Endangered Species Act - Reinitiated Section 7 Consultation

BIOLOGICAL OPINION
AND INCIDENTAL TAKE STATEMENT

Effects of The Pacific Coast Salmon Plan
on
California Central Valley Spring-Run Chinook, and
California Coastal Chinook Salmon

Agency: National Marine Fisheries Service,
Northwest and Southwest Regional
Sustainable Fisheries Divisions

Consultation Conducted by
National Marine Fisheries Service
Protected Resources Division

Date Issued: April 28, 2000

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INTRODUCTION

The National Marine Fisheries Service (NMFS) is required under section 7 of the Endangered Species Act (ESA) to conduct consultations which consider the impacts of ocean salmon fisheries to salmon species which are listed as threatened or endangered under the ESA. NMFS recently added to the list of threatened and endangered species two distinct population segments, or evolutionarily significant units (ESU), of California chinook salmon: the Central Valley spring-run chinook ESU and the California coastal chinook ESU (64 FR 50394, September 16, 1999).

The ocean salmon fisheries in the exclusive economic zone (EEZ) off Washington, Oregon, and California are managed under authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Annual management recommendations are developed according the "Pacific Coast Salmon Plan" (FMP) of the Pacific Fishery Management Council (PFMC). The PFMC provides its management recommendations to the Secretary of Commerce, who implements the measures in the EEZ if they are found to be consistent with the Magnuson-Stevens Act and other applicable law. Because the Secretary, acting through NMFS, has the ultimate authority for the FMP and its implementation, NMFS is both the action agency and the consulting agency in this consultation.

CONSULTATION HISTORY

Since 1989, NMFS has listed 26 ESUs of salmon and steelhead (Table 1). As the listings have occurred, NMFS has initiated formal section 7 consultations and issued biological opinions (Table 2) which consider the impacts to listed salmonid species, and some proposed salmonid species, resulting from proposed implementation of the FMP, or in some cases, from proposed implementation of the annual management measures. NMFS has also reinitiated consultation on certain ESUs when new information has become available on the status of the stocks or on the impacts of the FMP on the stocks. Some opinions have concluded that implementation of the FMP is not likely to jeopardize the continued existence of certain listed ESUs. Other opinions have found the FMP is likely to jeopardize certain listed ESUs, and have identified reasonable and prudent alternatives that would avoid the likelihood of jeopardizing the continued existence of the ESU under consideration.

DESCRIPTION OF THE PROPOSED ACTION

A. Proposed Action

Pursuant to the Magnuson-Stevens Act, NMFS proposes to promulgate ocean salmon fishing regulations developed in accordance with the FMP as amended by Amendment 13. This biological opinion considers the effects of ocean salmon fishing conducted in accordance with the FMP on two recently listed salmon ESUs, Central Valley spring chinook salmon and California coastal chinook salmon.

Table 1. Salmon ESUs listed under the Endangered Species Act

Species	Evolutionarily Significant	Status	Federal Register
Chinook Salmon (O. tshawytscha)	Sacramento River Winter	Endangered	54 FR 32085 8/1/89
	Snake River Fall	Threatened	57 FR 14653 4/22/92
	Snake River Spring/Summer	Threatened	57 FR 14653 4/22/92
	Puget Sound	Threatened	64 FR 14308 3/24/99
	Lower Columbia River	Threatened	64 FR 14308 3/24/99
	Upper Willamette River	Threatened	64 FR 14308 3/24/99
	Upper Columbia River Spring	Endangered	64 FR 14308 3/24/99
	Central Valley Spring	Threatened	64 FR 50394 9/16/99
	California Coastal	Threatened	64 FR 50394 9/16/99
Chum Salmon (O. keta)	Hood Canal Summer-Run	Threatened	64 FR 14508 3/25/99
	Columbia River	Threatened	64 FR 14508 3/25/99
Coho Salmon (O. kisutch)	Central California Coastal	Threatened	61 FR 56138 10/31/96
	S. Oregon/ N. California Coastal	Threatened	62 FR 24588 5/6/97
	Oregon Coastal	Threatened	63 FR 42587 8/10/98
Sockeye Salmon (O. nerka)	Snake River	Endangered	56 FR 58619 11/20/91
	Ozette Lake	Threatened	64 FR 14528 3/25/99
Steelhead (O. mykiss)	Southern California	Endangered	62 FR 43937 8/18/97
	South-Central California	Threatened	62 FR 43937 8/18/97
	Central California Coast	Threatened	62 FR 43937 8/18/97
	Upper Columbia River	Endangered	62 FR 43937 8/18/97
	Snake River Basin	Threatened	62 FR 43937 8/18/97
	Lower Columbia River	Threatened	63 FR 13347 3/19/98
	California Central Valley	Threatened	63 FR 13347 3/19/98
	Upper Willamette River	Threatened	64 FR 14517 3/25/99
	Middle Columbia River	Threatened	64 FR 14517 3/25/99

Table 2. NMFS' biological opinions on ocean fisheries implemented under the FMP and duration of the proposed action covered by each opinion.

Date	ESU covered and effective period
March 1, 1991	Sacramento River winter chinook (now superseded)
March 8, 1996	Snake River chinook and sockeye (until reinitiated), Sacramento River winter chinook (5 years)
February 18, 1997	Sacramento River winter chinook (4 years)
April 30, 1997	S. Oregon/ N. California Coastal coho, Central California Coastal coho, Umpqua River cutthroat trout, all steelhead ESUs proposed for listing (1 year)
April 29, 1998	S. Oregon/ N. California Coastal coho, Central California Coastal coho, Umpqua River cutthroat trout, seven listed steelhead ESUs (1 year)
April 28, 1999	Oregon Coastal coho, S. Oregon/ N. California Coastal coho, Central California Coastal coho (until reinitiated)
April 30, 1999	Upper Columbia River Spring chinook, Upper Willamette River chinook, Lower Columbia River chinook, Puget Sound chinook (1 year)

B. Conservation Measures Included in the Proposed Action

The FMP defines the management unit for PFMC fisheries as the stocks of salmon that are harvested off the coasts of Washington, Oregon, and California. The management unit is comprised of several specific stocks or stock groupings and includes those stocks listed under the ESA. Draft Amendment 14 to the FMP (PFMC 1999) adds both California Coastal chinook and Sacramento River spring chinook to the list of stocks managed under the FMP. However, the PFMC has yet to develop goals for these stocks and no FMP objectives are in place that specifically regulate the harvest of these stocks. The FMP does specify that stocks listed under the ESA will be managed consistent with NMFS' ESA jeopardy standards or the objectives of NMFS' recovery plans. NMFS' ESA consultation standards and management recommendations for listed species are summarized and provided annually to the PFMC prior to its salmon management process.

C. Action Area

In developing the annual management recommendations pursuant to the FMP, the PFMC analyzes several management options for ocean fisheries occurring in the EEZ. The analysis includes assumptions regarding the levels of harvest in state marine, estuarine, and freshwater areas, which are regulated under authority of the states and tribes. The States of Washington, Oregon and California generally manage their marine waters consistently with the management scheme approved by the Secretary of Commerce. NMFS establishes fishery management measures for ocean salmon fisheries occurring in the EEZ (3-200 nautical miles off shore). In the case where a state's actions substantially and adversely affect the carrying out of the FMP, the Secretary may, under the Magnuson-Stevens Act, assume responsibility for the regulation of ocean fishing in state marine waters; however that authority does not extend to a state's internal waters. For the purposes of this consultation, the action area is the EEZ (which is directly affected by the federal action) and the marine waters, other than internal, of the States of Washington, Oregon and California (which may be indirectly affected by the federal action.)

STATUS OF THE SPECIES AND CRITICAL HABITAT

A. Central Valley Spring Chinook

Species Description The ESA defines a "species" to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." NMFS published a policy (56 FR 58612, November 20, 1991) describing the agency's application of the ESA definition of "species" to anadromous Pacific salmonid species. NMFS' policy provides that a Pacific salmonid population will be considered distinct and, hence, a species under the ESA if it represents an evolutionarily significant unit of the biological species. A population must satisfy two criteria to be considered an ESU: it must be reproductively isolated from other conspecific population units, and it must represent an important component in the evolutionary legacy of the biological species. NMFS determined that Central Valley spring chinook satisfy the definition of an ESU (63 FR 11482, March 9, 1998; Myers et al. 1998). The Central Valley spring chinook ESU includes chinook salmon entering the Sacramento

River from late February to July and spawning from late August through early October, with a peak in September.

Table 3. Percent female spawners at age for the four races of Central Valley chinook salmon (from Fisher 1994)

	Late Fall Run	Winter Run	Spring Run	Fall Run
Age 2	2%	1%	2%	3%
Age 3	57%	91%	87%	77%
Age 4+	41%	8%	11%	20%

Life History The four Central Valley chinook salmon races (winter, spring, fall and late-fall) are named on the basis of their upstream migration time and defined by adult migration timing, spawning period, length of juvenile residency and timing of smolt migration. Central Valley spring chinook exhibit a characteristic run timing and other adaptive features which allow them to enter the upper reaches of river systems prior to the onset of the low flows and high water temperatures that inhibit access to these areas during the fall. The run appears in the Sacramento River and its tributaries from February to July and spawning occurs from late August through early October, with a peak in September. Prior to the construction of Shasta Dam, the peak migration time in the upper Sacramento River and tributaries occurred in late May and early June. Their higher fat reserves, smaller body size and entry into fresh water with undeveloped gonads facilitate the ascent to higher streams (up to 1,500 m elevation) (California Department of Fish and Game (CDFG) 1998; Yoshiyama et al. 1996). Central Valley spring chinook exhibit an ocean-type life history, emigrating as fry, sub-yearlings, and yearlings, and, like winter chinook, mature primarily as age-3 adults (Table 3, Fisher 1994).

Critical Habitat Critical habitat is designated to include all river reaches accessible to listed chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) (65 FR 7764, February 16, 2000).

Legal Status The Central Valley spring chinook ESU was proposed as endangered (63 FR 11482, March 9, 1998); however, new information, primarily regarding the status of the Butte Creek spring population, indicated that a threatened status was appropriate for the ESU (64 FR 50394, September 16, 1999). The consultation requirements associated with the listing action took effect on November 15, 1999. At the time of listing, NMFS did not issue protective regulations under section 4(d) of the ESA. Even though NMFS did not issue protective regulations for this ESU, section 7(a)(2) of the ESA requires federal agencies to ensure that activities they authorize, fund, or conduct are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a federal action may affect a listed species or its critical habitat, the responsible federal agency must enter into consultation with NMFS.

The State of California has listed Central Valley spring chinook as threatened under the California Endangered Species Act (February 5, 1999; Title 14, California Code of Regulations, Section 670.5(b)(2)(D)). To the extent that California can require changes in activities conducted by State agencies, the State listing has the potential of providing protection for the ESU not available under the federal ESA, particularly with respect to improvement of spawning and migration habitats. State fishing regulations have been implemented to minimize take of naturally spawning spring chinook in inland waters. In addition to requiring that take of listed species be minimized, the California Endangered Species Act also requires full mitigation for take that does occur.

Distribution and Population Trends Historically, spring chinook were most abundant in the San Joaquin Basin and the dominant run in both the Sacramento and San Joaquin River systems (Clark, 1929; Fry 1961). Native populations in the San Joaquin River have apparently all been extirpated (Campbell and Moyle, 1990). Clark (1929) estimated that there were historically 6,000 stream miles of salmonid habitat in the Sacramento-San Joaquin River Basin, but only 510 miles remained by 1928. Subsequently, elimination of access to spawning and rearing habitat resulting from construction of impassable dams has extirpated spring chinook from the San Joaquin River Basin and the American River. Construction of impassable dams has also curtailed access to habitat in the upper Sacramento and Feather rivers.

Calkins et al. (1940) estimated a spawning escapement of 38,792 spring chinook for the Sacramento River based on fishery landings. In the mid-1960s, CDFG (1965) estimated total spawning escapement of spring-run chinook salmon to be 28,500, with the majority (15,000) spawning in the mainstem Sacramento River and the remainder scattered among Battle, Cottonwood, Antelope, Mill, Deer, Big Chico, and Butte Creeks and the Feather River. CDFG (1965) reported spring-run chinook salmon to be extinct in the Yuba, American, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers. Today, spawner survey data are available for the mainstem Sacramento River, Feather River, Butte Creek, Deer Creek and Mill Creek. Small populations are also reported in Antelope, Battle, Cottonwood, and Big Chico Creeks. The Butte Creek population is genetically distinct from the Deer and Mill Creek populations, returning earlier and spawning at lower elevations (Myers et al., 1998). Sacramento River mainstem spawners have declined sharply since the mid-1980s, from 5,000-15,000 to a few hundred fish, and are believed to have hybridized with the fall run (Myers et al., 1998).

Table 4. Total spawning escapement and three year replacement rates of spring chinook and Sacramento River winter chinook (SRWC) (from CDFG, 1998; 1999 data from Colleen Harvey-Arrison, CDFG, personal communication)

Year	Mill Creek	3Y RR	Deer Creek	3Y RR	Butte Creek	3Y RR	SRWC[1]	3Y RR
1987	89		200		14		1,761	
1988	572		371		1300		1,386	
1989	561		77		1300		480	
1990	844	9.49	458	2.29	100	7.14	425	0.24
1991	319	0.56	448	1.21	100	0.08	134	0.10
1992	237	0.42	209	2.71	730	0.56	1,122	2.34
1993	61	0.07	259	0.57	650	6.50	267	0.63
1994	723	2.27	485	1.08	474	4.74	153	1.14
1995	320	1.35	1,295	6.20	7,500	10.27	1,296	1.16
1996	252	4.13	614	2.37	1,413	2.17	612	2.29
1997	200	0.28	466	0.96	635	1.34	480	3.14
1998	424	1.33	1,879	1.45	20,212	2.40	1,784	1.38
1999	560	2.22	1,591	2.59	3,000	2.12	885	1.45
Mean 3YRR 1994-1999		1.47		1.96		3.05		1.75

1. Adult spawners

The long term abundance trends for the Mill, Deer, and Butte creek populations are negative (Myers et al., 1998), however since 1991 these populations have been increasing. Population trends can be evaluated by examining cohort return rates, defined as the number of females in a given cohort that return to spawn divided by the number of females that produced the cohort. Such a calculation requires data on age structure and

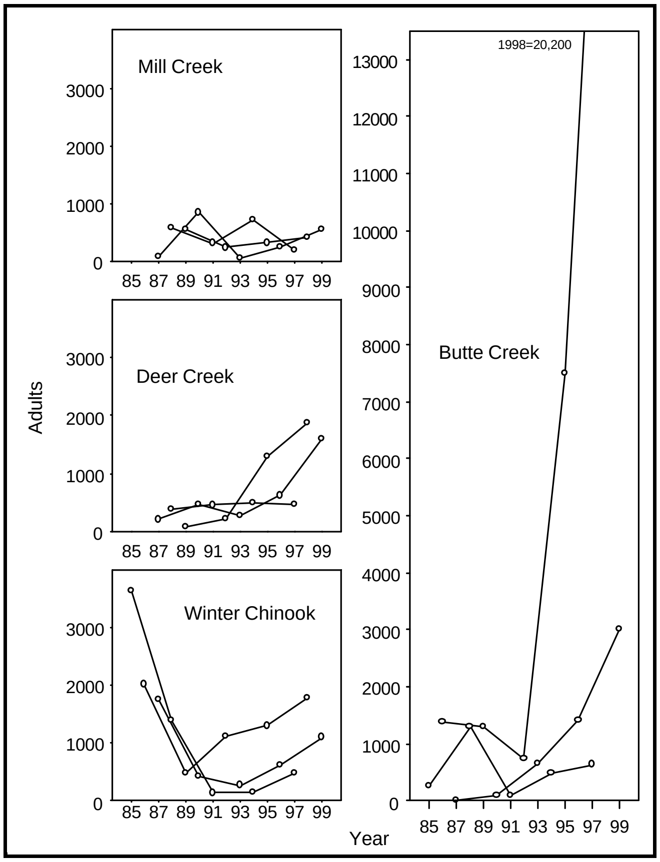

Figure 1 Total spawner abundance for spring chinook populations returning to Deer Butte and Mill creeks. Bottom left panel displays adult spawner abundance for Sacramento River winter chinook.

sex ratio of returning adults. The abundance estimates of Central Valley spring chinook populations do not permit the calculation of cohort replacement rates. However an estimate of the relative strength of brood year lineages can be made by assuming that the majority of spawning adults return at age 3 and there is a 1:1 sex ratio. To the extent that these assumptions are true, three year replacement rates, calculated as the adult escapement in year n divided by the adult escapement in year n-3, are indicators of the cohort replacement rate. Three year replacement rates of less than 1.0 indicate the population is declining; rates of 1.0 or greater mean the population is stable or growing.[1] Table 4 shows spawner estimates and 3-year replacement rates for spring chinook populations in Deer, Mill, and Butte Creeks and for Sacramento River winter chinook, which were listed as threatened in 1989 and reclassified as endangered in 1994. Since 1994, 3-year replacement rates for both the spring and winter chinook populations have generally been greater that one. The geometric mean of the 3-year replacement rates for the most recent 6 years are 1.47, 1.96, and 3.05 for the Mill, Deer, and Butte Creek spring-run populations respectively.

Figure 1 displays spawner abundance estimates presented in Table 4 for spring chinook populations in Deer, Mill, and Butte Creeks and adult spawner abundance estimates for Sacramento River winter chinook. Lines connect every third year to indicate trends in cohort abundance. The 1992-1995-1998 lineage is consistently the strongest for Deer and Butte Creek spring chinook and Sacramento River winter chinook; the 1991-1994-1997 lineage is relatively weak.

Artificial Propagation Efforts to enhance runs of Sacramento River spring chinook salmon through artificial propagation date back over a century. Since 1967, artificial production has focused on the program at the Feather River Hatchery (FRH). The FRH releases several million spring chinook salmon annually, with the bulk of their production released off-site into the Sacramento River Delta. The use of a fixed date to distinguish returning spring- and fall-run fish at the Feather River Hatchery, however, has likely resulted in considerable hybridization between the two runs.

[1] Interpretation of the causes of the apparent increases in three year replacement rates is complicated by changes in ocean harvest regimes that may have resulted in a shift of part of the total brood year production from ocean harvest to spawning escapement.

In half of the years between 1987 and 1994 substantial numbers (21-46%) of the progeny of fish spawned as fall run were subsequently spawned as spring run (CDFG 1998). Analysis of protein samples from Feather River Hatchery spring chinook suggest that they are genetically intermediate between spring- and fall-run samples and most similar to the sample of Feather River Hatchery fall chinook (Myers et al. 1999). FRH spring chinook do not enter the Feather River until May or June in contrast with Butte Creek spring chinook, which are present in Butte Creek in early February, March and April (Yoshiyama et al., 1996). FRH spring chinook stock do exhibit life history characteristics consistent with spring chinook in the Central Valley. Therefore, NMFS considers FRH spring chinook (and their progeny) as part of the ESU, however, they are not considered to be essential for its recovery and are not listed at this time.

Status Spring chinook are listed as threatened because they presently have access to a small fraction (perhaps 10% or less) of their historic spawning habitat and the habitat remaining to them is degraded. In addition, they face hostile downstream conditions in the mainstem Sacramento River and the Sacramento-San Joaquin Delta, they are caught in ocean and freshwater fisheries and they may be subject to the adverse genetic affects of straying hatchery populations such as Feather River Hatchery spring chinook.

Spring chinook historically occupied the upper reaches of all major tributaries to the Sacramento and San Joaquin rivers. Of the 21 populations identified by the California Department of Fish and Game in their status review (CDFG 1998) only 3 self-sustaining populations now exist in the upper Sacramento in Deer, Mill and Butte Creeks. Although these streams have not been affected by large impassable dams, diversions and small dams have degraded the spawning habitat.

Since 1993, spring chinook populations have increased in abundance. The factors responsible for these increases likely include adequate rainfall, improvements in fresh water spawning and migration habitat, as well as the reduction in harvest rates on Central Valley chinook during the last three years. The California Department of Fish and Game (CDFG 1993) estimated that Deer Creek has sufficient habitat to support "sustainable populations" of 4,000 spring chinook; 1,900 and 1,500 spawners returned in 1998 and 1999 respectively. Efforts to restore salmon habitat in Butte Creek have been underway for the past decade. Over 20,000 spring chinook returned to Butte Creek in 1998 and 3,000 in 1999. Both years represent greater than two fold increases in the three-year replacement rate.

B. California Coastal Chinook

Species Description The California coastal chinook ESU was proposed as threatened as part of a larger ESU, the Southern Oregon and California coastal chinook salmon ESU (63 FR 11482, March 9, 1998). Based on a re-assessment of information relevant to the configuration of this ESU, NMFS concluded that the proposed Southern Oregon and California Coastal chinook salmon ESU should be split into two ESUs: a Southern Oregon and Northern California Coastal chinook salmon ESU, extending from Euchre Creek through the Lower Klamath River (inclusive), and a California Coastal chinook salmon ESU, extending from Redwood Creek south through the Russian River (inclusive). This new ESU boundary is similar to that designated between Klamath Mountains Province and Northern California steelhead ESUs. At this time, NMFS concludes that the Russian River Basin presently contains the most southern persistent population of chinook salmon on the California coast, although in The Review of the Status of Chinook Salmon (Myers et al. 1998), NMFS noted a "nearly total lack of biological information for chinook salmon south the Eel River." The California Coastal Chinook ESU includes all naturally spawned coastal chinook salmon spawning from Redwood Creek south through the Russian River inclusive.

Life History Chinook salmon in the California coastal chinook ESU are a fall run and exhibit an ocean-type life-history. Low summer flows and high temperatures in many rivers result in seasonal physical and thermal barrier bars that block movement by anadromous fish. Sand bars at the mouths of streams in the southern part of the ESU often prevent access by chinook until November or December. Chinook salmon from coastal areas north of the Eel River, from the Central Valley and from Klamath River Basin upstream from the Trinity River confluence are genetically and ecologically distinguishable from those in the California coastal chinook ESU.

Critical Habitat Critical habitat is designated to include all river reaches and estuarine areas accessible to listed chinook salmon from Redwood Creek (Humboldt County, California) to the Russian River (Sonoma County, California), inclusive. Excluded are areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) (65 FR 7764, February 16, 2000). Ecologically, the majority of the river systems in this ESU are relatively small and heavily influenced by a maritime climate.

Legal Status The California coastal chinook ESU is listed as threatened (64 FR 50394, September 16, 1999). The consultation requirements associated with the listing action took effect on November 15, 1999. At the time of listing, NMFS did not issue protective regulations under section 4(d) of the ESA. Even though NMFS did not issued protective regulations for this ESU, section 7(a)(2) of the ESA requires federal agencies to ensure that activities they authorize, fund, or conduct are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with NMFS.

Although California coastal chinook are not listed under the California Endangered Species Act, the California Fish and Game Commission has prohibited the retention of chinook in all streams within the California coastal chinook ESU.

Distribution and Population Trends

Coastal California streams support small, sporadically monitored populations of fall-run chinook salmon. Chinook occur in relatively low numbers in northern streams, and their abundance is sporadic in streams in the southern portion of the geographic region encompassing this ESU. Estimates of absolute population abundance are not available for most populations in this ESU. Coastal chinook are highly dependent upon seasonal rainfall and stream flows in ascending tributaries to spawn; fish may spawn in the main stems of rivers if they do not have access into tributaries. As a result, many of the index counts available for Coastal chinook may be reflective of flow conditions rather than population trends. Where available, surveys of coastal chinook spawner abundance in some cases show improvement relative to the extremely low escapements of the early 90s; other streams, such as Tomki Creek remain extremely depressed (Figure 2). Hatchery chinook salmon occur in the Russian and North Fork Mad rivers, but the contribution of hatchery fish to natural spawning escapements is not known (Myers et al. 1998).

Artificial Propagation California coastal hatcheries and egg collecting stations began operating on several coastal streams in the early 1890s. There are currently two state operated hatcheries in the ESU, Warm Springs Hatchery on the Russian River and Mad River Hatchery on the Mad River, and several small scale co-operative hatchery programs. In the California Coastal ESU, chinook salmon (and their progeny) from the following hatchery stocks are considered part of the ESU:

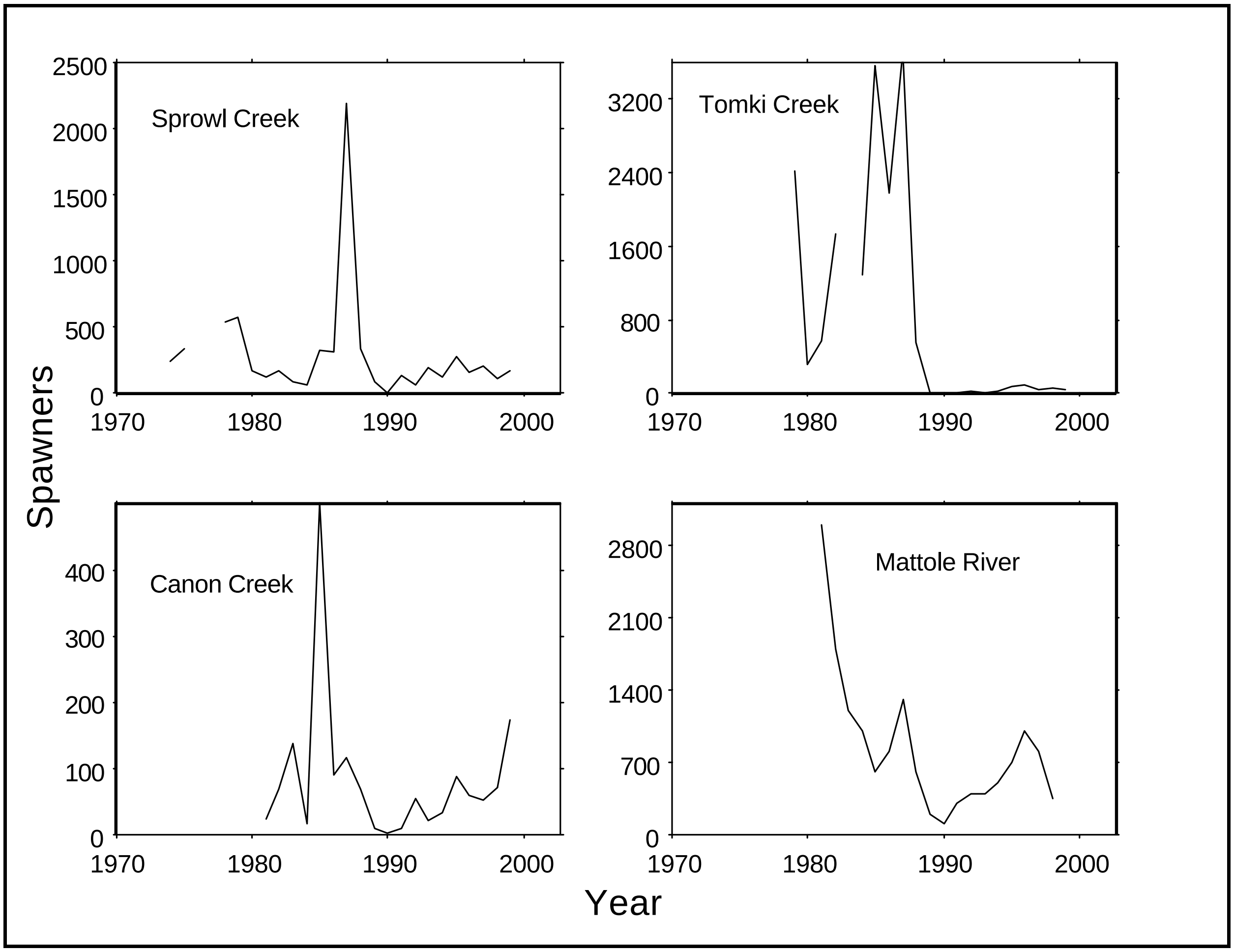

Figure 2 Estimates of chinook spawning abundance in the Mattole River and tributaries to the Eel River (Sprowl and Tomki creeks) and Mad River (Canon Creek). Survey area for Canon Creek is from mouth to falls (2 miles); survey area for Sprowl Creek is the main stem and West Fork; estimate for Tomki Creek is the total run size including jacks. (PFMC 2000 and the Mattole Salmon Group).

Redwood Creek, Hollow Tree Creek, Freshwater Creek, Mad River Hatchery, Van Arsdale Station, Yager Creek, and Mattole River fall-run stock. However, theses stocks are not considered to be essential for the ESU's recovery and are not listed. NMFS concluded that the Warm Springs Hatchery stock of fall run chinook is not part of the California Coastal ESU, primarily due to the large number of out-of-ESU fish transferred to the hatchery (Myers et al. 1999).

Status California coastal chinook are listed as threatened as a result of the habitat blockages, logging and agricultural activities, urbanization and water withdrawals in the river drainages that support California coastal salmon. These have resulted in widespread declines in abundance of chinook relative to historical levels and the present distribution of small populations with sporadic occurrences. Smaller coastal drainages such as the Noyo, Garcia and Gualala rivers may have supported chinook salmon runs historically, but they contain few or no fish today. The Russian River probably contains some natural production, but the origin of those fish is not clear because of a number of introductions of hatchery fish over the last century. The Eel River contains a substantial fraction of the remaining chinook salmon spawning habitat within the ESU (CDFG 1965).

ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

<u>Status of The Species Included in This Biological Opinion</u> Two distinct population segments of chinook salmon (Oncorhynchus tshawytscha), which are listed as threatened species pursuant to section 4 of the ESA are considered in this biological opinion: California Central Valley spring chinook and California Coastal chinook. None of the inland critical habitat designated for Central Valley spring chinook or California Coastal chinook lies within the action area. Marine habitats (i.e., oceanic or near shore areas seaward of the mouth of coastal rivers) are vital to the species, and ocean conditions are believed to have a major influence on chinook salmon survival (see review in Pearcy, 1992). However, there does not appear to be a need for special management consideration or protection of this habitat.

<u>Factors Affecting Species Environment Within the Action Area</u> Salmon are taken incidentally in the groundfish fisheries off Washington, Oregon, and California. NMFS has conducted several section 7 consultations on the impacts of fishing conducted under the Pacific Coast Groundfish Fishery Management Plan (PCGFMP) on species listed under the ESA and concluded that impacts on listed species are negligible (NMFS 1992, 1993, 1996). NMFS reinitiated consultation on the PCGFMP regarding impacts to recently listed species (NMFS 1999) and concluded that continued implementation of the PFMC groundfish FMP as amended will not jeopardize the continued existence of any of the salmonid ESUs listed or proposed for listing as threatened or endangered under section 7 of the ESA.

<u>Ocean Salmon Fishery Management and Recent Trends in Harvest Levels</u> Ocean salmon fisheries off California, Oregon and Washington are managed to meet the increasingly complex combination of NMFS' requirements established through ESA section 7 consultations and the spawning escapement goals established for certain key stocks under the FMP. NMFS issued biological opinions in 1996 and 1997 requiring reductions in ocean harvest impacts on Sacramento River winter chinook, and in 1998 and 1999 limiting the ocean exploitation rate on Oregon coastal coho and southern Oregon/northern California coho and prohibiting retention of coho salmon in ocean fisheries off California.

The chinook salmon fisheries off California, which target Sacramento River fall run chinook, have in recent years been constrained to meet FMP escapement goals and in-river harvest allocation objectives for Klamath River fall chinook, as well as NMFS' ESA consultation standards for listed Sacramento River winter chinook and three listed ESUs of coho.

The FMP spawning escapement objective is between 33% and 34% of the potential adult natural spawners, but no fewer than 35,000 naturally spawning adults in any one year. In 1993, the Department of the Interior quantified the federally reserved fishing rights of the Yurok and Hoopa Valley Indian tribes of the Klamath Basin. The Tribes are entilted to 50% of the total available harvest of Klamath-Trinity Basin salmon. Application of Tribal fishing rights has required significant reductions in the ocean harvest rate on Klamath River fall chinook (Figure 3), and will permanently constrain California and Oregon commercial troll seasons relative to pre-1993 seasons.

In 1996 and 1997, NMFS issued biological opinions requiring reductions in fishing effort off California in order to protect Sacramento River winter chinook. The 1997 opinion required that the PFMC reduce ocean harvest sufficiently to increase the adult spawning escapement by 31% relative to a base period (1989-1993). The restrictions necessary to meet this requirement have been applied to both the California recreational and commercial salmon fisheries. Figure 4 shows annual California troll and recreational effort since 1972 (PFMC 2000). Recreational effort averaged 188,000 angler trips from 1996 to 1998, compared to an average of 227,000 during the prior 10 year period. Nominal commercial effort has declined substantially over the past 20 years. It is likely, however, that the effective effort has not declined as sharply, since those participants that remain in the fishery are the usually the more proficient. Since 1992, commercial troll effort off California has been largely limited to the San Francisco and Monterey areas (Figure 5). Commercial and sport fisheries in areas north of Point Arena, where Klamath River fall chinook make up a significant portion of the catch, are capable of taking the entire ocean allocation of Klamath River fall chinook in relatively short periods of time. Fishing seasons have been severely restricted in these areas to allow longer seasons south of Point Arena and permit access to the relatively abundant stocks of Central Valley fall chinook.

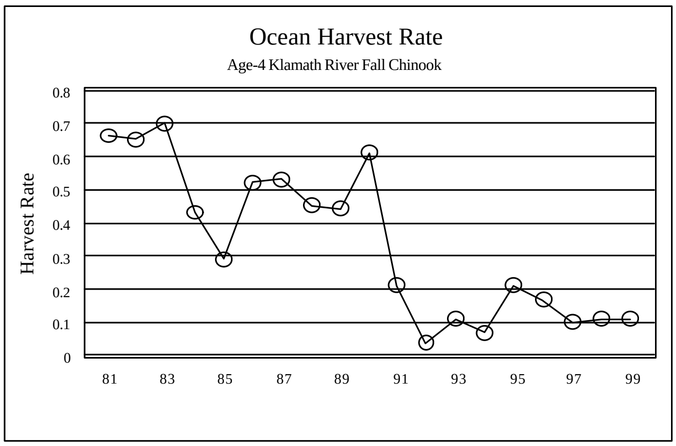

Figure 3 Annual age-4 ocean harvest rates for Klamath River fall chinook salmon. From PFMC 2000. The annual ocean harvest rate is the fraction of age-4 fish available at the beginning of the fishing season that are caught by ocean fisheries.

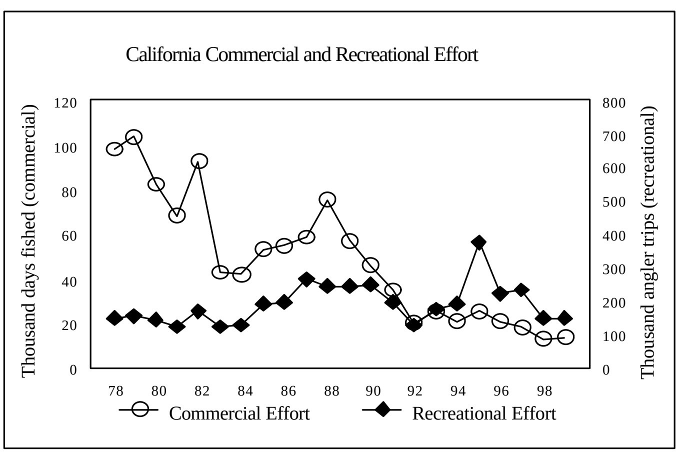

Figure 4 Commercial and recreational salmon fishing effort off California. Note that effort in the two sectors are measured differently and are not comparable. From PFMC 2000.

The annual abundance of Central Valley

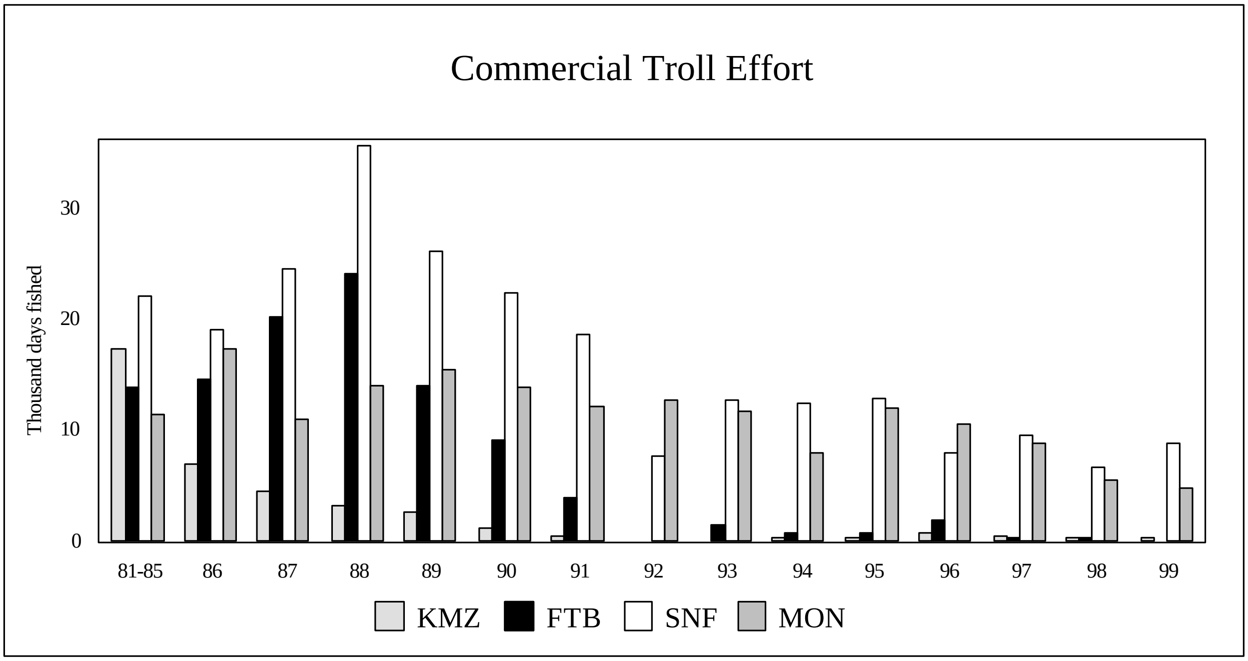

Figure 5 Commercial troll salmon fishing effort (PFMC 2000). Effort estimates are based on port of landing.

chinook salmon is estimated by the Central Valley Index (CVI), which is the sum of the ocean chinook harvest south of Point Arena and the Central Valley adult chinook spawning escapement of the same year. The harvest of Central Valley chinook is evaluated by the Central Valley Ocean Harvest Index, which is calculated as the total catch of chinook south of Point Arena divided by the CVI. The Ocean Harvest Index is an indicator of the annual harvest rate (catch/(catch+escapement)) of Central Valley chinook. In the past four years there has been a substantial reduction in the Central Valley Ocean Harvest Index (Figure 6). Commercial harvest rates, as indicated by the commercial component of the Ocean Harvest Index have been declining since the late 1980s. From 1986 to 1993 the commercial harvest averaged 56% of the CVI abundance index, compared to an average of 44% from 1994 to 1999. Recreational harvests averaged 17% of the CVI between 1986 and 1992 and 20% of the CVI between 1993 and 1999.

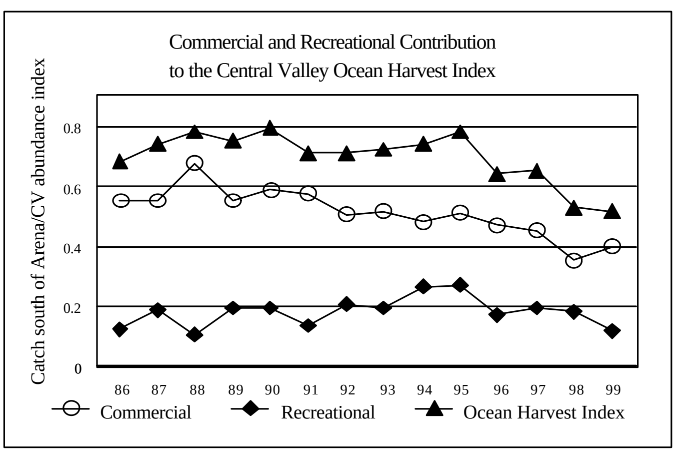

Figure 6 Central Valley Ocean Harvest Index and relative contributions of the recreational and commercial sectors to the Index. From PFMC 2000a.

Several factors bias the Central Valley Ocean Harvest Index as an indicator of harvest rate of Central Valley fall run chinook. The catch of chinook salmon south of Point Arena (including stocks originating from outside the Central Valley) may not equal the total ocean catch of Central Valley chinook. Estimates of the magnitude of the recreational catch in the Central Valley have not consistently been available and are not included in the estimate of chinook escapement to the Central Valley. It is not clear how these factors bias the Index with respect to actual harvest rates of Central Valley chinook.

Natural Factors Causing Variability in Population Abundance The natural factors affecting chinook abundance are variable and specific to different life stages. Changes in the abundance of chinook populations are a result of variations in freshwater and marine environments. For example, large scale changes in climatic regimes, such as El Niño, likely affect changes in ocean productivity; much of the Pacific coast has experienced drought conditions in recent decades, which may depress freshwater salmon production.

Chinook salmon are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contributes to significant natural mortality; however, the levels of predation are largely unknown. In general, chinook are prey for pelagic fishes, birds, and marine mammals, including harbor seals, and sea lions. The rebounding of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, may have resulted in increased mortality for salmonids. Where possible, variations in productivity and natural mortality are incorporated in management models.

EFFECTS OF THE ACTION

The standards for determining jeopardy are set forth in Section 7(a)(2) of the ESA as defined at 50 CFR §402.02. The determinations in this opinion are based on the consideration of the proposed management actions taken to reduce the catch of listed fish, the magnitude of the remaining harvest, particularly as it relates to the period of decline, and available risk assessment analyses.

A. Central Valley Spring Chinook

Pacific coast salmon management is largely based on the analysis of recoveries of fish marked with fin clips, with or without coded wire tags (CWTs) embedded in their snouts. The fish's origin, brood year, year of release, etc., can be determined based on the number encoded on the wire. The states of Washington, Oregon, and California conduct extensive monitoring programs for the detection of CWT marked fish recovered in ocean fisheries. If fisheries are randomly sampled for fish carrying CWTs, estimates can be made of the contribution rate of a particular tag group to the total harvest. If estimates are also available for the number of tagged fish that escape ocean fisheries and return to fresh water to spawn, estimates can be made of the harvest rate on hatchery stocks. Such estimates are available for Klamath River fall chinook. However, the composition of Central Valley hatchery stocks in ocean landings cannot be extrapolated from the CWT recoveries because of incomplete data recovery from in-land fisheries and natural spawning areas (CDFG 1998). Ocean recovery rates of CWTs can be used to draw inferences about the relative harvest levels between fishery sectors, across age-classes and months.

With the exception of two relatively small groups (less than 6,000 each) of naturally produced spring chinook from Butte Creek, the only data available on the ocean recovery rates of Central Valley spring chinook are for the spring chinook produced at the Feather River Hatchery. As discussed earlier, genetic evidence indicates that the FRH stock designated as "spring run" is a hybrid of spring- and fall-run stocks, and raises concern regarding the appropriateness of using the stock to model the effects of ocean harvest on naturally spawning spring chinook. However, the FRH spring-run stock appears to retain some of the life history characteristics of the original stock. Figure 7 displays the monthly recovery pattern of tagged FRH spring chinook recovered between 1978 and 1999. Of the total recoveries, 68% were taken in commercial fisheries.

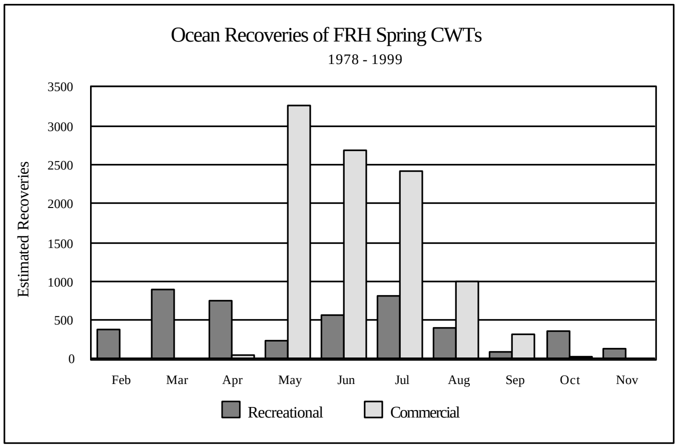

Figure 7 Recoveries of Feather River Hatchery spring chinook in ocean recreational and commercial fisheries. Recoveries are expanded for sample size. Based on data retrieved from the Pacific States Marine Fisheries Commission Regional Mark Information System.

Commercial fisheries off California do not open prior to May 1 and, in recent years, the recreational harvest that occurs prior to May has amounted to less than 7% of the total annual recreational and commercial ocean catch. The harvest rates experienced by the different runs of Central Valley chinook may be affected by the respective maturation rates (the probabilities that a fish will mature at a given age) and the timing of entry into fresh water relative to when ocean harvest occurs.

Chinook salmon are harvested both as mature fish (destined to spawn in the year of harvest) and immature fish (destined to spawn in a subsequent year) and generally become vulnerable to recreational fisheries as age 2 fish and to commercial fisheries as age 3 fish. Maturing spring chinook enter fresh water as early as mid-February, peak in May and conclude in July. Maturing age-3 fish are only vulnerable to the early portion of the recreational and commercial season (when many of the age-3 fish are sub-legal in the commercial fishery), while immature age-3 fish are exposed to the remainder of the fishing season. Maturing age-4 spring chinook are vulnerable to the early portion of the recreational and commercial season. In contrast, maturing fall run chinook enter fresh water in September and October and are exposed to an entire harvest season. Figure 8 compares the distribution of CWT recoveries of FRH spring and fall chinook in the recreational fishery: 25% of the fall chinook recoveries occur prior to May 1 whereas 44% of the spring chinook recoveries occurred during the same period. The expected difference in exposure to harvest resulting from run timing should result in lower harvest rates on spring chinook relative to fall run chinook. Reliable estimates of ocean harvest rates on Central Valley spring- and fall-run chinook are not available to confirm this expectation. The Klamath River Technical Advisory Team (1998) reported substantially lower age-4 harvest rates on Trinity River Hatchery spring chinook compared to fall run chinook. However, Hankin (1990) found no significant difference in age-4 ocean harvest rates between Klamath River fall chinook and Rogue River spring chinook.

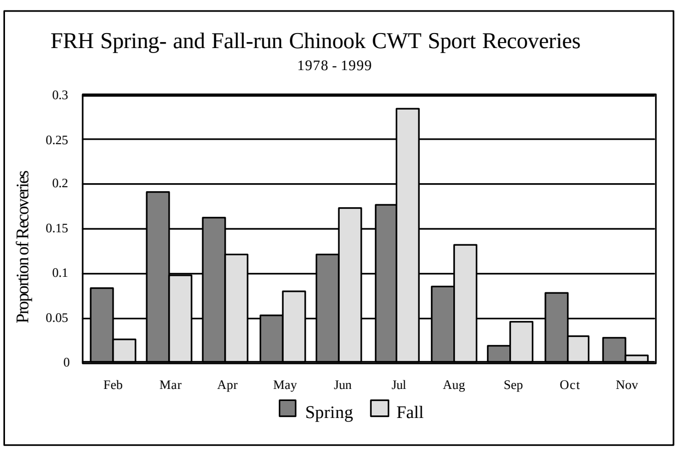

Figure 8 Recoveries of FRH spring- and fall-run chinook salmon in recreational fisheries between 1978 and 1999. Recoveries were expanded for sample size; values represent the proportion of the total estimated recoveries for each run. Based on data retrieved from the Pacific States Marine Fisheries Commission Regional Mark Information System.

Estimates of harvest rates are unavailable for Central Valley spring chinook and the FMP provides no specific protection for the stock, apart from acknowledging that the PFMC will manage ocean fisheries consistent with NMFS' ESA consultation standards. However, the current FMP constraints on ocean harvest off California, in combination with the ESA consultation standards for Sacramento River winter chinook, have limited harvest impacts on Central Valley spring chinook sufficiently to permit substantial increases in the spawning abundance since 1994, ranging from an average of 47% to 300% for the 3 spawning populations (Table 4) .

B. California Coastal Chinook

Data do not exist to directly estimate ocean harvest rates for populations of California coastal chinook salmon. Ocean harvest rates, however, are available for Klamath River fall chinook, which should be comparable to harvest rates for coastal chinook populations off southern Oregon and northern California (Myers et al. 1998).

Since 1991, ocean harvest rates on age-4 Klamath River fall chinook have ranged from 0.07 to 0.21 and averaged 0.13 (Figure 3), which is a 75% decline from the average rate of 53% of the previous 10 years. The harvest rate of age-4 Klamath River fall chinook is an indicator of the percent reduction in adult (age 3, 4 and 5) spawning abundance due to harvest. For example, under the 2000 abundance projections, an ocean harvest rate of 13.8% would, in the absence of in-river fisheries, reduce adult spawning escapement by 12.4% relative to adult escapement in the absence of all fishing. When in-river sport and tribal fisheries are added consistent with the 2000 management measures, the reduction in adult escapement is estimated to be 48%.

Fishing mortality on California coastal chinook is almost entirely limited to ocean harvest, unlike the Klamath Basin, where substantial in-river chinook harvest occurs. Therefore, the total harvest rates on populations of California coastal chinook would be expected to be similar to the ocean harvest rates on Klamath River fall chinook, to the extent that the ocean distribution of the stocks are the same. Figure 9 displays the proportion of coded wire tagged fish originating from the Klamath River, the Eel River and the Central Valley recovered in 6 ocean areas roughly corresponding to major ports (Monterey (MON), San Francisco (SNF), Fort Bragg (FTB), the combined ports of Eureka, Crescent City, and Brookings (KMZ), Oregon Ports between Humbug Mt. OR and Hecata Head, OR (CSB) and Oregon ports north of Hecata Head (NOR)). The values correspond to the relative proportion of recoveries, expanded for sampling, of each stock from each area. Of the total number of Eel River chinook recovered, 35% were taken off Fort Bragg and 41% off San Francisco. The values are not scaled to effort and therefore represent the effects of the distribution of fish and the distribution of fishing effort. Differences between areas reflect differences in fishing effort and distribution of fish populations (the first set of columns in Figure 5 display the average commercial effort between 1981 and 1986). However the differences in the relative magnitudes of the recovery rates

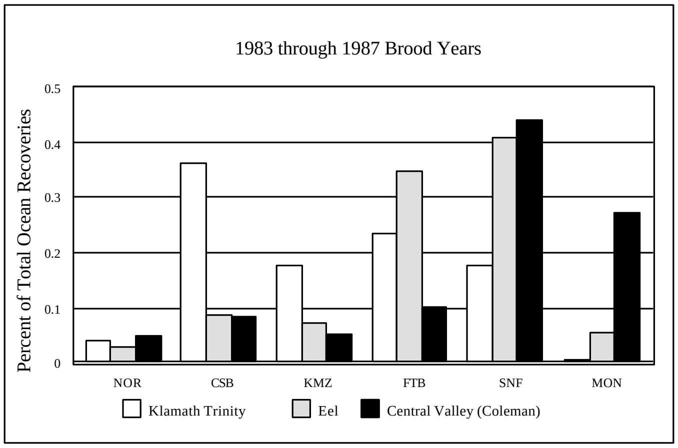

Figure 9 Percent recoveries by reported catch area for Klamath Basin fall run chinook, Eel River chinook, and Coleman National Fish Hatchery. See Appendix A for releases groups used in analysis.

within each area indicate differences in stock distributions in the area. The higher proportion of the Central Valley chinook recoveries occurring off San Francisco and Monterey relative to recoveries of chinook from the Eel and Klamath Rivers would be consistent with a more northerly distribution of Eel River chinook compared to Central Valley chinook. Overall, the pattern of recoveries suggests a distribution of Eel River chinook between that of Klamath River and Central Valley chinook.

A more southerly distribution of California coastal chinook relative to Klamath River fall chinook, in combination with the larger amounts of sport and commercial fishing effort south of Point Arena, would likely result in ocean harvest rates on California coastal chinook that are higher than the recent rates of 11-17% estimated for Klamath River fall chinook, but lower than the harvest rates on Central Valley fall chinook. The Central Valley Ocean Harvest Index, which has declined over the past four years, is not a reliable index of ocean harvest rates on Central Valley fall chinook. Although it is not possible to estimate how much the total harvest rates on California coastal chinook exceed the ocean harvest rates of Klamath River fall chinook, harvest impacts on California coastal chinook have likely declined in concert with the reduction in ocean harvest of both Klamath River fall chinook and Central valley chinook.

Estimates of harvest rates are unavailable for California coastal chinook and the FMP provides no specific protection for the stock, apart from acknowledging that the PFMC will manage ocean fisheries consistent with NMFS' ESA consultation standards. Under the FMP escapement goals and tribal/non-tribal harvest allocation objectives for Klamath River fall chinook, it is possible, under certain conditions of Klamath River fall chinook abundance and age distribution, that ocean harvest rates of Klamath fall chinook could rise above 0.20, with an accompanying increase in the harvest rates of California coastal chinook.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. For the purposes of this analysis, the action area includes ocean fishing areas off the coast of Washington, Oregon, and California.

On December 17, 1999, the California Fish and Game Commission announced it would delay the opening of the recreational fisheries south of Point Arena, California by two weeks in order to provide additional protection to Central Valley spring chinook. The action was in response to a request by NMFS to implement the winter chinook ESA consultation requirements as much as possible through a delay in the opening of the recreational season. The opening of the recreational season traditionally occurred around Feb 15 off California. Beginning in 1991, the opening of seasons south of Point Arena have been progressively delayed in order to meet NMFS' ESA consultation standard for winter chinook. The Commission's action, which was also implemented by NMFS in the EEZ, set the opening of the 2000 season on April 1 south of Pigeon Point, and on April 15 between Point Arena and Pigeon Point. Although recreational harvests in March and April are small relative to the summer catches, the maturing population of spring chinook exiting the ocean at that time are likely to be contacted at higher rates than in the summer (Figure 8). It is difficult to estimate the extent of protection this action will afford spring chinook. CDFG (1998) noted that the timing of FRH spring chinook CWT recoveries suggested that delaying the opening of the recreational seasons south of Point Arena could reduce the harvest of age-3 and age-4 FRH spring chinook by 24% and 27% respectively. However much of the fishing mortality on immature fish would be deferred to later in the season.

INTEGRATION AND SYNTHESIS

Of the eight chinook and coho salmon ESUs occurring in California, one is listed as endangered, four as threatened, and one is a candidate for listing. All of these ESUs are impacted to some extent by ocean fisheries. The lack of an annual estimate of ocean harvest rate for the Central Valley fall chinook stocks targeted by ocean fisheries makes assessment of fishery impacts on listed stocks difficult. While the harvest rates on listed ESUs are believed to be less than that occurring on Central Valley fall chinook, the lack of a harvest rate estimate for even the targeted Central Valley stocks requires the PFMC and NMFS to address recovery of weak stocks through “adaptive management” strategies, in which fishing effort is either eliminated or reduced by somewhat judgmental amounts and the effect is then assessed by monitoring spawning escapement in subsequent years. Estimates of ocean harvest rates on salmon stocks which share similar distribution patterns with listed stocks in California must be developed, in order to better indicate trends in harvest rates on those listed stocks.

Ocean harvest is only one of many factors affecting salmon abundance and the effects of harvest on abundance must be assessed within the context of the prevailing quality of spawning and migration habitats and ocean productivity. The changes in productivity of salmon populations related to annual variations in river flows and temperatures, as well as to longer term changes in ocean productivity regimes, limit the reliability of the relationship between ocean harvest rates and the replacement rates on which conclusions regarding the viability of a population are in part based. Gulland (1983) expressed the situation thus: “It should be stressed to begin with that any stock is part of a complex natural system. It is therefore very difficult to state with any certainty what the effects of any action will be. Some of the problems …[include] the effects of changes in adult stock abundance on the average level of subsequent recruitment. The scientist, and those he is advising, must therefore accept the fact that a comprehensive assessment of the long-term effects of any pattern of fishing is difficult, and is likely to be subject to inaccuracies.”

A. Central Valley Spring Chinook

Spring chinook in the Central Valley currently have access to a small fraction of their historic spawning habitat; self-sustaining populations persist in only three tributaries to the upper Sacramento. Although these streams have not been affected by large impassable dams, diversions and small dams have degraded spawning habitat. Spring chinook face hostile conditions in the mainstem Sacramento River and the Sacramento-San Joaquin Delta, and are incidentally harvested in the mixed stock ocean fisheries off California. The data available on ocean harvest and spawning escapement for Central Valley spring chinook do not permit reliable estimates of harvest rates. However, ocean harvest rates on spring chinook are likely to be lower than fall chinook harvest rates as a result of differences in run timing and maturation rates.

Since 1994, the three-year replacement rates of spring chinook returning to Deer and Butte creeks show a consistent increase in the populations with relatively strong returns to Butte Creek. The factors responsible for these increases include adequate rainfall, improvements in spawning and migration habitat, and reduced ocean harvest rates on Central Valley chinook during the last three years. Over 20,000 spring chinook returned to Butte Creek in 1998 and 3,000 in 1999. Both years represent greater than two fold increases in the three-year replacement rate (Table 4).

The recent increase in abundance of Central Valley spring chinook populations has occurred under harvest management measures developed by the PFMC in compliance with the 1996 and 1997 supplemental biological opinions on the FMP. These opinions required reductions in ocean harvest sufficient to increase the adult spawning escapement of Sacramento River winter chinook by 31% relative to the 1989 - 1993 base period. The geometric mean of the adult winter chinook 3 year replacement rate for returns in 1997 - 1999 is 1.84, which is 36% above the mean rate observed during the base period and exceeds the 31% target. The similar life history features shared between spring and winter chinook, particularly run timing, make it likely that the harvest constraints required since 1996 by NMFS ESA consultation standard for Sacramento River winter chinook have also benefitted spring chinook and will continue to do so. The two week delay in the opening of the recreational seasons south of Point Arena implemented by the California Fish and Game Commission for the 2000 season will provide additional protection to spring chinook.

The observed trends in spawning abundance of Central Valley spring chinook indicate that the current FMP constraints on ocean harvest, in conjunction with the continued implementation of the requirements of the February 18, 1997 biological opinion on Sacramento River winter chinook, are sufficiently protective to avoid appreciable reductions in the likelihood of the survival and recovery of the Central Valley spring chinook ESU.

B. California Coastal Chinook

The factors threatening California coastal chinook salmon throughout its range are numerous and varied. The present depressed condition is the result of several longstanding, human-induced factors, such as habitat degradation, water diversions and harvest, that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought, floods, and unfavorable ocean conditions.

Assessment of whether implementation of the FMP is likely to jeopardize the continued existence of California coastal chinook must consider the following factors: 1) the uncertainty regarding population trends, the magnitude of ocean harvest rates on the population, and the reaction of the population to the reduced ocean harvest levels of the past four years; 2) the lack of information regarding the magnitude of harvest rates on Central Valley fall chinook, which provide an upper limit on harvest rates that likely exist on California coastal chinook; and 3) the potential for ocean harvest rates on California coastal chinook to increase under the FMP above the relatively low levels observed since 1991.

The uncertainty regarding abundance trends of California coastal chinook populations and the absence of reliable estimates of ocean harvest rates for California coastal chinook make it difficult to assess the potential for coastal chinook populations to recover under the current levels of fishing mortality. The available spawning survey data suggest that spawner abundance of some California coastal chinook populations may have improved since 1996, when ocean harvest constraints were introduced to protect Sacramento River winter chinook.

The limited CWT recovery data indicate that ocean harvest rates on California coastal chinook are likely intermediate between the ocean harvest rates on Klamath River fall chinook and Central Valley chinook stocks. Conclusions regarding trends in ocean harvest on California coastal chinook are based on the harvest information available for Klamath River fall chinook and Central Valley chinook.

Since 1991, harvest allocation and FMP management objectives have required substantially lower ocean harvest rates on Klamath River fall chinook and frequently limited commercial seasons south of Point Arena that target Central Valley fall chinook. Ocean harvest rates on Klamath River fall chinook observed since 1991 have decreased 75% on average from levels observed between 1981 and 1990; as a result, commercial fishing has been nearly eliminated from the areas between Brookings, Oregon and Point Arena, California, which is near the southern extent of the California coastal chinook ESU's spawning range (in Figure 5 this area corresponds to the KMZ and FTB areas).

Beginning in 1996, NMFS' ESA consultation standards to protect Sacramento River winter chinook further constrained recreational and commercial fisheries south of Point Arena. The Central Valley Ocean Harvest Index, an indicator of harvest rates on fall chinook, fell from 0.78 in 1995 to 0.52 in 1999; between 1986 and 1995 the index averaged 0.74. Although the index is useful as an indicator of trends in harvest rates on Central Valley chinook, it does not reflect the actual magnitude of annual harvest rates on Central Valley fall chinook.

Ocean harvest rates on California coastal chinook have undoubtedly declined in recent years as a result of the reduced ocean harvest rates of Klamath River fall chinook and ESA constraints to protect Sacramento River winter chinook. The California Fish and Game Commission has prohibited the retention of chinook salmon in all streams within the California coastal chinook ESU. As a result, fishing mortality on California coastal chinook is almost entirely limited to ocean harvest, unlike Klamath Basin and Central Valley chinook stocks, where large amounts of freshwater recreational harvest and, in the case of the Klamath Basin, tribal harvest occur.

Ocean harvest rates on Klamath River fall chinook permitted under the FMP could, depending on the relative year-class strengths and abundance of Klamath River chinook, increase to levels above 0.20. Such increases, particularly if they are realized through an expansion of fishing seasons in areas off California north of Point Arena, would increase fishing mortality on California coastal chinook and appreciably reduce the likelihood of the survival and recovery of the California coastal chinook ESU. The complexity of the relationship between ocean harvest and population viability makes it difficult to draw conclusions regarding the effect of any particular level of harvest (if it is known) on a stock's ability to recover. The incidental harvest of coastal chinook under management measures designed to achieve low ocean harvest rates on Klamath River fall chinook and reduced ocean harvest of Sacramento River winter chinook appears to be sufficiently low to allow persistence of coastal chinook populations at low abundance levels. However, the uncertainty regarding the reaction of California coastal chinook to the levels of ocean harvest over the past four years strongly suggests a precautionary approach to allowing harvest rates on CC to increase above those of the past four years.

Finally, the lack of a harvest rate estimate for Central Valley fall chinook substantially impairs NMFS' ability to assess fishery impacts on listed stocks that may share similar ocean distributions and vulnerability to harvest.

CONCLUSION

After reviewing the current status of California coastal chinook salmon and Central Valley spring chinook salmon, the environmental baseline for the action area, and the effects of the proposed implementation of the Pacific Coast Salmon Plan, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Central Valley spring chinook salmon, but is likely to jeopardize the continued existence of California coastal chinook salmon.

REASONABLE AND PRUDENT ALTERNATIVE

The regulations implementing section 7 of the ESA (50 CFR 402.02) define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that (1) can be implemented in a manner consistent with the intended purpose of the action, (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction, (3) are economically and technologically feasible, and (4) would avoid the likelihood of jeopardizing the continued existence of listed species and avert the destruction or adverse modification of critical habitat.

NMFS has developed a four part alternative to the proposed action. When taken together as an integrated action, NMFS concludes that the following Reasonable and Prudent Alternative (RPA) is not likely to jeopardize listed species. Taken as a whole, NMFS believes the RPA is not likely to jeopardize the continued existence of California coastal chinook.

1. **Management measures developed under the FMP must achieve a projected age-4 ocean harvest rate on Klamath River fall chinook of 0.17 or less.**

Ocean harvest rates on California coastal chinook have likely declined in concert with harvest rates on Klamath River fall chinook and Central Valley chinook. To insure that California coastal chinook are not subject to harvest rates substantially higher than those observed in recent years, Klamath River fall chinook age-4 ocean harvest rates should not be allowed to exceed the levels observed since 1996. Pending the development of ocean harvest indices that will enable more specific protection for California coastal chinook stocks, PFMC fisheries must be managed to achieve a projected age-4 harvest rate on Klamath River fall chinook of 0.17 or less. The observed (post-season) age-4 harvest rate on Klamath River fall chinook has ranged from 0.04 to 0.21 between 1991 to 1999 and averaged 0.53 during the 10 year period prior to that. The harvest rate of 0.17 is the maximum rate observed since 1996, the year in which additional ESA requirements to protect Sacramento River winter chinook were put in place.

2. **NMFS must continue to evaluate the use of the Klamath River fall chinook age-4 ocean harvest rate as an indicator of the harvest rate on California coastal chinook populations.**

NMFS must analyze alternative applications of the age-4 Klamath River fall chinook ocean harvest rate as a consultation standard for California coastal chinook. In particular, NMFS must evaluate whether applying a harvest rate limit only to those management areas most likely to affect harvest of coastal chinook would provide more consistent protection to coastal chinook; and whether the methods currently used to estimate the impacts of fall fisheries (those occurring after August 31) on age-4 Klamath River fall chinook appropriately estimate impacts on California coastal chinook.

3. **NMFS, in cooperation with the State of California and the U.S. Fish and Wildlife Service, must, within 2 years of the issuance of this opinion, identify monitoring and evaluation programs that permit the post-season estimation of ocean harvest rates on one or more appropriate Central Valley chinook stocks.**

Harvest rates on California coastal chinook are likely intermediate between those that exist for Central Valley chinook and Klamath River fall chinook. The lack of reliable predictors available to forecast the Central Valley Ocean Harvest Index, and the uncertain relationship between the Index and actual harvest rates on Central Valley chinook stocks, make the use of the Index inappropriate to control harvest rates. If a harvest rate estimate were available for a representative Central Valley chinook stock, better assessments of the relative impacts of ocean harvest on Coastal chinook as well as Central Valley spring and winter chinook would be possible. Chinook stocks produced at the Coleman National Fish Hatchery operated by the Fish and Wildlife Service make up a substantial fraction of the chinook harvest off California and are among the candidates for evaluation in developing estimates of ocean harvest rates.

4. **NMFS shall cooperate with the affected states and the PFMC to ensure that ocean salmon fisheries are monitored and sampled for stock composition including the collection of CWTs in all fisheries and other biological information to allow for a post-season analysis of fishery impacts on listed species.**

Such monitoring may include the collection and genetic analysis of tissue samples collected at appropriate ports to provide estimates of the contribution rate of California Coastal chinook to the catch.

INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, and the propsed action may incidentally take individuals of a liste species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts.

The measures described below are non-discretionary, and must be undertaken by NMFS. NMFS has a continuing duty to regulate the activity covered by this incidental take statement. If NMFS fails to implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must document the progress of the action and its impact on the species as specified in the incidental take statement. [50CFR §402.14(i)(3)]

This incidental take statement is applicable to all activities related to the promulgated ocean salmon fishing regulations developed in accordance with the FMP. Unless modified, this incidental take statement does not cover activities that are not described and assessed within this opinion.

Amount or Extent of Incidental Take

The proposed FMP, as modified by the RPA, is expected to result in the incidental take of Central Valley spring chinook and California coastal chinook. However, the magnitude of the take associated with incidental ocean harvest cannot be easily quantified due to an inability to distinguish California coastal chinook and Central Valley spring chinook from the other chinook stocks in the ocean, and unknown ocean abundances of California coastal chinook and Central Valley spring chinook.

A. Central Valley Spring Chinook

The harvest of Central Valley spring chinook that may occur in ocean salmon fisheries will be limited by the measures proposed by the PFMC in accordance with the FMP and NMFS jeopardy standards for listed species, including quotas and other time, area, gear and catch limitations measures that are implemented as part of the package of annual regulations. The amount of incidental take of Central Valley spring chinook cannot be directly assessed at this time; however, NMFS anticipates a level of take that will permit continued increases in the spawning populations of Central Valley spring chinook.

B. California Coastal Chinook

NMFS projects a level of take consistent with the terms specified in the RPA. The amount of incidental take of California coastal chinook cannot be directly assessed at this time; however, the best available information suggests that the level will be intermediate between the harvest rates for Central Valley chinook and Klamath River fall chinook.

Effect of the Take

In the accompanying biological opinion, NMFS determined that the level of anticipated take of Central Valley spring chinook and California Coastal chinook is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat when the RPA is implemented.

Reasonable and Prudent Measures

NMFS included two reasonable and prudent measures in the incidental take statement of the March 8, 1996, biological opinion, which remain in effect: 1) in-season management actions taken during the course of the fisheries shall be consistent with the harvest objectives established preseason that were subject to review for consistency with this biological opinion, and 2) incidental harvest impacts of listed salmon stocks shall be monitored using best available measures.

Terms and Conditions

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action or RPA. In order to be exempt from the prohibitions of sections 9 and 4(d) of the ESA, NMFS must continue to comply with all of the terms and conditions listed in the March 8, 1996, biological opinion, as amended by the February 18, 1997, opinion concerning Sacramento River winter chinook. In addition, NMFS must comply with the following terms and conditions to implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

3. NMFS shall confer with the affected states and PFMC chair to ensure that in-season management actions taken during the course of the fisheries are consistent with the harvest objectives established preseason.

4. NMFS, in cooperation with the affected states and PFMC chair, shall monitor the catch and implementation of other management measures at levels that are comparable to those used in recent years. The monitoring is to ensure full implementation of, and compliance with, management actions specified to control the various ocean fisheries.

5. NMFS, in cooperation with the affected states and PFMC chair, shall sample the fisheries for stock composition, including the collection of CWTs in all fisheries and other biological information to allow for a thorough post-season analysis of fishery impacts on listed species.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NMFS believes the following conservation recommendations, in addition to those included in the March 8, 1996, biological opinion, are consistent with these obligations, and therefore should be implemented by NMFS.

1. NMFS should evaluate the ability of each listed ESU to survive and recover, given the totality of impacts affecting each ESU during all phases of the salmonid's life cycle, including freshwater, estuarine and ocean life stages. For this effort, NMFS should evaluate available life cycle models or initiate the development of life cycle models where needed.

2. NMFS should coordinate with State and other agencies as appropriate to ensure that the appropriate monitoring of listed California coastal chinook populations is instituted. NMFS should institute genetic studies capable of characterizing naturally spawning populations for assessment as potential contributors to recovery efforts using artificial propagation.

REINITIATION OF CONSULTATION

This concludes formal consultation on the Pacific Coast Salmon Plan and Amendment 13 to the Plan. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take specified in the Incidental Take Statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the specified amount or extent of incidental take is exceeded, section 7 consultation must be reinitiated immediately.

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Appendix A

CWT release groups of fall chinook from Trinity River Hatchery and Iron Gate Hatchery, brood years 1983 through 1987.

Brood Year	Hatchery Name	Tag Code	CWT Released	Untagged Fish	Release Dates	Release Site Name	Stock Name	Weight of Fish
83	Iron Gate	065923	191352	2,688,372	6/28/1984	Iron Gate Hatchery	Klamath River	6.05
83	Iron Gate	065924	97566	0	6/25/1984	Klamath Glen	Klamath River	5.04
83	Iron Gate	065925	94738	1,127,221	11/21/1984	Iron Gate Hatchery	Klamath River	0
83	Iron Gate	065926	23725	0	11/14/1984	Klamath Glen	Klamath River	0
83	Iron Gate	065931	22599	0	11/21/1984	Iron Gate Hatchery	Klamath River	43.7
83	Iron Gate	065932	24830	0	11/21/1984	Iron Gate Hatchery	Klamath River	0
83	Iron Gate	065933	23766	0	11/21/1984	Iron Gate Hatchery	Klamath River	0
83	Trinity River	065608	91153	0	6/19/1984	Steel Bridge	Trinity River	9.86
83	Trinity River	065612	97311	0	6/20/1984	Junction City	Trinity River	9.26
83	Trinity River	065613	100227	0	6/22/1984	Lime Point	Trinity River	9.86
83	Trinity River	065614	25547	0	10/16/1984	Steel Bridge	Trinity River	37.49
83	Trinity River	065615	25754	0	10/17/1984	Junction City	Trinity River	33.85
83	Trinity River	065616	26171	1,190	10/18/1984	Lime Point	Trinity River	32.17
83	Trinity River	066113	100520	784,656	9/26/1984	Trinity R Hatchery	Trinity River	36.29
83	Trinity River	066126	191094	2,075,925	6/1/1984	Trinity R Hatchery	Trinity River	7.69
83	Trinity River	066301	92965	102,000	3/1/1985	Trinity R Hatchery	Trinity River	85.58
84	Iron Gate	065922	98500	803,000	10/23/1985	Iron Gate Hatchery	Klamath River	50.4
84	Iron Gate	065927	187500	2,587,544	6/27/1985	Iron Gate Hatchery	Klamath River	3.87
84	Iron Gate	065928	93710	0	6/17/1985	Klamath Glen	Klamath River	4.18
84	Iron Gate	065935	24275	0	11/26/1985	Klamath Glen	Klamath River	50.4
84	Trinity River	065617	98906	0	6/10/1985	Steel Bridge	Trinity River	8.26
84	Trinity River	065618	98989	0	6/12/1985	Junction City	Trinity River	8.25
84	Trinity River	065619	94100	0	6/14/1985	Lime Point	Trinity River	8.38
84	Trinity River	065620	30459	0	10/8/1985	Steel Bridge	Trinity River	36.29
84	Trinity River	065621	24541	0	10/8/1985	Junction City	Trinity River	37.8
84	Trinity River	065622	25450	0	10/9/1985	Lime Point	Trinity River	41.24
84	Trinity River	065624	102512	52,350	2/27/1986	Trinity R Hatchery	Trinity River	81
84	Trinity River	066127	189708	0	6/10/1985	Trinity R Hatchery	Trinity River	8.56
84	Trinity River	066128	97070	810,313	9/10/1985	Trinity R Hatchery	Trinity River	41.24
85	Iron Gate	065929	95296	759,531	11/20/1986	Iron Gate Hatchery	Klamath River	62.1
85	Iron Gate	065934	147356	12,017,669	6/13/1986	Iron Gate Hatchery	Klamath River	6
85	Iron Gate	066318	24443	0	11/20/1986	Iron Gate Hatchery	Klamath River	68.73
85	Trinity River	065623	196249	1,351,875	6/19/1986	Trinity R Hatchery	Trinity River	6.39
85	Trinity River	065625	97368	919,890	10/24/1986	Trinity R Hatchery	Trinity River	33.6
86	Iron Gate	065942	97800	749,847	11/20/1987	Iron Gate Hatchery	Klamath River	37.8
86	Iron Gate	065960	180600	9,120,000	6/26/1987	Iron Gate Hatchery	Klamath River	5.04
86	Iron Gate	066332	23770	0	11/20/1987	Iron Gate Hatchery	Klamath River	41.24
86	Trinity River	065626	202486	3,395,015	6/11/1987	Trinity R Hatchery	Trinity River	5.1
86	Trinity River	065627	100320	733,238	9/21/1987	Trinity R Hatchery	Trinity River	23.87
86	Trinity River	065628	26730	17,820	9/24/1987	Trinity R Hatchery	Trinity River	41.24
87	Iron Gate	065936	57600	809,420	10/19/1988	Iron Gate Hatchery	Klamath River	56.7
87	Iron Gate	065937	38400	0	10/19/1988	Iron Gate Hatchery	Klamath River	56.7
87	Iron Gate	B60201	157380	6,077,000	5/16/1988	Iron Gate Hatchery	Klamath River	3.52
	Total Releases		3,840,836	46,983,876				

CWT release groups of fall chinook in the Eel River Basin, brood years 1983 through 1987

Brood Year	Hatchery Name	Tag Code	CWT Released	Untagged Fish	Release Dates	Release Site Name	Stock Name	Weight of Fish
83	Redwood Creek Ponds	065015	23,748	1915	5/23/1984	Redwood Cr(trib Eel)	Redwood Cr(trib Eel)	5.04
83	Silverado Plant.base	065012	43,685	25935	6/1/1984	Hollow Tree Creek	Hollow Tree Creek	4.05
83	Sprowel Creek Ponds	065014	8,796	1126	5/22/1984	South Fork Eel River	Redwood Cr(trib Eel)	1.51
83	Van Arsdale	065013	36,557	0	5/30/1984	South Fork Eel River	Outlet Creek	2.83
84	Redwood Creek Ponds	062912	14,259	0	6/12/1985	Scotia	Redwood Cr(trib Eel)	3.24
84	Redwood Creek Ponds	H60606	54,760	0	5/8/1985	Redwood Cr(trib Eel)	Redwood Cr(trib Eel)	1.67
84	Silverado Plant.base	062911	15,364	0	5/1/1985	Hollow Tree Creek	Hollow Tree Creek	3.02
84	Warm Spring Hatcher	065016	48,714	21747	6/20/1985	Mc Cann Bridge	Outlet Creek	3.54
85	Marshall Creek Ponds	065023	24,869	0	5/13/1986	Redwood Cr(trib Eel)	Eel River	3.78
85	Redwood Creek Ponds	062905	1,818	6746	5/18/1986	Rattlesnake Creek	Eel River	3.13
85	Redwood Creek Ponds	065017	18,192	0	5/14/1986	Redwood Cr(trib Eel)	Eel River	23.87
85	Silverado Plant.base	H60701	91,390	0	4/29/1986	Outlet Creek	Outlet Creek	2.27
86	Dinner Creek Ponds	B61501	21,289	0	5/16/1987	Redwood Cr(trib Eel)	Eel River	1.62
86	Hollow Tree Cr Ponds	B61506	8,185	90217	5/8/1987	Hollow Tree Creek	Eel River	1.51
86	Marshall Creek Ponds	065003	20,348	0	5/18/1987	Redwood Cr(trib Eel)	Eel River	2.83
86	Marshall Creek Ponds	B61502	25,847	0	5/19/1987	Redwood Cr(trib Eel)	Eel River	1.62
87	Dinner Creek Ponds	B61512	22,971	0	5/12/1988	Redwood Cr(trib Eel)	Eel River	2.1
87	Hollow Tree Cr Ponds	B61508	21,976	138244	5/15/1988	Hollow Tree Creek	Hollow Tree Creek	2.91
87	Hollow Tree Cr Ponds	B61509	21,886	0	5/15/1988	Hollow Tree Creek	Hollow Tree Creek	2.83
87	Marshall Creek Ponds	B61515	19,814	0	5/15/1988	Redwood Cr(trib Eel)	Eel River	1.51
87	Redwood Creek Ponds	B61513	21,044	0	5/13/1988	Redwood Cr(trib Eel)	Redwood Cr(trib Eel)	1.15
87	Sprowel Creek Ponds	B61514	23,022	0	5/16/1988	Redwood Cr(trib Eel)	Eel River	1.56
87	Warm Spring Hatcher	B61505	22,801	0	5/13/1988	Outlet Creek	Outlet Creek	7.09
	Total Releases		611,335	285,930				

CWT release groups in the Coleman National Fish Hatchery brood years 1983 through1987

Brood Year	Hatchery Name	Tag Code	CWTs Released	Untagged Fish	Release Dates	Release Site Name	Stock Name	Weight of Fish
83	Coleman NFH	066042	50742	0	5/9/1984	Coleman Hfh	Battle Creek	8.1
83	Coleman NFH	H60404	43883	0	3/1/1984	Below Red Bluff Dam	Battle Creek	0.96
83	Coleman NFH	H60405	48460	0	3/5/1984	Courtland	Battle Creek	1
83	Coleman NFH	H60406	45465	0	3/8/1984	Ryde-koket	Battle Creek	1.17
83	Coleman NFH	H60407	42165	0	3/12/1984	North Fork Mokelumne	Battle Creek	1.22
83	Coleman NFH	H60501	45036	0	3/14/1984	South Fork Mokelumne	Battle Creek	1.15
83	Coleman NFH	H60502	46767	0	3/19/1984	Ryde-koket	Battle Creek	1.19
83	Coleman NFH	H60503	48157	0	3/21/1984	Courtland	Battle Creek	1.17
83	Coleman NFH	066043	49479	0	5/9/1984	Coleman NFH	Battle Creek	8.1
83	Coleman NFH	066041	50921	0	5/9/1984	Below Red Bluff Dam	Battle Creek	8.1
83	Coleman NFH	066040	51948	0	5/9/1984	Below Red Bluff Dam	Battle Creek	8.1
83	Coleman NFH	066038	49400	0	5/9/1984	Knights Landing	Battle Creek	8.1
83	Coleman NFH	066039	49351	0	5/9/1984	Knights Landing	Battle Creek	8.1
83	Coleman NFH	H60504	47855	0	3/23/1984	Below Red Bluff Dam	Battle Creek	1.2
84	Coleman NFH	054004	10698	0	5/31/1985	Coleman NFH	Coleman NFH	7.7
84	Coleman NFH	050616	10209	0	5/31/1985	Coleman NFH	Coleman NFH	6.98
84	Coleman NFH	H50107	23519	0	5/31/1985	Sacra.r, Ab Collinsv	Coleman NFH	7.69
84	Coleman NFH	H50106	23378	0	5/31/1985	Sacra.r, Ab Collinsv	Coleman NFH	7.57
84	Coleman NFH	H50105	22558	0	5/31/1985	Coleman NFH	Coleman NFH	6.98
84	Coleman NFH	050947	21871	0	5/31/1985	Sacra.R, Ab Collinsv	Coleman NFH	7.57
84	Coleman NFH	050948	21943	0	5/31/1985	Sacra. R, Ab Collinsv	Coleman NFH	7.69

Brood Year	Hatchery Name	Tag Code	CWTs Released	Untagged Fish	Release Dates	Release Site Name	Stock Name	Weight of Fish
84	Coleman NFH	053904	11484	0	5/31/1985	Coleman NFH	Coleman NFH	6.98
84	Coleman NFH	054104	10330	0	5/31/1985	Coleman NFH	Coleman NFH	6.98
84	Coleman NFH	054204	10610	0	5/31/1985	Sacra. R, Ab Collinsv	Coleman NFH	7.57
84	Coleman NFH	H50307	29136	0	3/31/1985	Coleman NFH	Coleman NFH	1.22
84	Coleman NFH	054304	9756	0	5/31/1985	Sacra. R, Ab Collinsv	Coleman NFH	7.57
84	Coleman NFH	H50401	23045	0	3/31/1985	Coleman NFH	Coleman NFH	1.22
84	Coleman NFH	050949	20460	0	5/31/1985	Sacra. R, Ab Collinsv	Coleman NFH	7.69
84	Coleman NFH	H60603	50550	0	3/5/1985	Ryde-koket	Battle Creek	1.11
84	Coleman NFH	H60604	51985	0	3/7/1985	Courtland	Battle Creek	1.19
84	Coleman NFH	H60602	51145	0	2/28/1985	North Fork Mokelumne	Battle Creek	1.07
84	Coleman NFH	H60601	50052	0	2/26/1985	South Fork Mokelumne	Battle Creek	1.23
84	Coleman NFH	H60507	49183	0	2/21/1985	Ryde-koket	Battle Creek	1.12
84	Coleman NFH	H60506	51201	0	2/19/1985	Courtland	Battle Creek	1.26
84	Coleman NFH	H60505	49155	0	2/14/1985	Below Red Bluff Dam	Battle Creek	1.13
84	Coleman NFH	H60605	52313	0	3/14/1985	Below Red Bluff Dam	Battle Creek	1.25
85	Coleman NFH	H60607	50961	0	2/27/1986	Courtland	Battle Creek	1.05
85	Coleman NFH	H60705	51426	0	3/19/1986	Below Red Bluff Dam	Battle Creek	1.3
85	Coleman NFH	H60704	52748	0	3/12/1986	Ryde-koket	Battle Creek	1.48
85	Coleman NFH	H60702	52635	0	3/4/1986	Ryde-koket	Battle Creek	1.16
85	Coleman NFH	H50402	24933	0	5/31/1986	Coleman NFH	Coleman NFH	7.3
85	Coleman NFH	H50403	28659	0	5/31/1986	Coleman NFH	Coleman NFH	7.3
85	Coleman NFH	H50405	27606	0	5/31/1986	Sacra. R, Ab Collinsv	Coleman NFH	7.3
85	Coleman NFH	H50406	23669	0	5/31/1986	Sacra. R, Ab Collinsv	Coleman NFH	7.1
85	Coleman NFH	H50407	22719	0	5/31/1986	Sacra. R, Ab Collinsv	Coleman NFH	7.1
85	Coleman NFH	H50707	51371	0	3/31/1986	Coleman NFH	Coleman NFH	378.33
85	Coleman NFH	H50404	26900	0	5/31/1986	Sacra. R, Ab Collinsv	Coleman NFH	7.3
85	Coleman NFH	H60703	53831	0	3/10/1986	Courtland	Battle Creek	1.35
86	Coleman NFH	H60707	52977	0	3/13/1987	Below Red Bluff Dam	Battle Creek	1.46
86	Coleman NFH	H60706	48733	0	3/5/1987	Courtland	Battle Creek	1.34
86	Coleman NFH	B50413	51075	0	3/12/1987	Coleman NFH	Coleman NFH	1.4
86	Coleman NFH	051841	51271	0	5/14/1987	Princeton Ferry	Coleman NFH	6.6
86	Coleman NFH	051840	51807	0	5/13/1987	Above Red Bluff Dam	Coleman NFH	6.6
86	Coleman NFH	051839	51706	0	5/12/1987	Coleman NFH	Coleman NFH	6.6
87	Coleman NFH	051940	52796	0	5/10/1988	Red Bluff Diver. Dam	Coleman NFH	6.58
87	Coleman NFH	B50206	48299	0	2/19/1988	Coleman NFH	Coleman NFH	0.99
87	Coleman NFH	051939	51923	0	5/9/1988	Coleman NFH	Coleman NFH	6.58
87	Coleman NFH	051941	52771	0	5/11/1988	Princeton Ferry	Coleman NFH	6.78
87	Coleman NFH	B61401	48280	0	2/22/1988	Red Bluff Diver. Dam	Coleman NFH	1.3
87	Coleman NFH	051842	51651	0	5/17/1988	Benicia	Coleman NFH	7.57
	Total Releases		2,404,957					