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Part III

Department of Commerce

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National Oceanic and Atmospheric Administration

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50 CFR Parts 222 and 227

Endangered and Threatened Species; Status of Sacramento River Winter-run Chinook Salmon; Final Rule  
DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 222 and 227

[Docket No. 930779-3330; I.D. 051192B]

Endangered and Threatened Species; Status of Sacramento River  
Winter-run Chinook Salmon

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

ACTION: Final rule.

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SUMMARY: NMFS has determined that the Sacramento River winter-run chinook salmon should be reclassified from threatened to endangered under the Endangered Species Act of 1973 (ESA). NMFS has determined that the current biological status of the species is endangered based on the continued decline and increased variability of run sizes since its first listing as a threatened species in 1989, the expectation of weak returns in certain years as the result of two small year classes (1991 and 1993), and continuing threats to the population. Although measures implemented through consultations conducted under section 7 of the ESA and State and Federal regulatory actions are designed to reduce adverse impacts on the species, quantifiable improvements in population levels are not likely to be evident for several years. NMFS will continue to closely monitor the status of this population, and evaluate the protective measures to determine whether there is evidence that these measures have reduced or eliminated threats to the species and whether a change in status may be warranted.

EFFECTIVE DATES: February 3, 1994.

FOR FURTHER INFORMATION CONTACT: James H. Lecky, NMFS, Southwest Region, Protected Species Management Division, 501 W. Ocean Blvd., suite 4200, Long Beach, CA, 90802-4213, (310) 980-4015, or Margaret Lorenz, NMFS, Office of Protected Resources, 1335 East-West Highway, Silver Spring, MD 20910, (301) 713-2322.

SUPPLEMENTARY INFORMATION:

Background

Under the ESA and its implementing regulations (50 CFR part 424), an ``endangered species'' is any species that is in danger of extinction throughout all or a significant portion of its range. A ``threatened species'' is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Based on a review of the status of the Sacramento River winter-run chinook salmon and the factors affecting the species, NMFS has determined that it is endangered.

The Sacramento River winter-run chinook salmon is a unique population that is distinguishable from other chinook salmon runs in the Sacramento River based on the timing of its upstream migration and spawning period. For the most part, the winter-run chinook salmon population is comprised of three year classes, each of which primarily returns to spawn as 3-year old fish.

The best available data on winter-run chinook salmon abundance are the annual estimates of the spawning run size made by the California Department of Fish and Game (CDFG) based on counts of fish passing the Red Bluff Diversion Dam. The CDFG began estimating the annual run size for winter-run chinook salmon in 1967 after the Dam was placed in operation. This time series of annual run size estimates has documented a precipitous decline in the winter-run chinook salmon to its present low level (Table 1).

Table 1.--Annual Estimated Run Size at Red Bluff Diversion Dam

Year	Number of Fish
1967.....	57,306
1968.....	84,414
1969.....	117,808
1970.....	40,409
1971.....	53,089
1972.....	37,133
1973.....	24,079
1974.....	21,897
1975.....	23,430

1976.....	35,096
1977.....	17,214
1978.....	24,862
1979.....	2,364
1980.....	1,156
1981.....	20,041
1982.....	1,242
1983.....	1,831
1984.....	2,663
1985.....	3,962
1986.....	2,422
1987.....	2,236
1988.....	2,085
1989.....	547
1990.....	441
1991.....	191
1992.....	1,180
1993.....	341
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In 1989, the CDFG estimated that the winter-run chinook salmon run size was only 547 fish. This unexpectedly small return represented nearly a 75 percent decline from the consistent, but low, run size of 2,000 to 3,000 fish that had occurred since 1982. As a result of this unexpected decline, NMFS issued an emergency interim rule listing the winter-run chinook salmon as threatened under the ESA on August 4, 1989 (54 FR 32085). During the period the emergency interim rule was in effect, NMFS published a proposed rule to list winter-run chinook salmon as threatened under the formal listing procedures of the ESA on March 20, 1990 (55 FR 10260). To avoid a hiatus in protection of the species until the formal listing process was completed, NMFS published a second emergency interim rule listing winter-run chinook salmon as threatened on April 2, 1990 (55 FR 12191). On November 5, 1990, NMFS completed the formal listing process and published a final rule (55 FR 46515) listing the species as threatened under the ESA.

On June 5, 1991, the American Fisheries Society petitioned NMFS to reclassify winter-run chinook salmon as an endangered species. At the time the petition was submitted, the best preliminary data available indicated that the 1991 run would consist of a return of only 88 to 200 adults from the progeny of the 1988 run of 2,085 fish. The final run size estimate made by the CDFG for 1991 was 191 fish (Table 1). NMFS reviewed the petition and determined that it contained substantial information indicating that the petitioned action might be warranted. On November 7, 1991, NMFS announced (56 FR 58986) its intention to review the status of the species to determine whether reclassification was appropriate. After conducting a status review, NMFS published a proposed rule (57 FR 27416) on June 19, 1992, to reclassify winter-run chinook salmon as endangered.

NMFS published a subsequent Federal Register notice (58 FR 31688) on June 4, 1993, delaying the issuance of a final determination on the reclassification for up to six months pursuant to section 4(b)(6)(B) of the ESA. On September 10, 1993, NMFS published another Federal Register notice that provided information on the 1993 run size estimate (341 fish) and reopened the public comment period on the proposed rule.

This determination does not change any of the prohibitions against taking Sacramento River winter-run chinook salmon. Section 9 of the ESA prohibits taking endangered species. The regulations issued when this species was listed as threatened in November 1990 also prohibit taking.

In a separate rulemaking, the U.S. Fish and Wildlife Service (FWS), which is responsible for the List of Endangered and Threatened Wildlife, will revise the list to reflect the reclassification of this species from threatened to endangered.

Conservation measures were implemented by the Bureau of Reclamation (Bureau) beginning in 1986-1987 in an effort to improve adult passage conditions for winter-run chinook salmon at Red Bluff Diversion Dam and to provide suitable spawning and egg incubation conditions for the species in the upper Sacramento River below Keswick Dam. Despite the implementation of measures in 1986-1987 and 1987-1988, the winter-run chinook salmon run size declined to 441 fish in 1990 and to 191 fish in 1991. The estimated 1991 run size of 191 fish was primarily the result of surviving progeny from the 1988 spawning population of 2,085 fish. Thus, the 1991 spawning escapement represented nearly a 90 percent decline in a single generation, and suggested that the 1988 year class was nearly a total failure (57 FR 27416).

In 1992, the CDFG estimated that the winter-run chinook salmon run size increased to 1,180 fish. This run size was substantially higher than the runs estimated in 1989 (547 fish), 1990 (441 fish), and 1991 (191 fish), and it represented more than a 100 percent increase in the spawning population in a single successive generation since the 1992 run was comprised primarily of the surviving progeny from the 1989 run. In 1989, the Bureau implemented conservation measures to manage upper Sacramento River water temperatures and provide improved fish passage at the Red Bluff. As a result of these actions, temperature conditions were much improved with favorable water temperatures occurring from Keswick Dam to Bend Bridge (44 miles downstream) during almost the entire spawning and egg incubation period. Spawning ground surveys in 1989 also indicated that nearly 100 percent of the estimated run spawned in this 44-mile river reach where water temperature was favorable. As a result of these factors, temperature-related mortality was minimal in 1989. The substantial increase in the 1992 run size suggests that the measures implemented to protect winter-run chinook salmon in 1989 were effective, and that similar or more protective measures may be successful in the future.

In 1993, the CDFG estimated the winter-run chinook salmon run size to be 341 fish. This represented nearly a 30 percent decline of the run size in one generation. NMFS had anticipated that the run size would likely decline in 1993 because the 1990 spawning population (441 fish) experienced less favorable water temperature conditions during spawning and egg incubation, and more of the run spawned downstream from the river reach where temperatures could be suitably managed by the Bureau. In 1990, as a result of continued drought conditions and high ambient temperatures, favorable water temperatures for spawning and egg incubation were present only from Keswick Dam to the Balls Ferry Bridge (26 miles downstream) during a portion of the egg incubation period. In addition, spawning distribution surveys indicated that nearly 10 percent of the run spawned downstream from Balls Ferry where temperatures were not favorable. Therefore, temperature-related mortality was substantially higher in 1990 than in 1989. In addition to less favorable temperature conditions, it is possible that conditions for outmigrants were less than favorable, and that ocean survival of the 1990 year class was reduced by the El Nino event that began in 1991-92.

Since the winter-run chinook salmon was formally listed as threatened in November 1990 (55 FR 46515), the species run size has continued to decline, with the exception of 1992, and exhibit considerable variability (Table 1). Although some protective measures were implemented beginning in 1987, this decline was exacerbated by the 6-year drought in California (1987-1992). Based on the run size estimates for the last 3 years (1991-1993), the population now has two weak year classes (1991 and 1993). NMFS expects that the 1994 run will also be weak because of the weak 1991 year class (191 fish) and the less than favorable conditions for spawning, egg incubation, and juvenile outmigration that occurred in 1991-92. Because of the small run in 1991 and the weak return expected in 1994, this year class is likely to remain weakened for some time.

As part of the status review, extinction probabilities were

estimated for the winter-run chinook salmon population using modifications of the model described by Dennis, Munholland, and Scott (1991), and the 3-year geometric moving average of the annual estimated run size for the periods of 1967-1993 and 1979-1993, respectively. Results of the analysis indicate that if past trends continue, the population faces a high probability of dropping below 100 spawners per year at least once over the next 10 years, and to even lower levels over the 50 and 100 year time horizons.

The extinction modeling results suggest that the risk of the winter-run chinook salmon population dropping to unacceptably low levels is high. However, this type of analysis is based only on historical trends in the population (1967-1993) and assumes that past conditions will continue in the future. Although the 1994 run is expected to be weak, NMFS believes that conditions for winter-run chinook salmon were substantially improved in 1992 and 1993 because of long-term protective measures implemented to reduce impacts of Central Valley and State Water Project operations and improve conditions for successful egg incubation, rearing, and outmigration, and the end of the drought. In addition to these protective measures, the FWS has been supplementing the natural production of juveniles with substantial numbers of hatchery produced fish. If these protective measures and supplementation efforts prove to be effective, run sizes in 1995 and 1996 will likely increase. For these reasons, the probability of the population declining to low levels is probably less than suggested by the extinction modeling analysis. However, because the effectiveness of these recently implemented protective measures and supplementation efforts is unknown and cannot be assessed until future runs return, there remains substantial risk that the population is in danger of extinction.

#### Summary of Comments

The World Wildlife Fund supported the reclassification and also encouraged NMFS to develop and implement a recovery plan for the conservation of Sacramento River winter-run chinook salmon. The Department of the Interior (Interior) also supported the reclassification of winter-run chinook salmon, and said the population remained at depressed levels and may be in danger of extinction after the next two runs. However, Interior noted that the 1989 year class survived particularly well and that the resulting 1992 run size of 1,180 adults represented more than a 100 percent increase in size in a single successive generation. Interior also acknowledged that the 1992 increase in run size may indicate that measures taken to protect the population in recent years may be effective. Interior also provided technical comments to clarify and update facts contained in the proposed rule.

The Westlands Water District, the Family Water Alliance, and the Glenn County Board of Supervisors all opposed reclassifying winter-run chinook salmon because of protective measures that have been recently implemented. They said that the threatened status should be retained until the effectiveness of these measures has been assessed.

#### Response to Comments

NMFS agrees with the World Wildlife Fund that development and implementation of a recovery plan is essential for the conservation and recovery of winter-run chinook salmon. For this reason, NMFS has appointed a National Sacramento River winter-run chinook salmon recovery team, comprised of fishery resource managers, experts on winter-run chinook salmon biology, and conservation biology specialists, to develop a recovery plan. The recovery team has been meeting since September 1992 and will submit a draft recovery plan to NMFS in 1994. Interior's technical comments were incorporated where appropriate.

NMFS disagrees with the comments of the Westlands Water District,

the Family Water Alliance, and the Glenn County Board of Supervisors that current protective measures should be allowed to be in place for a certain amount of time and their effectiveness evaluated before NMFS determines whether reclassification is necessary. Although measures have been implemented to reduce adverse impacts on winter-run chinook salmon, and NMFS believes they are likely to be effective, their effectiveness is currently unknown and cannot be evaluated until data on future returns are available.

One of the factors to be considered in listing, delisting and reclassifying a species is "the inadequacy of existing regulatory mechanisms." Judicial interpretation of this language allows NMFS to also consider the "adequacy" of regulatory mechanisms in its listing decisions. It is premature to determine the adequacy of these measures for purposes of this reclassification. Most measures will not demonstrate positive results until the 1996 return of adult winter-run chinook salmon. NMFS must determine whether reclassification is justified on the basis of the current status of the population and the factors affecting its continued existence.

#### Summary of Factors Affecting the Species

Section 4(a)(1) of the ESA specifies five criteria to be evaluated in reviewing the status of a species or population proposed for listing or reclassification. The following discussion is in addition to the evaluation of these factors in the proposed rulemaking to reclassify winter-run chinook salmon as an endangered species (57 FR 27416, June 19, 1992), the first Notice of Determination (52 FR 6041, February 27, 1987), a subsequent Notice of Determination (53 FR 49722, December 19, 1987), two emergency rules (54 FR 32088, August 4, 1989 and 55 FR 12193, April 2, 1990), the proposed rule to list winter-run chinook salmon as threatened (55 FR 10260, March 20, 1990), and the final rule listing the species as threatened (55 FR 46515, November 5, 1990).

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

Modification and loss of spawning and rearing habitat have been major factors contributing to the decline of the winter-run chinook salmon.

##### Shasta and Keswick Dams

On February 12, 1993, NMFS issued a biological opinion and incidental take statement to the Bureau of Reclamation which concluded that long-term operations of the Federal Central Valley Project and the State Water Project would jeopardize the continued existence of winter-run chinook salmon. The opinion identifies a reasonable and prudent alternative with measures designed to protect winter-run chinook salmon from the long-term operations of Shasta and Keswick Dams, as well as other facilities of the Central Valley Project. Implementation of these measures is expected to substantially improve water temperature and flow conditions in the upper Sacramento River for winter-run chinook salmon spawning, incubation, and rearing. The specific measures contained in the reasonable and prudent alternative that relate to Shasta and Keswick Dams require the Bureau to (1) use a more conservative forecasting approach to determine the annual allocation of deliverable water stored in Shasta Reservoir, (2) maintain a minimum end-of-water-year carryover storage in Shasta Reservoir (1.9 million acre-feet) for most water year types, (3) maintain daily average water temperatures in the winter-run chinook salmon spawning grounds below Keswick Dam at no more than 56 degrees Fahrenheit from April 15 through August 31 and at no more than 60 degrees Fahrenheit from October 1 through October 31, (4) maintain a minimum flow of 3,250 cubic feet per second (cfs) from Keswick Dam from October 1 through March 31, and (5) reduce releases from Keswick Dam according to specific criteria from July 1 through March 31. The reasonable and prudent alternative identified specific temperature control points in the upper Sacramento

River for various operating scenarios based on the water year type and reservoir storage conditions at the start of the water year.

Based on forecasted water supplies and reservoir storage conditions in February and March 1993, the Bureau met the reasonable and prudent alternative requirement to maintain water temperatures at or below 56 degrees Fahrenheit throughout the entire winter-run chinook salmon spawning and incubation season from Keswick Dam to Bend Bridge. The CDFG conducted numerous aerial surveys of redd (nests) counts during the winter-run chinook spawning period and observed an unusually large number of redds (in proportion to the estimated run size) due to excellent viewing conditions in the river. Based on these surveys, virtually all redds were observed in the vicinity of Redding well upstream from Ball's Ferry. Two redds were observed between Ball's Ferry and the Bend Bridge temperature control point, and only a single redd was observed below Bend Bridge (immediately downstream from the Red Bluff Diversion Dam). As a result of the temperature control maintained by the Bureau and the distribution of spawners in the river, the incremental impact of temperature on winter-run chinook salmon egg and juvenile survival was minimal in 1993. In addition to providing temperature control during the 1993 spawning, incubation, and rearing season, the Bureau's operations in 1993 resulted in an end-of-water-year Shasta Reservoir storage (in excess of 3.0 million acre-feet) that far exceeded the requirements of the reasonable and prudent alternative.

The incidental take statement issued with the February 1993, long-term CVP biological opinion also contains specific measures that must be implemented to minimize the effects of Shasta and Keswick Dam operations on winter-run chinook salmon incidental take. These measures include (1) the continuation and expansion of temperature monitoring in the upper Sacramento River to ensure compliance with the temperature criteria, (2) NMFS review of the Bureau's proposed water allocation plans before delivery commitments are made each year to determine their potential effects on upper river water temperatures, and (3) monitoring in the upper river when Keswick Dam releases are reduced to prevent the stranding of juvenile winter-run chinook salmon. These measures were implemented by the Bureau as required by the incidental take statement.

Spawning habitat utilized by winter-run chinook salmon in the Sacramento River has also been degraded by decreases in the rate of replenishment for gravel suitable for spawning (NMFS 1992c). In 1990, the California Department of Water Resources placed 100,000 cubic yards of spawning gravel in the upper Sacramento River between Salt Creek and Clear Creek to restore degraded spawning riffles in areas of the river used by winter-run chinook salmon. The FWS has been evaluating these gravel restoration efforts and issued progress reports in 1992 and 1993. Thus far, the majority of the gravel remains where it was originally placed because flows have not reached rates great enough to disperse it in the upper river. Studies by the FWS are expected to continue through at least 1993 with a final report on the program expected in 1994.

Adult winter-run chinook salmon can also be adversely impacted by operation of the Keswick Dam stilling basin. Overflow of water from the stilling basin during operation of the spillway attracts upstream migrating adult salmon into the basin at the base of the Dam where they become trapped. The CDFG and FWS have conducted fish rescue operations at the stilling basin and removed hundreds of trapped salmon. Until the facility is structurally modified to allow fish free passage back to the river, it is likely that some adult winter-run chinook salmon will be lost. To remedy this long-standing problem, the incidental take statement issued with NMFS' February 12, 1993, biological opinion requires the Bureau to structurally modify the stilling basin by no later than December 31, 1993, so that adult winter-run chinook salmon will be able to freely pass from the basin back into the Sacramento River. NMFS and the Bureau have been meeting to discuss and evaluate alternative methods of correcting the problems with the stilling basin. Red Bluff Diversion Dam

Another serious habitat concern for winter-run chinook salmon is the impediment to adult upstream migration caused by the Bureau's operation of this dam on the Sacramento River. Operation of the dam and the associated Tehama-Colusa Canal also adversely impacts juvenile winter-run chinook salmon migrating downstream past the facility. Impacts of the dam and its operations are discussed in the February 12, 1993, biological opinion addressing long-term operations of the Central Valley and State Water Projects.

The 1993 biological opinion also includes specific measures to minimize the impact of gate operations at Red Bluff Diversion Dam on both the upstream passage of adult winter-run chinook salmon and the downstream passage of juveniles. These measures require the Bureau to maintain the dam gates in the raised position at least through April 30, 1993, and from November 1, 1993, through at least April 30, 1994. After the Bureau's proposed pilot pumping project is operational in 1994, the Bureau must raise the dam gates from September 15 through at least May 14 in all subsequent years. Operation of dam gates in accordance with this schedule is expected to provide unimpeded access to upper river spawning habitat for most migrating adults and substantially reduce losses of downstream migrating juveniles due to predation. The Bureau maintained the dam gates in the raised position through April 30, 1993. In an effort to provide additional protection for outmigrating juveniles in 1993, the Bureau raised the dam gates in mid-October rather than on November 1 as required by the reasonable and prudent alternative.

Operation of the Tehama-Colusa Canal water diversion facilities associated with Red Bluff Diversion Dam before 1990 also adversely affected juvenile winter-run chinook salmon during their outmigration. To improve operation of the dam and canal and to reduce impacts to juvenile salmonids, including winter-run chinook salmon, the Bureau installed ``state-of-the-art'' drum screens and a bypass system at the canal headworks in 1990. Studies conducted to date indicate that the entrainment problem has been greatly diminished by the new screens. FWS is expected to publish a report in 1993 summarizing the results of monitoring and evaluation studies conducted in 1992. Additional studies, including monitoring of entrainment and an evaluation of mortality associated with the bypass system is anticipated in 1993. The February 1993 biological opinion for long-term CVP operations requires the Bureau to develop and implement a program to evaluate the fish bypass facilities, and correct any identified problems. This evaluation has not been completed.

The Bureau, in conjunction with Federal and state fishery agencies, has been evaluating various alternatives to the existing facilities at Red Bluff Diversion Dam. The Bureau published an appraisal report in 1992 that identified and analyzed several alternatives for improving fish passage at the dam. Among the four most reasonable alternatives identified in the appraisal report, two involve installation of a new pumping plant based on the Archimedes screw design. The Bureau has postponed final selection of a preferred alternative until experimental data are collected and analyzed from a pilot pumping plant that will be constructed downstream from the dam in 1994.

The pilot pumping plant that the Bureau has proposed to install at the dam will consist of three large pumps to be located on the west bank of the Sacramento River immediately downstream from the dam. Two of the pumps will be closed Archimedes pumps and the third will be a helical style pump, with each having approximately a 100 cfs capacity. This pilot program is intended to evaluate the pump design and operation, and to allow the Bureau to meet irrigation demands in the Tehama-Colusa Canal service area while maintaining the dam gates in the raised position. NMFS conducted an ESA section 7 consultation with the Bureau on the pilot pumping project and issued a biological opinion and incidental take statement in February 1993 which requires the Bureau to conduct an extensive monitoring program to evaluate the effects of fish passage by the pumps and assess the level of taking. Consultation was reinitiated in June 1993 to address modifications in the design,

construction, and operations of the pumping facility that would delay eventual operation from October 1993 to December 1994.

#### Pollution

Pollution in the Sacramento River has also degraded winter-run chinook salmon spawning and rearing habitat. In particular, NMFS is concerned about the effects on adult and juvenile winter-run chinook salmon from runoff entering the upper Sacramento River that is contaminated by heavy metals leached from inactive mining sites at Iron Mountain Mine (IMM). Heavy metal concentrations from this runoff can reach levels that are lethal to winter-run chinook salmon eggs and juveniles. Metal-laden runoff that flows from IMM into the Spring Creek drainage is impounded behind the Spring Creek Debris Dam operated by the Bureau. The Bureau generally operates this dam to control the release of contaminated Spring Creek flow in conjunction with dilution releases from Shasta and Whiskeytown Reservoirs. The Bureau is expected to continue controlling releases from Spring Creek Debris Dam in this manner until source control and/or cleanup can be achieved.

The Environmental Protection Agency (EPA) has placed IMM on the Superfund Priority List, and the State of California and EPA are continuing to evaluate options for the long-term control of contaminants originating from the IMM complex. Based on an memorandum of Agreement between the Bureau and EPA, the Bureau will develop a plan to enlarge Spring Creek Debris Dam to provide additional storage for IMM effluent. EPA also issued a Record of Decision on September 30, 1992, identifying an interim remedial action plan to clean up hazardous substances in the Boulder Creek Operable Unit at the IMM site. The remedial action involves the collection and treatment of acid mine drainage discharges from the Richmond and Lawson portals at IMM, and the excavation and capping of existing waste piles that are eroding and discharging into Boulder Creek and subsequently Spring Creek and the upper Sacramento River. The Richmond and Lawson portals are the two largest sources of hazardous materials at the IMM site and represent the sources for nearly 40 percent of the copper and 80 percent of the cadmium and zinc leached from IMM and discharged into tributaries leading to the Sacramento River. In addition to these activities, the EPA is moving forward with plans to study several remaining sources of contamination at IMM and identify appropriate remedial actions.

The 1993 biological opinion to the Bureau also addressed contamination from IMM. The opinion's incidental take statement requires the Bureau to operate Spring Creek Debris Dam and Shasta Dam so as to minimize the chronic exposure of adult and juvenile winter-run chinook salmon to heavy metal concentrations and eliminate the potential scouring of metal laden sediments from Keswick Reservoir.

NMFS has previously expressed concern that outmigrating juvenile winter-run chinook salmon may be adversely impacted by the disposal of contaminated dredge sediments at disposal sites located in the San Francisco Bay area. The residence time for outmigrating winter-run chinook salmon through the Bay is thought to range from 1 week to more than 2 months depending on the water year type. Prey organisms utilized by juvenile winter-run chinook salmon may bioaccumulate contaminants originating from in-bay disposal of contaminated dredge sediments, thereby exposing juveniles to these contaminants as they forage and migrate through the Bay.

Although NMFS continues to be concerned about the potential effects of in-bay disposal, the Corps has taken recent action to ensure that in-bay disposal of contaminated materials does not occur. In June 1992, the Corps, EPA, the Regional Water Quality Control Board, and the San Francisco Bay Conservation and Development Commission published proposed interim testing guidelines for dredged sediments that would be disposed of at in-bay sites. On February 1, 1993, the Corps formally adopted these guidelines in Public Notice 93-2. These interim testing guidelines are designed to ensure that sufficient information is available to characterize sediments to be dredged for all projects so that disposal does not result in chemical or biological degradation of the disposal site. These guidelines are intended to apply to all open

water disposal projects until a long-term plan for managing dredged sediments in the San Francisco Bay area is developed and implemented.

Although the interim testing guidelines adopted by the Corps represent an important short-term action aimed at preventing the in-bay disposal of contaminated sediments, NMFS believes it is essential that a long-term strategy be developed and implemented for San Francisco Bay area dredging and disposal activities. To meet this need, the Corps and several other Federal, state and local agencies, including NMFS, are developing a Long-Term Management Strategy (LTMS) for managing dredging and disposal activities. The LTMS is designed to provide appropriate dredged material disposal alternatives for a 50-year planning horizon through the designation of ocean, in-bay, and upland disposal sites and the identification of beneficial reuse options. Implementation of the LTMS management programs is anticipated to begin in August 1994.

#### Bank Stabilization

Bank stabilization projects in the Sacramento River are believed to adversely affect winter-run chinook salmon rearing habitat. The Corp of Engineers has developed the Sacramento River Bank Protection Project as a long-range program for construction of bank erosion control works. On October 28, 1991, NMFS issued a biological opinion to the Corps that concluded Phase II of the project was not likely to jeopardize the continued existence of winter-run chinook salmon. However, the incidental take statement issued with the opinion requires the Corps to select the least damaging bank stabilization methods available and to provide NMFS with detailed mitigation plans for each bank protection project in Phase II that would adversely affect winter-run chinook salmon habitat. Based on recent information developed by the FWS concerning bank protection methods that minimize impacts and the importance of protecting shaded riverine aquatic habitat, NMFS requested the Corps to reinitiate consultation on Phase II of the project in late 1992. The Corps is currently developing additional environmental documentation for the remaining Phase II bank protection projects, and NMFS anticipates that further consultation will be initiated when that documentation is completed.

## 2. Overutilization for Commercial, Recreational, Scientific or Educational Purposes

### Commercial and Recreational Fishing

In 1991, NMFS consulted with the Pacific Fishery Management Council (PFMC) pursuant to section 7 of the ESA to evaluate the potential effects of the proposed Pacific Ocean Salmon Fishery Management Plan (FMP) on winter-run chinook salmon. A biological opinion was issued to the PFMC on March 1, 1991, that concluded management of the salmon fishery under the Pacific Ocean Salmon FMP was not likely to jeopardize the continued existence of winter-run chinook salmon. An incidental take statement was also issued with the opinion that authorized a limited incidental take of winter-run chinook salmon by the ocean fishery (NMFS 1991b). NMFS has also consulted with the Council concerning implementation of Amendment 4 to the Pacific Coast Groundfish FMP. The opinion issued by NMFS concluded that implementation of the FMP would not jeopardize the continued existence of winter-run chinook salmon as a result of incidental bycatch of salmon in the fishery. NMFS will continue to consult internally and with the PFMC, as appropriate, to ensure that ocean salmon and other fishery management actions do not jeopardize the continued existence of winter-run chinook salmon.

Since 1987, the CDFG has implemented seasonal fishing closures in the upper Sacramento River and monitored the recreational salmon catch. In 1990, the California Fish and Game Commission adopted regulations that prohibited the retention of salmon in the Sacramento River when adult winter-run chinook salmon are present. This closure has virtually eliminated the taking of winter-run chinook salmon by recreational fishermen. NMFS will continue to coordinate with CDFG concerning in-river fishing restrictions.

## Scientific Studies

In 1991, NMFS issued an ESA section 10 scientific research permit to the FWS to conduct several scientific research studies on Sacramento River winter-run chinook salmon. The FWS's Northern Central Valley Fishery Resource Office published a report in early 1993 summarizing their 1992 activities under the permit. The results from the juvenile monitoring program, the hatchery propagation program, and the temperature tolerance experiments are expected to significantly contribute to NMFS efforts to protect and recover winter-run chinook salmon.

CDFG and FWS also conduct annual spawning distribution surveys of winter-run chinook salmon in the upper Sacramento River and develop estimates of the annual spawning run size based on counts of fish passing the dam. CDFG conducts aerial surveys each year to count winter-run chinook spawning redds and determine their distribution in the upper River. The FWS also counts winter-run chinook salmon redds in an index area in the vicinity of Redding.

In March 1993, NMFS modified the FWS's scientific research to authorize the directed take and sacrifice of coded-wire tagged winter-run chinook juveniles produced at Coleman National Fish Hatchery and collected during monitoring studies in the Sacramento River, the Delta, and at the State and Federal water export facilities in the southern Delta. The purpose of the study was to determine growth rates of juvenile winter-run chinook salmon produced at the hatchery and released into the wild, and to help verify the size criteria developed by CDFG to separate and identify juvenile chinook salmon by race.

Under the terms of the May 1988 Ten Point Restoration Plan for winter-run chinook salmon, the FWS agreed to fund and implement a winter-run chinook salmon propagation program at the hatchery. Prior to 1991, this program was unsuccessful. However, in 1991 the FWS was able to successfully hold and spawn six female winter-run chinook salmon despite the low numbers of fish available (only 22), and produce and release about 11,000 juveniles into the Sacramento River near Redding, California. In 1992, the winter-run chinook salmon spawning run size was substantially higher (1,180 fish), more adults were collected for broodstock use, and a total of approximately 28,000 juvenile winter-run chinook salmon with tags were released into the upper Sacramento River in late January 1993. The FWS continued this program in 1993 using approximately 17 wild adults and is currently rearing in excess of 20,000 juveniles at the hatchery. The surviving juveniles will eventually be tagged and released into the upper Sacramento. This marking program is expected to provide information on the timing of winter-run chinook salmon outmigration and growth. In addition, marked fish that return to the upper Sacramento River to spawn in the future will be easily distinguishable from wild fish, thereby allowing the FWS to assess the effectiveness of this supplementation program and ensure that hatchery produced adults are not mated with each other. The marking program may also provide additional information concerning the ocean harvest of winter-run chinook salmon. NMFS is currently conducting a section 7 consultation with the FWS to address the long-term effects of this propagation program, as well as a proposed captive broodstock program, and other existing propagation programs at the hatchery, on the wild winter-run chinook salmon population. NMFS expects to conclude consultation and issue a biological opinion to the FWS before the end of 1993.

In April 1992, FWS applied for a modification to its scientific research permit in order to initiate a captive breeding program using about 1,000 juveniles that remained from the hatchery propagation effort in 1991. A primary objective of this program was to provide insurance against extinction or loss of unique genetic variability until the wild winter-run chinook salmon population began to recover. The goal of the program is to produce about 200 mature broodstock for each of three consecutive years beginning in 1994.

The FWS transferred approximately 750 of the juveniles produced from adults captured during the 1991 spawning run to the University of

California's Bodega Marine Laboratory in September 1992 for extended captive rearing. A small number of these juveniles (approximately 50) were subsequently transferred to Steinhart Aquarium in San Francisco during March 1993 for further rearing and display. Additional juveniles produced from adults collected and spawned in 1992 were transferred from the hatchery to Bodega Marine Laboratory for extended rearing in February 1993. As of September 1993, the Bodega Marine Lab was rearing approximately 425 fish from the 1991 broodyear and approximately 640 fish from the 1992 broodyear. A portion of the surviving adults produced from the 1991 and 1992 broodyears may eventually be returned to the hatchery for use as broodstock. However, these captively reared adults will not be used in any matings nor can their progeny be released into the wild until after NMFS and FWS have concluded the ongoing section 7 consultation that is addressing the potential adverse effects of the captive broodstock program on wild fish, and NMFS has amended the FWS's existing ESA section 10 research and propagation permit.

### 3. Disease or Predation

The magnitude and extent of predation on winter-run chinook salmon in the Sacramento River and Sacramento-San Joaquin Delta are poorly known. However, studies by the FWS have found that predation at Red Bluff Diversion Dam, primarily by squawfish, significantly contributes to the mortality of downstream winter-run chinook salmon migrants. The FWS has undertaken periodic electrofishing below the dam which may be useful in developing a relative squawfish abundance index. All of the fisheries agencies believe that before squawfish control is possible, more must be learned about their life history. In 1992, the FWS conducted limited studies of predation at the fish bypass outfall as part of its continuing evaluation of the dam and the new screens that were installed in 1990.

NMFS has addressed this problem, in part, by requiring the Bureau, through the 1993 biological opinion on long-term operations of the Central Valley Project, to maintain the Red Bluff Diversion Dam gates in the raised position during most of the outmigration period. This action is expected to reduce substantially the adverse effects of predation at the dam on juvenile winter-run chinook salmon.

The potential for high levels of predation on juvenile winter-run chinook salmon also exist at the Glen-Colusa Irrigation District (GCID) diversion facility and other manmade structures such as the California Department of Water Resource's Suisun Marsh Salinity Control Structure and Clifton Court Forebay in the southern Delta. Predation studies conducted by the CDFG in forebay indicate that the pre-screening mortality of marked salmonids, primarily due to predation by striped bass, is approximately 75 percent. Squawfish and striped bass predation has also been observed on juvenile salmonids released back into the Sacramento River from salvage operations conducted by the CDFG at State and Federal fish protection facilities in the lower Sacramento-San Joaquin Delta.

The CDFG is conducting an extensive ongoing program to assess the abundance of predators in the forebay, remove predators by means of gill nets and other fishing gear, and investigate and evaluate all factors that are thought to contribute to pre-screening losses of juvenile salmonids. The February 1993 opinion on long-term operation of the CVP indirectly address predation in the forebay by limiting the combined incidental take of juvenile winter-run chinook salmon at the State and Federal facilities to 1 percent of the annual estimated juvenile production. In addition, implementation of specific measures contained in the opinion's reasonable and prudent alternative, such as closure of the Delta Cross Channel and reverse flow criteria in the western Delta, is expected to limit the diversion of juvenile winter-run chinook salmon from the Sacramento River and their subsequent exposure to predation in the Delta and possibly Clifton Court Forebay.

The CDFG began a large-scale program of stocking hatchery-reared

striped bass in 1981 through the Striped Bass Stamp Program authorized that year. Approximately 60,000 yearling bass were stocked that year, and the program increased substantially in subsequent years. Beginning in 1984, the program expanded to include several private hatcheries and two state facilities. Between 1982 and 1990, the program raised and planted nearly 3.0 million juvenile striped bass. Additionally, privately reared yearling bass have purchased and stocked by the State's Department of Water Resources and the Pacific Gas and Electric Company as mitigation for fish losses at their facilities in the Delta. Since 1984, the company has purchased and stocked over 2.5 million juvenile bass, and the State has stocked almost 5.0 million juvenile bass since 1988.

Several groups raised concerns in 1992 about the possible effects of CDFG's striped bass enhancement and management program on winter-run chinook salmon. NMFS reviewed CDFG's proposed enhancement program for 1992 and recommended several changes, as well as the implementation of studies designed to assess the magnitude of striped bass predation on winter-run chinook salmon. As a result of these and other concerns, CDFG eventually decided to suspend the planting of hatchery-reared striped bass in Delta waters in 1992. In June 1993, NMFS requested that CDFG delay further release of hatchery fish as part of its striped bass management program, and apply for an ESA section 10 incidental take permit.

#### 4. The Inadequacy of Existing Regulatory Mechanisms

In the final rule listing winter-run chinook salmon as threatened (55 FR 46515, November 5, 1990), NMFS concluded that the existing regulatory mechanisms at that time were not adequate to recover the Sacramento River winter-run chinook salmon. In the proposed rule reclassifying the species as endangered (57 FR 27416, June 19, 1992), NMFS concluded that regulatory mechanisms might not have been sufficient or applied effectively. NMFS believes that measures currently being taken by Federal agencies pursuant to their ESA section 7 obligations will reduce adverse impacts on the species. However, these measures do not necessarily provide for the recovery of the species, but that the continued existence of the species is not likely to be jeopardized. Further, the adequacy or inadequacy of these measures cannot be determined until at least the 1996 return of adult salmon.

In addition, NMFS believes that Title XXXIV of Public Law 102-575-- Central Valley Project Improvement Act--which was enacted by Congress in late 1992 will also contribute to the restoration and recovery of the winter-run chinook salmon. Although that Act is intended to protect, restore, and enhance all fishery resources and habitats in the Central Valley and Trinity River basins of California, the implementation of several provisions will directly benefit winter-run chinook salmon and aid in its recovery. Several of the provisions are also expected to help implement actions that NMFS has identified as necessary to avoid jeopardizing the continued existence of winter-run chinook salmon and ensure its eventual recovery.

Provisions of the Act that have the most direct beneficial effect on winter-run chinook salmon are those requiring:

- (1) Dedication of 800,000 acre-feet of CVP water for fish, wildlife, and habitat restoration purposes annually,
- (2) Installation and operation of a temperature control device at Shasta Dam and modifications of CVP operations to control water temperatures in the upper Sacramento River,
- (3) Development and implementation of measures at the Red Bluff Diversion Dam to minimize fish passage problems,
- (4) Expansion of the FWS's existing hatchery facility,
- (5) Modification of the Keswick Dam fish trap and spillway to prevent trapping of fish,
- (6) Development and implementation of a continuing program to restore and replenish lost spawning gravel in the upper Sacramento

River,

(7) Development and implementation of a program that provides for modified operations or new and improved control structures at the Delta Cross Channel and Georgiana Slough,

(8) Development and implementation of a program to resolve fish passage and stranding problems associated with operation of the ACID dam,

(9) Maintenance of minimum carryover storage in Sacramento and Trinity River reservoirs,

(10) Design and construction, in conjunction with the State of California and other Federal agencies, of a new fish protection structure at the GCID pumping facility near Hamilton City, and

(11) Development and implementation, with the State of California, of measures to avoid losses of juvenile fish resulting from unscreened or poorly screened diversions.

EPA is expected to propose, in December 1993, regulations that would set water quality standards for the San Francisco Bay/Sacramento-San Joaquin Bay/Delta estuary. This is in response to EPA disapproving many elements of a water quality control plan for salinity adopted in May 1991 by the California State Water Resources Control Board. The plan was disapproved because it failed to adequately protect the estuarine habitat and its resources. NMFS is presently consulting with EPA concerning the effects of the standards to be proposed on winter-run chinook salmon and its critical habitat.

## 5. Other Natural or Manmade Factors Affecting the Continued Existence of the Species

### Unscreened Diversions and Entrainment

Juvenile winter-run chinook salmon are subject to entrainment by large numbers of unscreened or inadequately screened diversions during their outmigration to the Pacific Ocean. These diversions range from small siphons diverting 20 cfs to the large export facilities operated by the Bureau and Department of Water Resources in the southern Delta that have the combined capacity of pumping approximately 12,000 cfs of water daily. The magnitude of this impact is currently unknown.

Because of the potential impact from unscreened diversions, NMFS published an Advanced Notice of Proposed Rulemaking (ANPR) on October 18, 1993, that stated NMFS is considering development of regulations that would establish screening requirements for water diversions from the Sacramento River and the Delta to protect juvenile winter-run chinook salmon. The ANPR also requested specific information and comments concerning the numbers, types, and sizes of diversions, the magnitude of juvenile salmon losses at unscreened diversions, the feasibility of installing positive-barrier fish screens to reduce losses, the estimated costs of screening and available funding mechanisms, and the availability of alternative management options for reducing fish losses due to entrainment. NMFS will evaluate all information and comments on the ANPR to determine whether to proceed with the development of screening regulations.

In addition, the CDFG has begun an inventory of all existing water diversions on the Sacramento River and in the Sacramento-San Joaquin Delta to determine the number and size of unscreened diversions and identify high priority facilities requiring screening. The Bureau, in conjunction with the State, has also established a demonstration screening program that is expected to be implemented in 1994. This program was included as a measure to reduce taking of winter-run chinook salmon in the incidental take statement that NMFS issued to the Bureau with the February 12, 1993, biological opinion covering long-term CVP operations. The program is intended to promote the advancement of state-of-the-art positive barrier screening technology at small (less than 40 cfs) unscreened diversions along the Sacramento River and within Delta waterways.

Anderson Cottonwood Irrigation District

The Anderson Cottonwood Irrigation District (ACID) operates a

diversion dam and two diversion facilities on the upper Sacramento River near Redding, California. The larger of the two diversions is protected by a screen operated and maintained by the CDFG. Until July 1992, the smaller Bonneyview water diversion facility (65 cfs capacity) was unscreened.

In May 1992 the ACID applied for a Corps of Engineers (Corps) permit to install a screening structure at the Bonneyview facility, and NMFS initiated section 7 consultation with the Corps to evaluate the effects of installing and operating the structure on winter-run chinook salmon. The ACID obtained a Corps permit and installed an impervious barrier with screens that was operational by early July 1992.

Monitoring by CDFG in the irrigation canal behind the screening structure in July and August 1992 demonstrated that the structure effectively eliminated the entrainment of juvenile winter-run chinook salmon and other species. Subsequent dive inspections of the screening facility by the NMFS found that the cleaning mechanism was working improperly. As a result, ACID personnel are now cleaning the screens manually and are expected to work with NMFS and the screen manufacturer to develop an alternative cleaning mechanism.

Glenn-Colusa Irrigation District

The GCID diversion facility located near Hamilton City, California, is the single largest diverter of water on the Sacramento River with the capacity to take up to 3,000 cfs daily. Inadequate fish screens at the facility result in the entrainment and impingement of juvenile salmon, including winter-run chinook salmon, that are dispersing in the river system during the peak of the irrigation season. Since 1990, NMFS has used the section 7 and section 10 provisions of ESA, together with direct legal action, in an effort to remedy the adverse effects of GCID water diversion operations on winter-run chinook salmon.

On August 16, 1991, the U.S. District Court in Sacramento, California issued a temporary restraining order that required GCID not to exceed a pumping rate of 1,100 cfs from August 19 to August 29, 1991. On January 9, 1992, the Court issued a permanent injunction that completely enjoined GCID from diverting any water at the facility from July 15 through November 30. The Court modified the permanent injunction in April 1992 to allow GCID to operate under the terms and conditions of a joint stipulation that was agreed to by GCID, the Department of Justice, and the State of California. Under the terms and conditions of the modified injunction, GCID was allowed to pump water on a restricted basis in 1992 in exchange for its commitment to implement a long-term solution to correct existing fish passage problems at the facility.

Following completion of an ESA section 7 consultation and the issuance of a biological opinion from NMFS on June 5, 1992, the Corps issued a 1-year permit to GCID that authorized dredging and other construction activities that were identified as terms and conditions in the modified the permanent injunction. GCID completed construction of a training wall, reconfiguration of the lower oxbow leading back into the Sacramento River, and additional maintenance dredging near the screens by mid-July 1992.

In September 1992, the Corps initiated consultation with NMFS concerning a new GCID permit application to conduct maintenance dredging and other activities at its facility over a 3-year period (1993-95). On April 22, 1993, NMFS concluded consultation and issued a jeopardy biological opinion and incidental take statement that limited dredging in the upper oxbow, required maintenance of the training wall and pilot cut through the lower oxbow, limited the permit duration to a period of 1 year, and required GCID to pursue a long-term solution for protecting winter-run chinook salmon and correcting passage problems at the facility. Following issuance of the Corps permit, GCID conducted maintenance dredging and other maintenance activities in accordance with the requirements of the biological opinion, and subsequently began pumping water on a restricted basis beginning on August 1, 1993.

The Department of Justice and GCID signed a new stipulated agreement in June 1993 that allowed operations to continue in 1993.

This new agreement, in conjunction with the biological opinion that was issued to the Corps, restricted pumping activities at the Hamilton City facility, required various types of monitoring, and committed GCID to ensure the implementation of long-term protective and conservation measures for winter-run chinook salmon at its Hamilton City facility.

In 1992, GCID, the State of California, and the Corps began a joint Federal and state environmental review process to evaluate several long-term alternatives for correcting fish entrainment, impingement, and passage problems at the GCID facility. The Bureau is now the lead Federal agency responsible for preparing the environmental documentation and constructing the selected long-term protective and conservation measures due to the passage of the Central Valley Improvement Act. The environmental review process has been delayed, but is expected to be completed by mid-1994. NMFS will consult with the Bureau to evaluate the effects of constructing and operating the selected long-term protection alternative on winter-run chinook salmon. Delta Export Facilities of the Central Valley Project and the State Water Project

The Bureau and the California Department of Water Resources operate facilities in the Sacramento-San Joaquin Delta to convey Sacramento River water into and through the Delta and to export water out of the Delta. These facilities include the Delta Cross Channel operated by the Bureau, and water export and fish protection facilities operated by the Bureau (Tracy Pumping Plant) and California Department of Water Resources (Byron Pumping Plant). The operations of these and other Central Valley and State water facilities, which are coordinated through the Coordinated Operations Agreement between the Bureau and the State, can adversely impact winter-run chinook salmon.

To address the potential adverse effects of gate operations on juvenile winter-run chinook salmon survival in 1992, NMFS included a reasonable and prudent alternative measure in the February 14, 1992, biological opinion for 1992 CVP operations requiring the Bureau to close the Delta Cross Channel from February 1 through May 1, 1992. This action was expected to substantially reduce the diversion of juvenile winter-run chinook salmon into the Delta from the Sacramento River, especially with the extremely critical water supply and low export pumping rates that were anticipated to occur in 1992. Operation of the Federal and State export facilities in 1992 was not expected to incidentally take more than a small percentage of the 1991 winter-run chinook salmon outmigrant population.

However, based on monitoring at these facilities during February and March 1992, NMFS determined that the taking of juveniles exceeded the amount identified in the incidental take statement, and requested consultation be reinitiated. After further consultation with the Bureau and the State was completed, NMFS amended the incidental take statement to restrict the combined daily water export rate from both facilities to 1,200 cfs during the remainder of April 1992. The amended take statement also required that consultation be reinitiated if the incidental take of juveniles exceeded 400 fish during this period or there was evidence to indicate that winter-run outmigration would substantially continue beyond April 30, 1992, and required both the Bureau and the State to support efforts to develop a more refined and accurate method for determining the level of taking incidental to pumping operations at the water export facilities.

Because the losses of juvenile fish at these facilities were higher than expected in the spring of 1992, NMFS and the CDFG established a Delta Salvage and Loss Working Group consisting of representatives from NMFS, FWS, the California Departments of Fish and Game and Water Resources, and the Bureau. The objectives of this group were to (1) review and refine the juvenile winter-run chinook salmon loss estimates at the water export facilities during the 1992 outmigration period, and (2) evaluate the loss estimation and reporting procedures used in 1992 and make recommendations for improving the procedures for 1993 and future years. The group met frequently to discuss these issues and issued a summary report in September 1992 that included a revised

estimate of juvenile winter-run chinook salmon losses in 1992 and a series of recommendations for loss estimation and reporting. The loss estimation and reporting procedures developed by this group were eventually incorporated into the February 12, 1993, biological opinion and incidental take statement that NMFS issued to the Bureau on the long-term operations of the Federal and State water projects.

The biological opinion also includes protective measures designed to reduce the impact of Delta operations on winter-run chinook salmon. The reasonable and prudent alternative in the opinion contains the following measures to avoid jeopardizing the continued existence of winter-run chinook salmon: (1) Closure of the Delta Cross Channel each year from February 1 through April 30; (2) operation of the cross channel gate each year from October 1 through January 31 to minimize the diversion of juveniles into the Delta based on the use of a real-time monitoring program; (3) operation of the delta water export facilities each year to ensure that no reverse flow conditions occur in the western Delta from February 1 through April 30; (4) operation of the delta export facilities each year to ensure that reverse flow conditions are minimized from November 1 through January 31; and (5) monitoring of winter-run chinook incidental take at the Federal and State export facilities. The incidental take statement included with the opinion also contains measures designed to minimize the taking of juvenile winter-run chinook salmon incidental to the operation of the water export facilities. This take statement identifies the level of incidental taking by the Bureau and State export facilities to be no more than 1 percent of the estimated number of outmigrant juvenile winter-run chinook salmon entering the Delta in any year, and requires the Bureau and the State to submit daily, weekly, and annual reports based on an extensive monitoring program to ensure the incidental take authorization is not exceeded.

Based on the 1992 run size estimate (1,180 fish), NMFS determined that the allowable take of outmigrating juvenile winter-run chinook salmon incidental to operation of the export facilities in 1992-93 was 2,700 fish. Monitoring of winter-run chinook salmon incidental take during the 1993 outmigration season indicated that the level of taking was substantially higher at the State export facility than at the Federal export facility. The monitoring program also indicated that the rate of taking by mid-February 1993 was higher than anticipated, and that continued high pumping rates could result in exceeding the annual take level authorized by NMFS. As a result, the State voluntarily curtailed pumping at its Delta pumping facility in late February to reduce the loss rate and cumulative loss of juvenile winter-run chinook salmon at its facility. Although pumping rates were gradually increased during March and April 1993 at the State facility, the cumulative loss of juveniles was less than 1 percent of the estimated outmigrant population in 1993. As a result of these and other actions taken by the State and Bureau in accordance with the February 12, 1993, biological opinion and incidental take statement, NMFS believes that the survival of outmigrating juveniles in 1993 was significantly improved over previous years. Continued implementation of these protective measures in future years is expected to improve outmigration success of juvenile winter-run chinook salmon and aid in recovery.

#### Suisun Marsh

Operation of the Suisun Marsh salinity control gate structure by the State can potentially affect winter-run chinook adversely by diverting outmigrating juveniles from the Sacramento River into Montezuma Slough where conditions for survival are poorer because diverted fish have a longer migration route, and are exposed to increased water temperatures, increased predation, and numerous unscreened water diversions. Upstream migrant adult winter-run chinook that enter the downstream end of Montezuma Slough may also be blocked or delayed by operation of the gates as they attempt to migrate into the Sacramento River.

In order to minimize impacts on winter-run chinook salmon juveniles, NMFS required (in the 1992 CVP opinion) that salinity

control gates to either close from March 1 through April 15, or that unscreened diversions in the Slough not operate during this period. The California Departments of Water Resources and Fish and Game conducted monitoring during this period and provided documentation to NMFS that these diversions were not operated. However, sampling by FWS during April 1992 also indicated that only a small percentage of marked juvenile salmonids (0.2-1.5 percent) were diverted into Montezuma Slough.

Since the potential impacts of operating the salinity control gates on winter-run chinook salmon are unclear based on the available information, NMFS addressed the need for additional studies at the facility in the incidental take statement included with the 1993 CVP biological opinion. Specifically, the incidental take statement requires the Bureau and the State to develop and implement a program to evaluate the effects of operating the salinity control structure on winter-run chinook salmon by spring 1994. The program is expected to assess the diversion rate of chinook salmon juveniles into Montezuma Slough, predation at the structure, survival of juveniles passing through the slough, and passage of adults upstream.

#### Droughts/El Nino

The natural factors of greatest concern to NMFS are drought conditions and the oceanographic phenomenon known as El Nino. The effects of the extended 1987-1992 drought on California's water supply have likely exacerbated the effects of management of State and Federal water operations and other activities on winter-run chinook salmon over the past several years. However, the end of the drought in 1993 due to above normal levels of precipitation throughout the State, and the implementation of protective measures contained in NMFS February 12, 1993, biological opinion are expected to reduce the adverse effects of drought in future years by ensuring that minimum carryover storage is maintained in Shasta Reservoir each year, and that conservative water supply forecasts are used by the Bureau to make annual water allocation decisions. In addition to these measures, the Bureau is expected to construct a temperature control device at Shasta Reservoir that should improve its ability to provide suitable water temperatures in the upper Sacramento River.

The El Nino event that began in 1991-1992 may result in reduced ocean survival of winter-run chinook salmon produced in 1990 and 1991 when the estimated run sizes were very low (441 and 191 fish respectively) and drought conditions prevailed. For these and other reasons, NMFS anticipated that the 1993 run size would be low, and also expects that the run size in 1994 will be weak. The only measure that may help to mitigate the impact of El Nino events may be the hatchery supplementation program developed by the FWS to augment natural juvenile production. If the hatchery supplementation program proves to be successful, it may provide the necessary juvenile production to offset any adverse effects of El Nino conditions.

#### Conclusion

Since the winter-run chinook salmon was formally listed as a threatened species in November 1990 (55 FR 46515), the annual estimated run sizes have become more variable and have continued to decline with the exception of an increase in 1992. Although some protective measures were implemented beginning in 1987, the decline was exacerbated by a 6-year drought in California (1987-1992) and threats adversely affecting the species that were not addressed until recently. Based on the run size estimates for the last 3 years (1991-1993), the population now has at least one and possibly two extremely weak year classes (1991 and 1993). NMFS expects that the 1994 run will also be weak because of the small numbers of adults returning in 1991 (191 fish) and less than favorable conditions for spawning, egg incubation, and juvenile outmigration that occurred in 1991-92. This years class is likely to remain weakened for the foreseeable future.

Although conditions for winter-run chinook salmon began improving

in 1992 and 1993 because of protective measures implemented to reduce the long-term impacts of operations of the Federal and State water projects and improve conditions for successful egg incubation, rearing, and outmigration, the 6-year drought ended, and the natural production of juveniles is being supplemented with hatchery produced fish, NMFS believes that quantifiable improvements in population levels are not likely to be evident for several years. Since the effectiveness of these recently implemented protective measures and supplementation efforts is unknown and cannot be assessed until future runs return, there remains substantial risk that the population is in danger of extinction.

Based on the continued decline of the population and increased variability of run sizes since 1991, the expected weak return in 1994, continuing threats to the population, and uncertainty about whether recently implemented protective and conservation measures will be effective, NMFS believes that the Sacramento River winter-run chinook salmon is in danger of becoming extinct and should be classified as an endangered species. NMFS will continue to monitor closely the status of this population as well as evaluate the effectiveness of existing and future protective and conservation measures to determine whether any further changes in its status are warranted.

#### Available Conservation Measures

Conservation measures provided to species that are listed under the ESA include listing, recovery actions, implementation of certain protective measures, and designation and protection of critical habitat. Some of the most useful protective measures are contained in section 7 of the ESA. Pursuant to section 7, Federal agencies are required to conduct conservation programs for endangered species and to consult with NMFS regarding the potential effects of their actions on winter-run chinook salmon.

Since winter-run chinook salmon was originally listed as a threatened species on an emergency basis in August 1989, NMFS has conducted numerous section 7 consultations with Federal agencies whose actions may affect the species. The most significant consultations have been with the Bureau and the California Department of Water Resources concerning the long-term operations of the Central Valley Project and the State Water Project and the Corps concerning fish passage at the GCID diversion facility at Hamilton City. NMFS is currently engaged in consultations with other Federal agencies and will continue this process to determine whether Federal actions affect winter-run chinook salmon.

Section 10 of the ESA provides for addressing the effects of private and state (non-Federal) actions on endangered species. NMFS has worked with GCID to address the impacts of their major diversion facility on winter-run chinook salmon through this process. NMFS also expects to work with the CDFG to address potentially adverse effects of striped bass and salmon hatchery management on winter-run chinook salmon. In the future, NMFS will continue to pursue opportunities to remedy private and non-Federal activities that may affect winter-run chinook salmon through this process.

In 1992, NMFS established a National Sacramento River Winter-run Chinook Salmon recovery team to develop a recovery plan for the species. The team is comprised of fishery resource managers, experts on winter-run chinook salmon biology and, other conservation specialists. The recovery team meets frequently and expects to complete development of a comprehensive draft recovery plan in 1994.

#### Critical Habitat

Section 4(a)(3)(A) of the ESA requires that, to the extent that it is prudent and determinable, critical habitat be designated concurrently with the listing of a species. NMFS published a final rule designating critical habitat for Sacramento River winter-run chinook

salmon on June 16, 1993. The designated critical habitat includes: the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, all waters of San Pablo Bay, and all waters in San Francisco Bay north of the San Francisco/Oakland Bay Bridge. The final rule also identifies those physical and biological features of the habitat that are essential to the conservation of winter-run chinook salmon.

#### List of Subjects

##### 50 CFR Part 222

Administrative practice and procedure, Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

##### 50 CFR Part 227

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

Dated: December 14, 1993.

Nancy Foster,  
Deputy Assistant Administrator for Fisheries, National Marine Fisheries Service.

For the reasons set forth in the preamble, 50 CFR parts 222 and 227 are amended as follows:

#### PART 222--ENDANGERED FISH OR WILDLIFE

1. The authority citation for part 222 continues to read as follows:

Authority: 16 U.S.C. 1531-1543.

#### Sec. 222.23 [Amended]

2. In Sec. 222.23, paragraph (a) is amended by adding the phrase ``Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*);'' immediately after the phrase ``Snake River sockeye salmon (*Oncorhynchus nerka*)'' in the second sentence.

#### PART 227--THREATENED FISH AND WILDLIFE

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

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

#### Sec. 227.4 [Amended]

4. In Sec. 227.4, paragraph (e) is removed and paragraphs (f) through (h) are redesignated paragraphs (e) through (g) respectively.

#### Sec. 227.21 [Amended]

5. In Sec. 227.21, paragraphs (a) and (b)(1), the phrase ``(e), (g) and (h)'' is removed, and the phrase ``(f) and (g)'' is added in its place; in paragraph (b)(2), the phrase ``(g) and (h)'' is removed and the phrase ``(f) and (g)'' is added in its place.

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