survivability to adult spawner will be understood.

SV-9 - Fish population will be monitored involving public and cooperators in annual accomplishment.

2011-2041:

Stock Productivity -

SP-1 - Annual spawning population will increase from fewer than 150 fish at the beginning of the period to over 2000 fish after 2041. Substantial numbers of adult fish will be available for harvest annually.

SP-2 - Annual average egg to fry survival rate will equal or exceed 30%.

SP-3 - Minimum annual smolt production will increase from about 3000 fish in 2001 to an average of 75,000 by the end of the period.

SP-4 - Annual average fry to smolt survival rate will equal or exceed 10%.

SP-5 - Annual average smolt-to-adult spawner survival rate will equal or exceed 3%.

Available Habitat Suitability

1991-2011: Inventory and Restoration

HA-1 - Watershed condition in basins affecting spring-run chinook habitat will be known by 1996. High priority basins will be completed by 1993, to allow action item implementation to begin as soon as feasible.

HA-2 - Salmon River basin specific habitat elements and conditions critical to holding adult and juvenile rearing survival will be understood by 1996.

HA-3 - Klamath basin-wide spring run chinook habitat condition will be known by 2001.

HA-4 - Manage riparian areas for optimum thermal regulation on all perennial streams and sediment reduction/bank integrity maintenance on all perennial and intermittent streams affecting spring chinook habitat. Professional hydrologist and/or fishery biologists shall prescribe and establish Streamside Management Zones by 1993 and prescribe activities necessary to maintain or accomplish riparian objectives. Riparian area vegetation conditions will be in the process of becoming more suitable through planting endemic species of evergreen and deciduous trees: plantings completed by 1996.

HA-5 - Net long-term reduction of sediment input to all 4th order and larger streams will be accomplished by controlling management activities: landscape management activites will focus on implementation of the recovery strategy and protection of existing spring-run chinook stocks and their habitat: stabilize erosion and sediment input sources **as** identified. Activities will be designed to result in **a** long-term net reduction of sediment input to spring chinook habitats (4th order and larger watershed scale). Vegetation management will focus first on recovery of habitat suitability and next on prevention of catastrophic watershed damage from large wildfires.

- HA-6 - Meet instream habitat complexity objectives by 2001: primary pool and woody debris frequency, cover for adult fish. Habitat structural elements will be regularly evaluated to ensure objectives are being met most efficiently.

HA-7 - Long-term habitat and watershed monitoring **will** provide insight into whether management objectives are or will be met.

2011-2041: Natural Recovery

NR-1 - Watershed condition in Klamath basin streams (outside Salmon River basin) previously identified as suitable for spring-run chinook production will be known.

NR-2 - Riparian area vegetation conditions will be approaching management objectives by end of period. Streamside Management Zones will maintain or accomplish riparian objectives.

NR-3 - Fine sediment input will be reduced to near natural levels within the transport capacity of each basin. The objective of road management will focus on implementation of the recover] strategy and protection of existing spring-run chinook stocks and their habitat: erosion and sediment input sources will be stabilized.

- NR-4 - In Klamath basin streams previously identified as suitable for spring-run chinook production, instream habitat complexity objectives will be met during the period: primary pool and woody debris frequency, cover for adult fish.

ACTION STRATEGY

The following action strategy is formulated based on the best information available (planning level information) and will need to be modified based on more detailed project level information as it becomes available.

A series of Action Options are presented and described in detail. The numbering of Action Options is not intended to suggest priority for implementation, all are relatively equal priority and all must be implemented if the strategy is to succeed. Table II displays annual implementation cost, time period for implementation, and total cost of implementation. Detailed descriptions also indicate which of the action options may be subject to change based on development of new information. The strategy will be scheduled in a logical sequence to allow development of site specific prescriptions prior to implementation of a related action option.

ACTION OPTIONS

Al - Monitor natural and supplemental smolt production annually at five sites: South Fork Salmon River, North Fork Salmon River, East Fork of South Fork Salmon River, Wooley Creek, and mainstem Salmon River. Annual cost would average $50,000 to maintain five traps.

A2 - Conduct freshwater life history study to validate site specific lifestage survival rates, juvenile life history types, frequency of occurrence, and relationship to survival to adult spawner. Research would also identify habitat factors limiting survival of rearing fish to smolt. Inventory Salmon River basin thermal conditions to determine suitability of and potential affects of tributaries on known suitable habitat. Complete cost for single study occurring over 4 year period would be $240,000.

A3 - Establish natural stock spawning channel to provide increase in short-term stocking level. Wild fish would be trapped in the holding habitat and transported to the spawning channel. A maximum of 30% of the annual holding adult population would be moved to the spawning channel. Fecundity of endemic fish could be determined at this facility. The spawning channel would be constructed to control sediment and high emergence could be expected. The channel could develop a brood stock for future outplanting and reseeding of other historic habitats when production goal for basin is met. Spawning channel cost would be approximately $200,000 for construction and $10,000 for annual operation until a run was established.

A4 - Harvest Rate Management - Eliminate poaching through a combination of public education, social pressure, and concerted community-based enforcement. Elimination of poaching would increase holding adult survival from 75% to 80%. Annual cost unknown at present time but possibly about $5000. Advocate ocean and in-river harvest rates if necessary to meet objectives of the strategy.

A5 - Determine genetic composition of Salmon River basin spring chinook population to establish how many stocks are present. Extend present proposal of Cal Poly-SLO for one year at a cost of $35,000.

A6 - Monitor adult fish returns to holding habitat and spawning grounds. Cost of cooperative holding habitat inventories in the entire Salmon River basin approximately $5000 per year. Annual spawning ground inventories would cost an additional $82,000 per year.

A7 - Complete Watershed condition inventories for all subbasins within Salmon River basin by 1996 which have not been inventoried. Approximately 425,000 acres remain to be inventoried in this basin. To complete this task in 5 years would require that 85000 acres be completed per year at an average cost of $3 per acre. Annual cost of $255,000 for 5 years - total cost of $1,275,000. Watersheds would be prioritized based on past disturbance level and projected opportunities for restoration to reduce sediment production.

A8 - Complete inventory of existing fish habitat condition in Wooley Creek, Clear Creek, Dillon Creek, and third order Salmon River tributaries. Use standard modified Bisson method of inventory on approximately 85 miles of habitat for a cost of $85,000.

A9 - Plant Riparian vegetation in first through fifth order drainages (1105 miles) within Salmon Basin. Total mileage of 3rd to 5th order streams estimated to be 85 miles, 2nd order total est. = 255 miles, 1st order est. = 765 miles. Estimate 24% deficiency in shade and conifer composition in riparian zones and 70% of the acres are plantable. 25 acres per stream mile x 1105 miles = 27,625 acres x .7 (plantable) = 19,340 acres plantable x .24 (deficient acres) = 4641 acres to plant at an average cost of $270 per acre. Total cost = $1,253,000. Planting schedule would be prioritized based on tributary basins with temperatures exceeding maximum recommended summer temperature.

A10- Road stabilization and erosion control on 20 miles of road per year at a cost of $3350 per mile. Average annual cost = $67,000. Slide stabilization, estimate 1000 landslides within inner gorges of 1st to 3rd order drainages. Average rehab cost per site is est. to be $2000. Rehab. 50 slides per year at annual cost of $100,000.

A11- Provide instream habitat complexity to meet criteria for 85 miles of 3rd to 5th order streams (20 pools per mile). Present condition is equivalent to 17 per mile, therefore need 3 pools/mi. x 85 miles = 255 pools at a cost of $2000 each = $510,000. Place 51 pools per year at an annual cost of $102,000. Criteria is 20 pieces of key wood per thousand linear feet, have 2 pieces per thousand lineal feet. 449,000 lineal feet of 3rd to 5th order channel need treatment. 449 x 18 pieces = 8082 pieces to be placed. Average wood structure contains 6 pieces and costs $1100 to place, therefore: 8082 pieces/6 pcs per structure = 1347 structures x $1100 each = $1,481,700 total. Place 270 structures per year to complete by 1996. Average annual cost = $297,000. Place submerged cover structures in 200 5th to 7th order channel pools for adult holding cover. Cost $1500 per structure x 200 = $300,000 total or average $60,000 per year to complete by 1996.

A12- Develop and implement long-term habitat and watershed condition monitoring strategy. Development cost estimated at $40,000. Annual implementation cost unknown but estimate $80,000.

Table II. Action Options to recover spring-run chinook and their habitat showing annual and total cost between 1992 and 2041.

ACTION OPTION	ANNUAL COST	COST 1992-2001	TOTAL COST 1992-2041
Al-Smolt Monitor	$ 50,000	$ 500,000	$2,500,000
A2-FW Lifehistory	$ 60,000	$ 240,000	$ 240,000
A3-Spn Chan costr	$200,000	$ 200,000	$ 200,000
A3-Spn Chan Oper	$ 10,000	$ 100,000	$ 100,000
A5-Genetic Compos.	$ 35,000	$ 35,000	$ 35,000
A6-Fish Monitor	$ 87,000	$ 870,000	$4,350,000
A7-Watershed Invt.	$255,000	$1,275,000	$1,275,000
A8-Fish Hab. Invt.	$ 85,000	$ 85,000	$ 85,000
A9-Riparian Reveg.	$125,300	$1,253,000	$1,253,000
A10-Erosion Ctrl.	$167,000	$1,670,000	$3,340,000
All-Instream Rstr.	$459,000	$2,295,000	$2,295,000
A12-Wshd Mntr.Dvl.	$ 40,000	$ 40,000	$ 40,000
A12-Wshd. Monitor	$ 80,000	$ 800,000	$4,000,000
TOTAL PROGRAM	$1,653,300	$9,363,000	$19,713,000

STRATEGY IMPLEMENTATION N

Implementation of the proposed recovery strategy will require appropriate scale environmental analysis and documentation of ground disturbing activities and securing necessary levels of funding. Funding sources for implementation include traditional National Forest System mechanisms, cooperative cost sharing opportunities with California Department of Fish and Game and the U.S. Fish and Wildlife Service. Historic budget trends indicate that traditional funding sources and mechanisms may not provide adequate funds for timely implementation. Other non-traditional sources must be identified and aggressively pursued to effectively complete strategy implementation. The Klamath National Forest or Pacific Southwest Region should establish a position to coordinate and manage implementation of the recommended strategy. That position would be responsible for preparing project level funding proposals and ensuring that recommended actions are completed in a timely manner.

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