UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
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WAR 2 2004

MEMORANDUM FOR: Scientific Research Permit No. 1400, SWR-02-8826:JSS

FROM: Rodney R. McInnis
Acting Regional Administrator

SUBJECT: Addendum to the Central Valley Programmatic Biological Opinion for Scientific Research

I. CONSULTATION HISTORY

Section 10(a)(l)(A) of the Endangered Species Act of 1973, as amended, (ESA) provides the National Marine Fisheries Service (NOAA Fisheries) with authority to grant exceptions to the ESA's "taking" prohibitions for scientific research (see regulations at 50 CFR 222.301 through 222.308, and 50 CFR 224.101 through 224.102). Scientific research or enhancement permits may be issued to Federal or non-Federal entities conducting research or enhancement activities that involve take of ESA-listed endangered or threatened species. Any permitted research or enhancement activities must: (1) be applied for in good faith, (2) if granted and exercised, not operate to the disadvantage of the endangered species, and (3) be consistent with the purposes and policy set forth in section 2 of the ESA (50 CFR 222.303(f)). NOAA Fisheries prepared this addendum to the Central Valley Programmatic Biological Opinion for Scientific Research (Central Valley Research Opinion; NOAA Fisheries 2003a), signed on September 5, 2003, in compliance with section 7(a)(2) of the ESA, as amended (16 U.S.C. 1536).

On July 30, 2002, Wildlands, Incorporated (Wildlands) submitted an application for a research permit for a fish monitoring program for the Kimball Island mitigation bank. The fish monitoring program was one of the conditions set forth in the U.S. Army Corps of Engineers' (Corps) permit for the construction of the mitigation bank. The proposed project may result in take of adult and juvenile ESA-listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon *(O. tshawytscha*), and threatened Central Valley steelhead *(O. mykiss*). NOAA Fisheries published a notice of receipt of Wildlands' permit application in the *Federal Register* on September 30, 2002, (67 FR 61327), announcing the beginning of a thirty-day public comment period. Four persons responded to the notice within the thirty-day comment period and provided comments on the proposed fish monitoring program. Two respondents gave their endorsements to the program as generally proposed with minor revisions, while the other two respondents had more detailed and numerous comments for improving the design of the monitoring program.

II. DESCRIPTION OF THE PROPOSED ACTION

Under the authority of section 10(a)(l)(A) of the ESA, NOAA Fisheries proposes to issue Scientific Research Permit No. 1400 (hereinafter referred to as Permit 1400) to Wildlands authorizing take of adult and juvenile Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. The permit would be in effect until January 1, 2009, and subject to the limitations of the ESA and the regulations in 50 CFR parts 222, 223, and 224, for the period stated on the permit, unless it is modified, suspended or revoked sooner.

A. Research Project Description

In a request for Permit 1400, Wildlands proposes to conduct a fish monitoring program to assess species occurrence and utilization of newly created aquatic habitat within the restored wetlands on Kimball Island, which is a 109-acre flooded island located in the western portion of the Sacramento-San Joaquin Delta near the mouth of the San Joaquin River. The monitoring program has five objectives:

1. Determine if take in terms of habitat change or direct mortality to listed species is occurring in the new habitat;

2. Determine if the new habitat is beneficial or detrimental to the listed species;

3. Identify Delta habitats used by the listed species and which habitats are most important to the listed species;

4. Determine which macrohabitat factors are important and worthy of protection and enhancement for the purpose of enhancing survival of listed species; and

5. Identify modifications to Kimball Island that may improve habitat and production of listed species.

In order to meet the objectives of the monitoring program, Wildlands proposes to incorporate a variety of fish sampling gears and methods that would cover various habitat types, species, and life stages expected to occur at Kimball Island. In addition, data will be collected on the different habitat conditions encountered in the various sampling locations throughout the action area. These will include water depth, current velocity, substrate type, type and extent of cover, water and air temperature, turbidity, salinity, and channel configuration. The habitat data will be related to the extent of fish use by species and age. The information obtained from the above fish and habitat data will be used to develop conceptual models that relate fish usage to habitat type by species, life stage, and native/non-native status.

1. Fish Sampling

Fish monitoring will be conducted utilizing a variety of sampling gears and methodologies. Light trap surveys and plankton sampling will be conducted quarterly in the six habitat types identified in Table 1 (attached). Fish larvae and juveniles will be identified to family and keyed to genus and species if practicable.

Demersal egg surveys will be conducted utilizing furnace filters as the collection substrate for the capture of adhesive eggs from spawning fish. The filters will be placed on the bottom at four sites within the island: two in high velocity inlet locations, and two within interior channels with relatively high current velocities. Filters will be placed during the spring sampling period (April-May) when native minnows *(e.g.,* Sacramento splittail; *Pogonichthys macrolepidotus*) and delta smelt (*Hypomesustranspacificus*) will most likely be spawning in the action area. Periodic monitoring of the filters for attached eggs will occur during the spring monitoring period. Any eggs adhered will be collected, enumerated, and identified as previously described for larval and juvenile fish.

Beach seines will be utilized in shallow water habitat to sample for fish. Prospective sampling locations will have gradual slopes with a minimum of debris or outcroppings to impinge on the effectiveness of the net. The beach seines to be employed in this monitoring program are "bagged-type" seines, measuring 50-feet in length with 1/8-inch stretch-mesh.

Fyke nets will be deployed in shallow, open tidal channels, with water depths of up to six feet and with slow to moderate currents. Many of these channels have steep banks and overhanging riparian vegetation. The fyke nets have a three-foot by three-foot square opening, and are made of 1/4-inch mesh. Nets will be set to sample into the tidal current on both incoming and outgoing tides. Previous studies with this type of fyke net found that fish could be held overnight in low current environments without overt signs of stress to the captured fish.

Gill net surveys will be conducted at all feasible sites, depending on conditions encountered during sampling. The dead-end sloughs and secondary and tertiary tributaries may be excluded due to shallow water conditions. The gill nets are 50 feet long with a variable mesh ranging in size from 0.5-inches to 2.0-inches knot to knot length (side of mesh). Gill net sets will range from thirty minutes to one hour. It is anticipated that the gill net sets will occur in open water, deeper than four to six feet, where the likelihood of capturing larger fish such as adult salmonids and salmonid predators is higher.

All captured fish will be identified to species and enumerated, and a subset will be measured for length. Non-salmonid, predatory fish captured during any of the samples may be collected for stomach contents analysis. Selected fish will be euthanized, and their stomachs removed and contents analyzed to determine prey selectivity of the predatory fish. Expected predatory fish include largemouth bass (*Micropterussalmoides*), crappie (*Pomoxis* spp.), catfish (*Ictalurus*

spp.), Sacramento pikeminnow (*Ptychocheilusgrandis*), and striped bass (*Moronesaxatilis*). A maximum of 25 fish of each species will be euthanized for this study.

2. Habitat Types and Sampling Schedule

The basic study design will incorporate a quarterly sampling schedule *(e.g.*, January, April, July, and October) over one calendar year. Sampling will occur during a neap and spring tidal cycle for each quarter period. The applicant intends to sample a variety of habitats which will include the following:

1. Open channel areas (*i.e.*, large sloughs and first order channels)–one site each in the eastern end of the island, mid-island, and western end of the island;

2. Two exterior channels adjacent to the outer levee ring of the island;

3. One shallow shoreline site on the southern exterior side of the island;

4. Two sites at the terminus of dead-end sloughs within the interior of the island;

5. Two each of second and third order channels within the interior of the island; and

6. Two sites at levee breaches.

B. Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). For the purposes of this consultation, the action area includes all riparian areas and waters of Cabin Slough, Whorehouse Slough, and the San Joaquin River adjacent to Kimball Island, and all riparian areas and constructed wetlands, including tidal channels and mudflats, within the interior of Kimball Island.

C. Requested Amount of Take

Wildlands has requested both lethal and non-lethal take authorization for Central Valley ESA-listed salmonids under Permit 1400 (Table 2, attached). Unintentional mortalities are not to exceed a total of 10 Chinook salmon per calendar year *(i.e.*, three percent of those captured), of which four may be Sacramento River winter-run Chinook salmon and six may be Central Valley spring-run Chinook salmon. This take limit includes any combination of juvenile and adult Chinook salmon. Unintentional mortalities for Central Valley steelhead are not to exceed 1 juvenile or adult per calender year *(i.e.*, three percent of those captured). It is anticipated that adult mortalities will occur infrequently due to adult avoidance of the sampling gears, the

shortened set times for gill nets, and the precautionary methods for removing any adult salmon from the gill nets deployed during the monitoring program.

D. Measures to Reduce the Impacts of Issuing Research Permit No. 1400

Implementation of the fish monitoring study described in the application for Permit 1400 will result in the take of ESA-listed Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. The following measures are to be implemented to minimize any adverse impacts on these salmonids during the research activities:

1. NOAA Fisheries has reviewed the credentials of the principal investigators for the proposed research: all listed supervisors and contracted field biologists are well qualified to conduct fishery monitoring and have provided evidence of experience working with salmonids or the concepts outlined in the proposed project description *(e.g.*, fishery monitoring, fish handling techniques, and study methodology).

2. NOAA Fisheries has developed nondiscretionary conditions for Permit 1400 that are necessary and appropriate to minimize take of listed salmonids, as described in the permit and Appendices A and B of the Central Valley Research Opinion. The principal investigators will ensure that all persons operating under Permit 1400 will be familiar with the terms and conditions therein.

3. NOAA Fisheries will monitor project activities to ensure that the project is operating satisfactorily in accordance with Permit 1400. NOAA Fisheries will monitor actual annual take of ESA-listed fish species associated with the proposed research activities (as provided in annual reports or by other means) and will adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the salmonids.

4. All persons operating under Permit 1400 will have proper training in the handling and care of netted fish, have access to properly maintained state-of-the-art equipment, and be knowledgeable with the conditions of the permit and the requirements of the ESA.

5. All ESA-listed salmonids will be removed from the nets prior to non-listed fish and processed in the minimal amount of time necessary to collect data.

6. Wildlands has proposed to use short soak times for gill net sets of up to one hour to minimize trauma and mortality to ESA-listed fish. In addition, fish will be removed from the gill net carefully, using a smooth "hooked" stick to lift the net's mesh over the opercula with minimal trauma to the fish's delicate gill structure (Hubert 1996). Fish will be revived in a flow-through tank system that allows the fish to "ram jet" ventilate during the recovery process (Farrell *et al.* 2000, 2001; Buchanan *et al.* 2002), and will only be released following

complete revival to minimize mortality resulting from the physiological stress of the netting process.

7. Wildlands has proposed to set fyke nets in low velocity current areas for periods of up to 12 hours to minimize stress to captured animals. In addition, monitoring personnel will remove large predators such as a striped bass or catfish as soon as possible to reduce mortality of ESA-listed fish in the fyke net live box.

8. If large catches of salmon and steelhead occur and mortality due to handling is expected, anesthetic will be used to minimize stress and improve survivability, or a subsample of the catch will be taken and held for processing while the remainder of the catch is released back into the waters from which they were sampled without handling.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The issuance of Permit 1400 may potentially affect Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. The recently issued Central Valley Research Opinion describes the status of the Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead Evolutionarily Significant Units (ESUs). The current status of listed salmonids in the Central Valley, based on their risk of extinction, has not significantly improved since the species were listed. Although the number of Sacramento River winter-run Chinook salmon has increased in the last six years, the ESU remains at risk of extinction. Sacramento River winter-run Chinook salmon run size declined from a high of approximately 118,000 fish in 1969 to a low of fewer than 200 fish in 1994, and has recently increased to just over 9,000 fish in 2002 (California Department of Fish and Game [DFG] 2002). Central Valley spring-run Chinook salmon have displayed broad fluctuations in abundance over time. Their numbers have ranged from lows of approximately 400 in 1966 and 3,000 in 1992 to highs of approximately 38,000 in 1982 and 34,000 in 1998, and recently number nearly 13,000 in 2002 (DFG unpublished data). Central Valley steelhead declined from an average of approximately 11,000 adult fish in the late 1960s and 1970s, to approximately 2,000 fish through the early 1990s (McEwan 2001). Recent estimates from trawling data in the San Francisco-San Joaquin Delta suggest that approximately 3,600 wild female steelhead spawn in the Central Valley basin, and that approximately 181,000 juveniles are produced (NOAA Fisheries 2003b).

As discussed in the Central Valley Research Opinion, factors affecting the species and their habitats include: (1) dam construction that blocks previously accessible habitat; (2) water development activities that affect water quantity, water quality, and hydrographs; (3) land use activities such as agriculture, flood control, urban development, mining, and logging; (4) hatchery operation and practices; (5) harvest activities; (6) ecosystem restoration actions; (7) natural conditions; and (8) scientific research. Large dams are present on almost every major tributary to the Sacramento River, San Joaquin River, and Delta, and block salmon and steelhead

access to the upper portions of watersheds that represent approximately 80 percent of historical habitat. Water diversions directly entrain fish, and can affect habitat for example by reducing wetted area and causing water temperatures to increase. Runoff from agricultural, urban, and other sources contains pollutants and suspended sediment, which affects water quality. Hatchery fish can compromise the genetic integrity of wild stocks, and fishing pressure on wild stocks can increase during years of high hatchery production. Habitat restoration projects can temporarily cause disturbance and increased suspended sediment in waterways, but ultimately may increase habitat abundance and complexity, stabilize channels and streambanks, increase spawning gravels, decrease sedimentation, and increase shade and cover for salmonids. Cycles in ocean productivity and drought conditions can have corresponding effects on salmonid life history parameters such as growth, recruitment, and mortality. Scientific research can lead to harm, harassment, and death of listed salmonids, but generally is thought to affect only a small number of fish in this manner. The knowledge gained from scientific research may lead to improved management of listed ESUs, increased population sizes, and consequently increased likelihood of survival and recovery.

The research activities described in this document do not result in any changes or effects to salmonid habitat including critical habitat for Sacramento River winter-run Chinook salmon. Therefore, critical habitat is not likely to be affected by issuance of Permit 1400 and is not considered further in this document.

IV. ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02). A detailed discussion of the factors affecting the species in each ESU is provided in the Central Valley Research Opinion.

A. Status of the Species and Habitat in the Action Area

The action area surrounding Kimball Island serves as a migratory corridor for adult salmonids swimming upstream to their spawning grounds, and as rearing habitat and a migratory corridor for juveniles outmigrating to the Pacific Ocean. Juveniles and adults of one or more listed species may be expected to be present in the action area from November through June.

Kimball Island is a 109-acre island that was flooded by levee breaching beginning in 1998 for the purpose of constructing wetlands as part of a mitigation banking program. Several tidal channels were constructed to give a broad spectrum of shallow water habitat and to provide for interior circulation of Delta waters in the island. Use of the interior habitat by salmonids is unquantified at present and is to be assessed by work performed under Permit 1400. Kimball Island has 5,000

lineal feet of shaded riparian habitat and approximately one acre of shallow water habitat. This portion of the Delta has diurnal tides and experiences changes in salinity in the surrounding waters depending on river outflow conditions.

B. Factors Affecting the Species in the Action Area

The Central Valley Research Opinion describes the ongoing activities and historical events that have affected listed salmonids in the Central Valley. In particular, water and land development activities in the Sacramento-San Joaquin Delta have had the largest impacts to the populations of listed salmonids in the action area. Adverse conditions created by water export operations of the Central Valley Project (CVP) and State Water Project (SWP) include upstream or reverse flows of water in the lower San Joaquin River and southern Delta waterways, which impede migration of juveniles and adults. Entrainment and mortality of juveniles occurs at the CVP/SWP export facilities and at numerous, smaller water diversions. Agricultural and urban surface water runoff is associated with increased water temperatures, decreased dissolved oxygen levels, and increased turbidity and contaminant loads in the Delta, all of which reduce habitat quality for salmonids. As a result of the diking and reclamation of wetlands in the Delta for agricultural, industrial, and urban development, only about six percent of the native wetlands remain. The original wetlands served as significant foraging areas for numerous species, enhanced nutrient cycling and retention, and acted as natural filters to enhance ambient water quality. The recent wetland construction activities on Kimball Island may help restore some of these characteristics of properly functioning ecological habitats to the action area.

V. EFFECTS OF THE PROPOSED ACTION

The purpose of this section is to identify effects on Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead associated with NOAA Fisheries' issuance of Permit 1400. The primary effects of the Kimball Island Fish Monitoring Program on ESA-listed salmonids will be related to harassment associated with intentional take. Harassment generally leads to stress and other sub-lethal effects and will be caused by capturing and handling fish. Wildlands has not proposed intentional lethal take of Chinook salmon or steelhead; however, unintentional mortality may occur during handling or after the fish have been released.

A. Project Specific Effects

The Kimball Island Fish Monitoring Program will result in the capture and handling of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. Fish are expected to be harassed, harmed, or killed from capture with gill nets, beach seines, and fyke nets, or from handling after capture with these gears. No take is expected from light traps, plankton nets, or demersal egg samplers because the juvenile and adult salmonids that will be present in the action area are expected to effectively avoid these gears.

Sampling protocols, and capture and handling procedures described in section III *(Description of the Proposed Action)* are expected to minimize the stress and mortality of captured fish. Adherence to similar procedures in work by the California Department of Water Resources have resulted in capture-related mortalities of less than three percent for adult salmonids and less than seven percent for juvenile salmonids (NOAA Fisheries 2003c).

The requested amount of take of Sacramento winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead resulting from the Kimball Island Fish Monitoring Plan is not expected to result in a significant effect at the scale of the ESU because capture rate is expected to be low relative to the overall abundance of the species and mortality rate is expected to be a small percentage of fish captured *(i.e.,* three percent). DFG samples shallow water sites in the Delta with beach seines. The three sites nearest Kimball Island (*i.e.*, Chipps Island, Antioch, and Sherman Island) averaged 0.05 to 0.5 Chinook salmon fry captured per cubic meter of water sampled for the months of January through March 1995 and 1996 (Brandes and McLain 2001), and most of these presumably were Central Valley fall-run Chinook salmon, which are not ESA-listed. Fewer than 300 Chinook salmon fry total have been collected Delta-wide during DFG beach seine sampling during all other months of the year for the years 1977 through 1997 (Brandes and McClain 2001). Gill nets and fyke nets may capture adult salmonids, but NOAA Fisheries expects these fish to inhabit primarily main river channels and sloughs. Lethal take of Central Valley steelhead will be limited to one fish, whereas recent estimates indicate that the Central Valley adult steelhead population averaged 3,628 wild female spawners over three years (1998 through 2000), and that approximately 181,000 steelhead smolts annually are being produced and entering the Delta (NOAA Fisheries 2003b).

B. Beneficial Effects of Issuing Research Permit No. 1400

The purpose of this study is to evaluate habitat use by anadromous salmonids and other fish species of the constructed wetland habitat on Kimball Island. Data from the capture of listed salmonids will provide needed information about the effectiveness of this and other similar habitat restoration projects in improving rearing conditions for juvenile salmonids in the Delta and in restoring properly functioning ecological conditions in general to Delta waterways.

VI. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR § 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." Future Federal actions, including the ongoing operation of hatcheries, water diversions, and some land management activities, will be reviewed through separate section 7 consultation processes and not considered here. Similarly, non-Federal actions that require authorization under section 10 will be evaluated in separate section 7 consultations and not considered here. A general summary of potential cumulative effects that may affect Sacramento River winter-run Chinook salmon, Central Valley spring-run

Chinook salmon, and Central Valley steelhead within the action area is described in the Central Valley Research Opinion. These include ongoing agricultural and urban activities that likely will continue to affect stormwater runoff patterns and water quality in the action area, and future population growth that will result in new urban development and increased disturbance of waterways and riparian areas, as well as stormwater and water quality impacts.

VII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of the species, the environmental baseline for the action area, the effects of the proposed issuance of Permit 1400, and the cumulative effects, it is NOAA Fisheries' biological opinion that the issuance of Permit 1400, as proposed, is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead, and is not likely to destroy or adversely modify the designated critical habitat Sacramento River winter-run Chinook salmon.

VIII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The issuance of Permit 1400 authorizes intentional take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead associated with Wildlands' proposed research activities. The action of issuing Permit 1400 does not anticipate incidental take of endangered or threatened species. This biological opinion does not authorize any taking of a listed species under section 10(a) or immunize any actions from the prohibitions of section 9(a) of the ESA.

IX. REINITIATION OF CONSULTATION

This concludes formal consultation on the issuance of Permit 1400. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this amendment to the Central Valley Research Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

X. LITERATURE CITED

Brandes, P.L., and J.S. McLain. 2001. Juvenile Chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin estuary. Pages 39-138 *in* R.L. Brown, editor. Contributions to the biology of Central Valley salmonids, Volume 2. Fish Bulletin 179. California Department of Fish and Game, Sacramento.

Buchanan, S., A.P. Farrell, J. Fraser, P. Gallaugher, R. Joy and R. Routledge. 2002. Reducing Gill-Net Mortality of Incidentally Caught Coho Salmon, *North American J. ofFish. Management,* 22:1270-1275.

California Department of Fish and Game. 2002. Sacramento River winter-run Chinook salmon biennial report 2000-2001. Prepared for the Fish and Game Commission by California Department of Fish and Game, Habitat Conservation Division, Native Anadromous Fish and Watershed Branch, Sacramento, California.

Farrell, A.P., P. Gallaugher, C. Clarke, N. DeLury, H. Kreiberg, W. Parkhouse, and R. Routledge. 2000. Physiological status of coho salmon (*Oncorhynchus kisutch*) captured in commercial nonretention fisheries. *Can. J. Fish. Aquat. Sci.* 57:1668-1678.

Farrell, A.P., P.E. Gallaugher, J. Fraser, D. Pike, P. Bowering, A.K.M. Hadwin, W. Parkhouse, and R. Routledge. 2001. Successful recovery of the physiological status of coho salmon on board a commercial gillnet vessel by means of a newly designed revival box. *Can. J. Fish. Aquat. Sci.* 58:1932-1946.

Hubert, W.A. 1996. Passive capture techniques. Pages 157-192 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques. Second Edition. American Fisheries Society. Bethesda, Maryland. 732 pages.

McEwan, D. 2001. Central Valley steelhead. Contributions to the biology of Central Valley salmonids. California Department of Fish and Game. Sacramento, California. 234 pages.

National Marine Fisheries Service. 2003a. Memorandum dated September 5, 2003, from Rodney R. McInnis to The Record. Endangered Species Act section 7 programmatic biological opinion on the issuance of section 10(a)(1)(A) scientific research permits for take of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead

National Marine Fisheries Service. 2003b. Draft Report of Updated Status of Listed ESUs of Salmon and Steelhead. NOAA Fisheries, Northwest Fisheries Science Center, Seattle, Washington. (http://www.nwfsc.noaa.gov/cbd/trt/brt/brtrpt.html)

National Marine Fisheries Service. 2003c. Memorandum dated May 15, 2003, from Rodney R. Mclnnis to The Record, SWR-01-5638:HLB. Endangered Species Act section 7 biological opinion on the issuance of a section 10(a)1(A) scientific research permit for endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead.

Total number of samples for Kimball Island Fish Monitoring

Quarter Sampled:	Winter		Spring		Summer		Fall	
	January-February		April-May		July-August		October-November	
Tidal Cycle:	Neap	Spring	Neap	Spring	Neap	Spring	Neap	Spring
Location								
1	Open Channel		Open Channel		Open Channel		Open Channel	
a (G,F)[1,2]	east	east	east	east	east	east	east	east
b (G,F)	west	west	west	west	west	west	west	west
c (G,F)	mid island	mid island	mid island	mid island	mid island	mid island	mid island	mid island
2	Adjacent Channel		Adjacent Channel		Adjacent Channel		Adjacent Channel	
a (G)	a	a	a	a	a	a	a	a
b (G)	b	b	b	b	b	b	b	b
3 (G,B)	Shallow Water		Shallow Water		Shallow Water		Shallow Water	
4	Dead End Slough		Dead End Slough		Dead End Slough		Dead End Slough	
a (F,B)	a	a	a	a	a	a	a	a
b (F,B)	b	b	b	b	b	b	b	b
5	Tributary[3]		Tributary		Tributary		Tributary	
a (F,B)	2° a	2° a	2° a	2° a	2° a	2° a	2° a	2° a
b (F,B)	2° b	2° b	2° b	2° b	2° b	2° b	2° b	2° b
a (F,B)	3° a	3° a	3°a	3° a	3°a	3° a	3°a	3° a
b (F,B)	3° b	3° b	3° b	3° b	3° b	3° b	3° b	3° b
6	Levee	Breach	Levee	Breach	Levee	Breach	Levee	Breach
a (G,F)	a	a	a	a	a	a	a	a
b (G,F)	b	b	b	b	b	b	b	b
Site Totals:								
Tidal Cycle	14	14	14	14	14	14	14	14
Quarter	28		28		28		28	
Year	112							

Footnotes:

1 Locations are divided into replications within each location type (i.e. a,b,c,...)

2 Gill Nets (G): Sampling will target all feasible sites. Locations 4 and 5 are often not practicable due to shallow water
Fyke Nets (F): Sampling will not occur at locations 2 or 3
Beach Seines (B): Sampling will occur at locations 3,4, and 5

3 Sections of channels sampled are secondary and tertiary tributaries to the main channel

Table 1: Anticipated Kimball Island Sampling Matrix

ESU	Beach Seine	Fyke Net	Gill Net	Total Tak	Mortality
Winter-run Chinook salmon	40	40	40	120	4
Spring-run Chinook salmon	80	80	40	200	6
Central Valley Steelhead	8	8	20	36	1

Table 2: Anticipated Take from Kimball Island Monitoring Studies