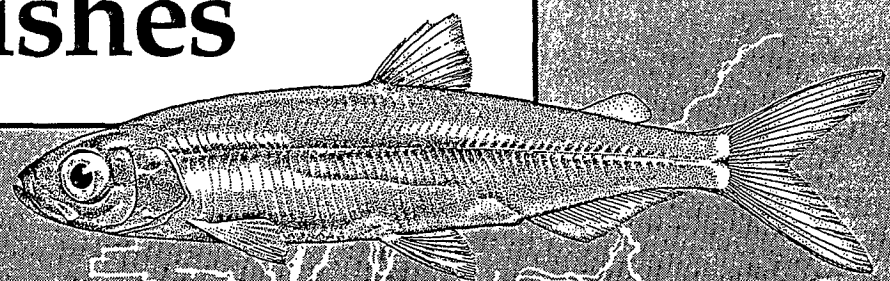
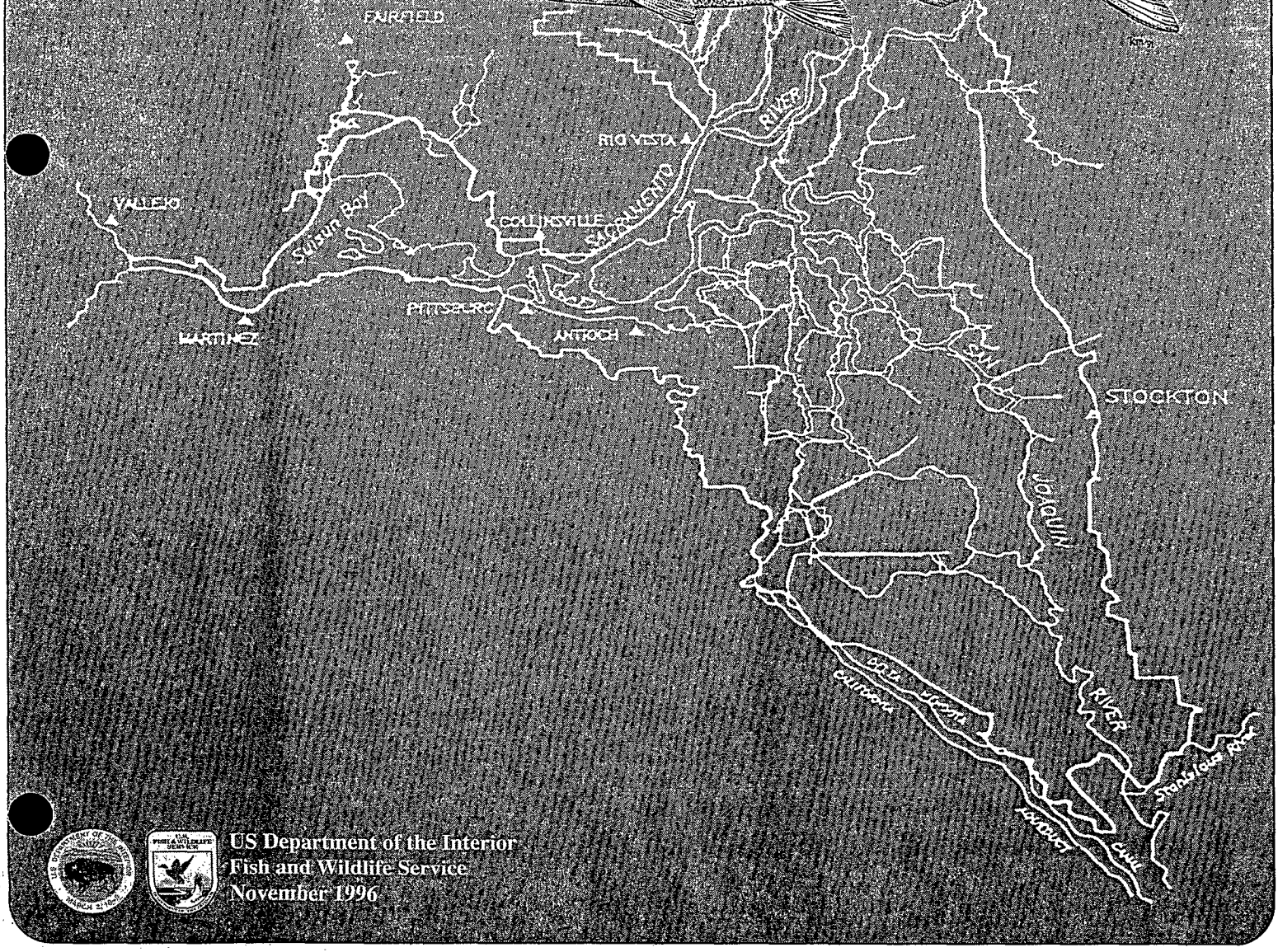
Recovery Plan for the Sacramento / San Joaquin Delta Native Fishes





US Department of the Interior
Fish and Wildlife Service
November 1996

C—048520

C-048520

hatchery fish (until 1992, when it was halted by DFG) may have artificially increased predation rates on splittail. Large adult splittail are presumably largely immune to such predation.

7. Exploitation

Although splittail have been harvested as food and bait by sport anglers, there is no evidence that this exploitation has contributed to their decline. However, the Asian sport fishery in the past has concentrated on presumably spawning fish, so it could inhibit restoration of the species.

Conservation measures: Conservation measures discussed in the delta smelt section will also benefit splittail, although the unique spawning and habitat requirements of splittail mean that additional actions to enhance splittail populations will probably be necessary.

Research is currently underway by DFG, DWR, Reclamation, Service, UCD, and others to learn more about the life history and habitat requirements of splittail.

RESTORATION

Restoration Objective

The objective of this part of the Delta Native Fishes Recovery Plan is to restore Sacramento splittail, a species proposed for threatened status under the Federal Act. Restoration of splittail should not be at the expense of other Delta native fishes. Splittail will be considered out of danger when their population dynamics and distribution patterns within the estuary are similar to those that existed from 1967-1983. This period was chosen because it includes the earliest continuous data on splittail abundances and was a period when splittail populations stayed reasonably high in most years within the estuary.

Splittail are currently restricted to a fraction of their historic range. Because restoration of splittail to their former range outside the Delta is unreasonable (i.e., it would require removal of major dams), restoration of the species refers primarily to restoration of the reduced Delta population. Nevertheless, some actions that may help restore the species to a portion of its previous upstream range: (1) creation of meander belts along the Sacramento River by levee setbacks; (2) creation of floodable wetlands in the lower San Joaquin, Tuolumne, and Stanislaus Rivers; (3) marsh restoration in the Delta and Suisun Marsh; (4) managing bypasses for fish; and (5) removal of upstream barriers to migration.

Restoration Criteria

The splittail was proposed for listing as a threatened species on January 6, 1994. The restoration criteria listed here would represent appropriate recovery criteria should the species be listed. Splittail will be considered restored when they meet two out of three possible restoration criteria, developed from three independent surveys. The three possible criteria are: (1) FMWT numbers must be 19 or greater for 7 of 15 years; (2) Suisun Marsh catch per trawl must be 3.8 or greater AND catch of young-of-year must exceed 3.1 per trawl for 3 of 15 years; and (3) Bay Study otter trawl numbers must be 18 or greater AND catch of young-of-year must exceed 14 for 3 out of 15 years. Within each survey, if target criteria are not met at least once in 5 consecutive years, the restoration period for the failed survey will be re-started. Criteria depend on data collected by three independent surveys, two conducted by DFG (FMWT and Bay Study otter trawl) and one conducted by UCD (Suisun Marsh otter trawl). These studies were chosen because they sample most of the splittail range and contain the earliest continuous data on splittail abundance. When any two out of three criteria are reached, splittail will be considered restored.

Justification for using numbers from three surveys: Restoration criteria were built around three surveys to increase flexibility in how criteria are met. Splittail catches tend to be low in the long-term data sets available on the estuary, so using two out of three surveys to meet the criteria provides added protection for splittail as well as flexibility for managers. The Bay Study and Suisun Marsh sample downstream portions of splittail range, so meeting abundance criteria in either one of these surveys will ensure wide distribution for splittail in the estuary. Numbers were chosen rather than the index because there is a high correlation between numbers and the index ($r^2 = 0.83$, a relatively high coefficient of determination, for the FMWT). Furthermore, using numbers reduces confusion due to the widely published indices for striped bass and delta smelt. Numbers are also consistent with the rest of the recovery plan for other species.

Justification for using 1967-1983 for the pre-decline period: Graphs from the surveys were used to establish pre- and post-decline periods for splittail. As is the case for other species, especially delta smelt, the decline in splittail numbers actually occurred over a multi-year period from 1981-1985. Further, because splittail live for 5-7 years, drops in abundance are dampened by the presence of several year classes.

Length of restoration period: Because all splittail mature by three years, 15 years were chosen as the restoration period. Fifteen years represent five generations of splittail. Restoration criteria specify that numbers can not fall below the restoration target for five consecutive years. This is to protect splittail

from reproductive failure and is based on historic FMWT data. Splittail numbers were very low from 1969-1974 and contributed to subsequent low numbers. Because splittail live from 5-7 years, a strong year class within this period is essential to sustain the species.

Restoration criteria: Restoration criteria are grouped and numbered by survey. When any two out of three restoration criteria are reached, splittail will be considered restored.

(1) Fall midwater trawl. The FMWT data set was filtered down to stations sampled in at least 3/4 of the years (6 of 24 years could be missed) in at least one month. Based on this reduced data set, average abundance of splittail from 1967-1992 was 19 based on the FMWT (Table 4.1). In years prior to 1984, splittail abundance exceeded this number in 7 out of 15 years. Since 1983 abundance has fallen below this value in 7 out of 9 years.

Splittail will be considered restored when the FMWT exceeds 19 for 7 out of 15 years. If splittail fail to meet this restoration criterion for five consecutive years, the restoration period will start over.

(2) Suisun Marsh criteria. Splittail catch per trawl (otter trawl)has declined steadily in Suisun Marsh since 1979 from a high of 20.3 in 1979, to fewer than 1 for each year since 1984 (Table 4.1, Figure 4.2). The average catch per trawl from 1979-1992 was 3.8. Splittail catches in Suisun Marsh were greater than this in all but one year of the pre-decline period (4 out of 5 years). Since 1984 catch per trawl has fallen below this value for all years except one. Suisun Marsh criteria are important to the restoration of splittail because shallow, unrip-rapped backwaters of the marsh are preferred habitat of splittail, indicated by high catches taken there (over 11,800 fish in 14 years). Splittail recruitment in the marsh has been poor since 1984. From 1980-1983, average abundance of splittail young was 3.1 per trawl (Figure 4.2). Splittail young abundance has fallen below that value in every year since 1984 except 1986 (Figure 4.2). Because splittail live for 5-7 years, a successful year class is necessary at least every five years to reduce the probability of extinction.

Splittail will be considered restored when Suisun Marsh catch per trawl exceeds 3.8 for 7 out of 15 years AND when splittail young abundance exceeds 3.1 per trawl for at least 3 out of 15 years. Splittail young abundance can be used to make up total abundance (*i.e.*, 3.1 young per trawl can be applied to meet the 3.8 target). If these target criteria (both young and overall) are not met for 5 consecutive years, the restoration period will begin again.

(3) Bay Study. The average number of splittail captured by Bay Study otter trawls from 1980-1992 is 18 (Table 4.1). In the pre-decline years, this

number was met half the time. After the decline, these numbers were met a third of the time. In wet years, which are highly correlated with strong splittail year classes, young-of-year make up more than half of the Bay Study's catches (Figure 4.3). Splittail young catch per unit effort must exceed 14 in at least 3 of 15 years.

Splittail will be considered restored when Bay Study otter trawl numbers exceed 18 for 7 out of 15 years AND when splittail young numbers exceed 14 for 3 out of 15 years. Young-of-year numbers can be applied to meet overall criterion. If these targets, including both young-of-year and overall criteria, are not met for five consecutive years, the restoration period will be re-started.

RESTORATION

Restoration Objective

The primary objective is to maintain a minimum population of 1,000 fish over1 meter (39 inches) total length each year, including 500 females over 1.3 meters (51 inches) total length (minimum size at maturity), during the period (presumably March-July) when spawners are present in the estuary and the Sacramento River. The restoration of green sturgeon should not be at the expense of other native fishes, including white sturgeon. The 1,000 number was determined as being near the median number of green sturgeon estimated to be in the estuary during the 1980s. The total size of the adult green sturgeon population that uses the estuary may be larger than 1,000 because non-spawning adults may be in the ocean. D. Kohlhorst (personal communication) estimates that the total population is around 3,000 fish over 1 meter (39 inches).

Restoration Criteria

Green sturgeon will be considered restored in the Sacramento-San Joaquin estuary once the median population of mature individuals (over 1 meter [39 inches] total length) has reached 1,000 individuals (including 500 females over 1.3 meters [51 inches] total length) over a 50 year period or for five generations (10 years is the minimum age of sexual maturity). If population estimates are fewer than 1,000 fish for more than three years in a row, the restoration period will be restarted. This definition is subject to revision as more information becomes available. Restoration will be measured by determining population sizes from tagging programs or other suitable means. The present sturgeon tagging programs, which focus on white sturgeon, are inadequate for determining accurately the abundance of green sturgeon. Therefore, a median population goal of 1,000 fish over 1 meter (39 inches) total length (including 500 females over 1.3 meters [51 inches]) is achievable with numbers determined through a monitoring program that focusses specifically on green sturgeon. Thus, the first restoration criterion will be establishment of an adequate population determination through a monitoring program. Once that program is in place, the minimum population goal can be re-evaluated and a realistic, presumably higher, goal established. It may be desirable to have the numbers high enough to support the removal of a minimum of 50 fish over 1 meter (39 inches) total length per year by a fishery (assuming an exploitation rate of 5 percent is sustainable).

At the present time, a Spring Chinook Work Group, consisting of representatives of various agencies, commercial fishermen, farmers, and others affected by spring chinook conservation efforts are attempting to devise a recovery plan for spring chinook in the upstream habitats of the Sacramento drainage (L. Davies, UCD, personal communication). It is assumed that if this group can agree to recovery measures, the measures will be adopted by the agencies concerned. Restoration measures being considered include: (1) providing passage of adults to holding and spawning areas, (2) protecting adults in the holding pools, (3) creating additional habitat by improving access to Antelope, Begum, and South Fork Cottonwood creeks, (4) improving management of Butte Creek for wild salmon, (5) providing passage flows for out-migrating juveniles, (6) providing better instream habitat for juvenile fish, (7) reduction in take by fisheries, (8) reducing effects of hatchery fish on wild populations, and (9) increased protection in the Delta.

RESTORATION

Restoration Objective

The objective is to restore wild populations of spring chinook salmon to optimum levels that can be supported by holding and spawning habitat in tributary streams to the Sacramento River (especially in Deer and Mill creeks) by improving outmigrant conditions in the Delta. Any improvements upstream or in ocean fishery regulations will be greatly negated if protections in the Delta are not implemented concurrently, especially during November through January when Deer and Mill creek smolts migrate. Therefore, the objective of this plan is to restore survival rates of outmigrating smolts to levels that existed before the construction of the pumps of the CVP and SWP in the south Delta. Measures taken to protect migrating adult and juvenile spring chinook salmon should not be made at the expense of measures taken to protect other native fishes in the system, including other runs of chinook salmon.

Restoration Criteria

Sacramento spring chinook will be regarded as restored when (1) self-sustaining populations in excess of 500 spawners each are present in both Deer and Mill creeks; (2) the number of wild spawners in Sacramento River tributaries reaches a mean number of 8,000 fish and does not drop below 5,000 fish, for 15 years, three of which are dry or critical years and (3) when the smolt survival rates between Sacramento and Chipps Island approach pre-project levels when the number of adults in the tributary streams is fewer than 5,000. Restoration will be measured by three interacting criteria: (1) presence of self-sustaining spawning

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populations in Deer and Mill creeks; (2) total number of spawners in Deer, Mill, Antelope, Butte, Big Chico, Begum, South Fork Cottonwood, and Clear creeks and (3) smolt survival rates through the Delta. The number of spawners can be estimated by carcass and redd counts and counting from weirs at dams on Dear and Mill creeks, but smolt survival cannot yet be satisfactorily estimated. These restoration goals can be achieved only if there is simultaneously improvement in conditions in spawning and rearing streams, in the Delta for passage of juveniles and adults, and improved management of the fishery to allow for increased survivorship of adults during periods of low population size.

Deer and Mill creeks: These two streams are largely unregulated streams that support the largest remaining populations of unquestioned wild spring-run chinook. Thus these two populations must be maintained as self-sustaining entities to provide a minimum level of protection for the wild fish. Based on historic (pre-1976) records, the number of salmon in each stream should not drop below 500 fish, with a three-year running average of no fewer than 1,000 fish (Table 6.1). While a fairly substantial population of salmon exists in Butte Creek, long-term sustainability of the population in a regulated stream is questionable, as is its relationship to the hatchery-maintained "spring" run population in the Feather River.

Number of spawners: Spring chinook will be regarded as recovered when the number of spawners in tributary streams to the Sacramento drainage exceeds 5,000 fish each year over a 15-year period (five generations X three-year life cycle), with 3 of the 15 years being dry or critical years. The average number of natural spawners of wild origin over the 15-year period must not be fewer than 8,000 fish. If the Yuba River proves to still have a natural run of spring chinook, this population goal should be raised by whatever number of spawners it is estimated that the stream can support. The total population goal assumes an equal (or nearly equal) sex ratio and that 90 percent or more of the females are age 3 or older. It does not include fish found in the Feather River or mainstem Sacramento River or those taken by the Feather River hatchery for artificial spawning. This number is a tiny fraction of the 500,000 to 1 million spring chinook that once spawned in the Central Valley but represents a reasonable number of spawners that can be supported in Sacramento River tributaries (F. Fisher, personal communication).

Smolt survival rate: The principal means for measuring suitability of habitat conditions for juvenile chinook salmon in the Delta is to have smolt survival rates between Sacramento and Chipps Island be equivalent to what they were prior to the present configuration of the CVP and SWP (*i.e.*, 1940s level of development, Service 1992). The 1994 Bay-Delta Accord should provide beneficial actions that benefit salmon. Accurately measuring smolt survival rates is extremely difficult,

so this cannot be used as a criterion for restoration until adequate methods of estimating survival are developed (something which should be done as part of the restoration process). Ideally, the survival rate should be based on mark-recapture studies of smolts of similar size released during the principal outmigration period. Because many Deer and Mill creek outmigrants enter the Delta as yearlings during November through January, this time period will be the most important to evaluate. However, hatcheries do not release spring-run during this time period, so late fall-run hatchery production may need to be used as a surrogate for the mark-recapture studies. Until reliable measures of survival rates are developed, the principal means for measuring restoration will be distribution and number of spawning adults. Once the criterion is developed, it should be used primarily in conjunction with adult criteria. When adult numbers drop below 5,000, smolt survival rates through the Delta the following year should be higher than would be permitted when adult numbers are higher. If possible, a sliding scale of minimum survival rates based on adult numbers should be developed.