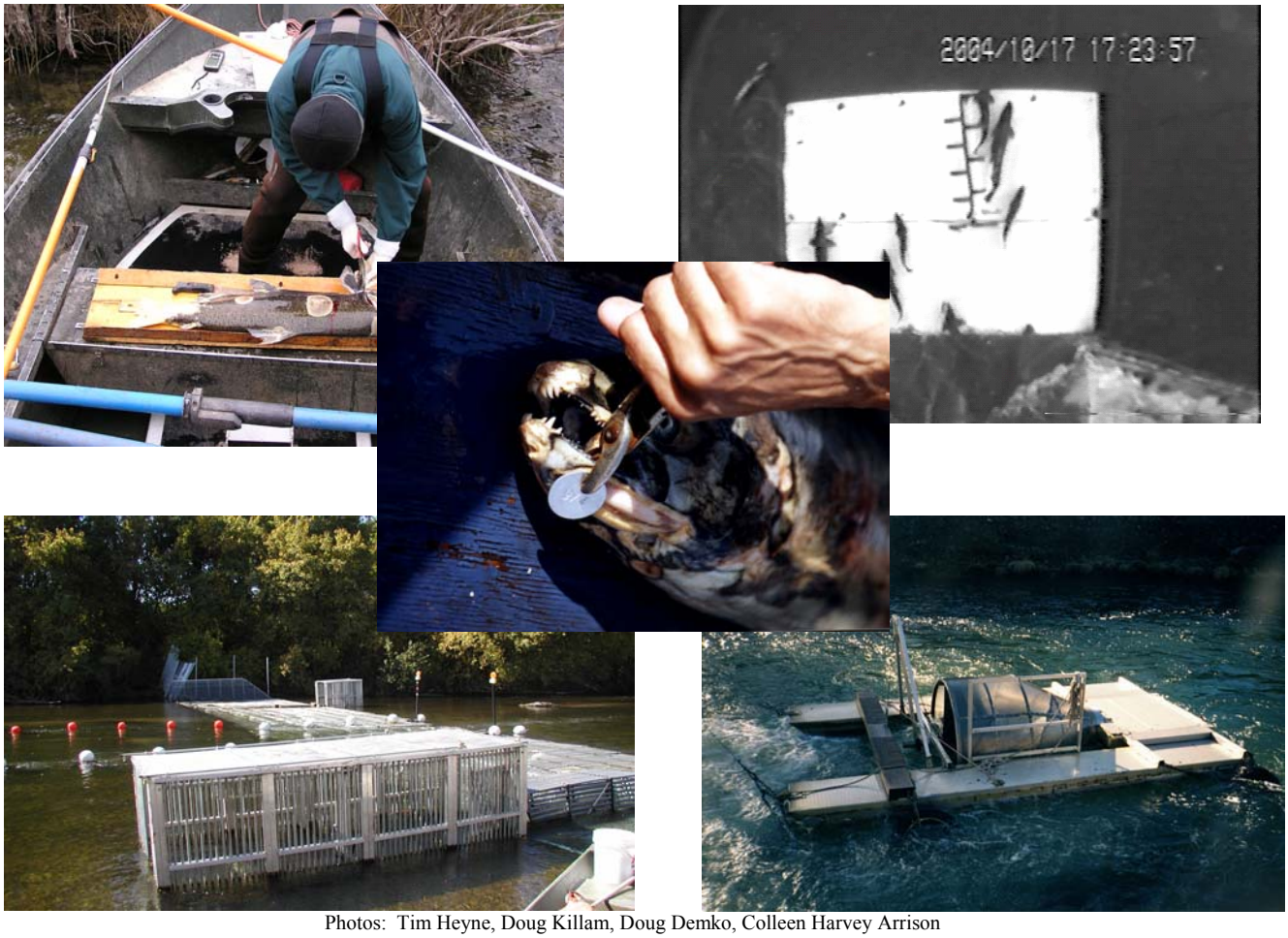
EXISTING PROGRAM SUMMARY

CENTRAL VALLEY SALMON AND STEELHEAD MONITORING PROGRAMS



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Interagency Ecological Program Juvenile Monitoring Project Work Team

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Introduction

Adult Escapement Monitoring

Estimates of the number of Chinook salmon and steelhead returning to spawn in the Central Valley have been made since the early 1950's, and in some cases since the 1940's. Programs have evolved over the years, and vary in methods used, intensity of sampling effort, and reliability of estimates. While mark-recapture carcass surveys are now widely used as the standard method to estimate in-river spawning escapement of most Chinook races, historic data were based on a variety of methods, including carcass surveys, extrapolation based on spatial and/or temporal subsets of an entire run, and expert judgment. The original purpose of the escapement surveys was to provide data for ocean harvest management, but purposes have now expanded to:

- Providing a sound basis for assessing recovery of listed stocks,
- Monitoring the success of restoration programs,
- Evaluating the contribution of hatchery fish to Central Valley populations, and
- Sustainably managing ocean and inland harvest.

In response to the need to coordinate and improve escapement monitoring programs in the Central Valley, the Interagency Ecological Program (IEP) Salmonid Escapement Project Work Team (SEPWT) was formed in 2001. The team, which includes biologists working on salmon escapement monitoring surveys throughout the Central Valley, is a satellite team of the IEP Central Valley Salmonid Project Work Team (CVSPWT).

In 2004, the Salmonid Escapement Project Work Team completed a proposal for the development of a comprehensive monitoring plan for Central Valley adult Chinook escapement. The goal of this plan will be to improve monitoring survey data for use in assessing the success of restoration activities, evaluating progress toward recovery of listed stocks, and sustainably managing ocean and inland fisheries.

Existing Central Valley adult salmonid escapement monitoring programs are summarized in Table 1 and Section I. These summaries were developed by members of the SEPWT, including staff from the California Department of Fish and Game, Department of Water Resources, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, Yuba County Water Agency, and East Bay Municipal Water District. Individual program summaries are organized, in general, from north to south by stream and target species. Summaries include monitoring methods, variables measured, program objectives, contact information, funding, staffing levels, data management and storage, and reporting.

Significant effort is expended each year on the adult programs, including an estimated:

- 22.8 person-years biologist time,
- 45.0 person-years technician time,
- Total cost of $ 3.7 million.

Juvenile Monitoring

Juvenile monitoring studies have been conducted in the Central Valley since the 1920's. Programs have evolved over the years, in response to development of new sampling technology and changes in program objectives. Early studies in the tributary and mainstem rivers used primarily fyke net, beach seine, and trawl gear to monitor juveniles rearing and emigrating from the rivers. Currently, most surveys in the tributary and mainstem rivers use rotary screw trap gear to monitor juvenile emigration. To monitor rearing, habitat use, growth, and stranding of juveniles, snorkel, beach seine, and electrofishing gear are also used. In the Sacramento-San Joaquin Delta, beach seine and trawl gear are used to monitor juveniles rearing and emigrating through the system.

Data from juvenile monitoring programs are used to:

- Evaluate the success of habitat restoration programs,
- Evaluate the impacts of water project operations on salmonid survival,
- Manage water project operations for the protection of salmonids on a real-time basis, and
- Evaluate hatchery propagation programs.

In response to the need to coordinate and improve juvenile salmonid monitoring programs in the Central Valley, the IEP Juvenile Monitoring Project Work Team (JMPWT) was formed in 2004. The team, which includes biologists working on juvenile monitoring surveys throughout the Central Valley, is a satellite team of the IEP Central Valley Salmonid Project Work Team (CVSPWT). This summary was developed by members of the team, including staff from the California Department of Fish and Game, Department of Water Resources, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, Stockton East Water District, S.P. Cramer and Associates, The Fishery Foundation, Turlock Irrigation District and East Bay Municipal Utility District.

Existing juvenile monitoring programs are summarized in Table 2 and Section II of this report. Individual program summaries are organized, in general, from north to south by stream and target species. Summaries include monitoring methods, variables measured, program objectives, contact information, funding, staffing levels, data management and storage, and reporting.

Significant effort is expended each year on the juvenile programs, including an estimated:

- 35.4 person-years biologist time,
- 47.9 person-years technician time,
- Total cost of $ 5.7 million.

Section I

Central Valley Adult Salmonid Escapement Monitoring Programs

CENTRAL VALLEY
CHINOOK SALMON AND STEELHEAD ANGLER SURVEY

SUMMARY

Stream: Sacramento River, American River, Feather River, Yuba River, San Joaquin River, and Mokelumne River

Target Species/run: Fall and late fall-run Chinook salmon, steelhead

Monitoring Method: Angler survey (creel census)

Variable Measured: Angler effort and harvest

Program Objectives:

- Estimate angler effort and harvest of Central Valley Chinook salmon and steelhead,
- Determine level of contact with listed species, and
- Determine compliance with fishing regulations.

Lead Agency: Department of Fish and Game

Contact: Rob Titus
California Department of Fish and Game
Native Anadromous Fish and Watershed Branch
8175 F Alpine Avenue
Sacramento, CA 95826
(916) 227-6390
rtitus@dfg.ca.gov

Program Duration: Field work re-initiated in 2007.

Previous Methods Used: Angler survey using similar methods conducted from 1990 through 2002.

COST

Funding Source(s): 75% Sport Fish Restoration Act funds, and 25% Fish and Game Preservation Account (Bay-Delta Sport Fishing Enhancement Stamp)

Total Annual Cost: $ 701,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

3 PY Biologists
1 PY Permanent technician
12 PY Temporary technicians

Funding End Date: On-going.

GEOGRAPHIC AREA

Reach Covered:

- Sacramento River from Carquinez Bridge to Redding,
- Amercian River from mouth to Nimbus Dam,
- Feather River from mouth to the Feather River Hatchery,
- Yuba River from mouth to Highway 20,
- San Joaquin River downstream of Mossdale Crossing, and
- Mokelumne River from mouth to Camanche Dam.

Sampling Reaches: Several sampling reaches per stream.

FIELD SAMPLING

Sampling Frequency: Surveys statistically designed to sample representative anglers fishing in boats and on shore. Sample days are stratified by weekdays and weekend days; sample days generally consist of all daylight hours.

Sampling Period: Year-round.

Survey Transport: Pick-up truck, jet boat, kayak.

Sampling Parameters and Methods:

Physical: N/A

Biological: Field crews contact and interview anglers, and examine any fish harvested. Anglers are contacted either by boat or at fishing access points.

DATA ANALYSIS

Methods: Angler effort and harvest estimates used to develop relative abundance estimates in the form of fish per angler-hour (catch per unit effort). Level of contact with listed species determined, and compliance with fishing regulations.

Results: Estimates of angler effort, harvest, and catch per unit effort, estimates of contact rates with listed species, compliance with fishing regulations.

DATA MANAGEMENT/STORAGE

Location: Sacramento, CA

Data Retrieval Contact: Rob Titus (see contact information above)

Electronic Storage Format (Software): Excel, Access.

REPORTING

Escapement Estimate: January

Annual Report: Year following survey year.

Other Reporting:

REFERENCES

1998 through 2002 Annual Reports:
Department of Fish and Game. Central Valley Salmon and Steelhead Harvest Monitoring Project. Sacramento, CA.

MAINSTEM SACRAMENTO RIVER
CHINOOK SALMON AERIAL REDD SURVEY

SUMMARY

Stream: Mainstem Sacramento River from Keswick Dam to Princeton.

Target Species/run: Fall, late-fall, winter, and spring-run Chinook salmon

Monitoring Method: Aerial redd counts, by plane or helicopter

Variable Measured: Distribution and timing of Chinook salmon spawning

Program Objectives:

- To collect data on the spatial/temporal patterns of spawning of the four runs of Chinook salmon on the mainstem Sacramento River upstream of Princeton California.

Lead Agency: California Department of Fish and Game

Contact: Doug Killam, CDFG, P.O. Box 578 Red Bluff CA 96080, 530-527-8893, dkillam@dfg.ca.gov

Program Duration: 1969 - present

Previous Methods Used: None.

COST

Funding Source(s):

U.S. Bureau of Reclamation (winter-run), Department of Fish and Game (all other runs). Department of Fish and Game funds are 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds. Sport Fish Restoration Act Grant F-51-R-16 Project 57- Job 1.

Total Annual Cost: $30,000

Staffing:

0.1 PY (Fish and Wildlife Technician)
0.1 PY (Assoc. Fish Biologist)

Funding End Date:

- Sport Fish Restoration Grant - ongoing to 2008, Associate Biologist/Fish and Wildlife Technician

GEOGRAPHIC AREA

Reach Covered:

Winter and spring-run: Sacramento River from Keswick Dam to Tehama Bridge
Fall and late fall-run: Sacramento River from Keswick Dam to Princeton Ferry

Sampling Reaches:

- Keswick Dam to A.C.I.D. Dam
- A.C.I.D. Dam to Highway 44 Bridge
- Highway 44 Br. to Airport Rd. Bridge
- Airport Rd. Bridge to Balls Ferry Bridge
- Balls Ferry Bridge to Battle Creek.
- Battle Creek to Jellys Ferry Bridge
- Jellys Ferry Bridge to Bend Bridge
- Bend Bridge to Red Bluff Diversion Dam
- Red Bluff Diversion Dam to Tehama Bridge
- Tehama Bridge To Woodson Bridge
- Woodson Bridge to Hamilton City Bridge
- Hamilton City Bridge to Ord Ferry Bridge
- Ord Ferry Bridge To Princeton Ferry.

FIELD SAMPLING

Sampling Frequency: Weekly, depending on aircraft availability

Sampling Period: Year-round

Survey Transport: Helicopter (winter-run), fixed wing plane (other runs)

Sampling Parameters and Methods:

Physical: None.

Biological: Experienced staff enumerate number of new redds observed.

DATA ANALYSIS

Methods: Sum redds observed by sampling reach

Results: Spatial and temporal spawning distributions

DATA MANAGEMENT/STORAGE

Location: Red Bluff

Data Retrieval Contact: Doug Killam

Electronic Storage Format (Software): Excel

REPORTING

Escapement Estimate: N/A

Annual Report: Annual SFRA report available in September of each year

Other Reporting:

- Weekly redd distribution data provided to the Upper Sacramento River Temperature Task Group during winter-run spawning period
- CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

Elwell, R.F. 1962. King salmon spawning stocks in California's Central Valley, 1961. Mar. Res. Br. Admin. Rept. 62-5.

Fry, D.H., Jr. 1961. King salmon spawning stocks of the California Central Valley, 1940-1959. Calif. Fish and Game 47(1):55-71.

Fry, D.H., Jr., and A. Petrovich, Jr. 1970. King salmon (Oncorhynchus tshawytscha) spawning stocks of the California Central Valley, 1953-1969. Anad. Fish. Admin. Rept. 70-11.

Hoopaugh, D.A. (ed.). 1977. King (Chinook) salmon spawning stocks in California's Central Valley, 1975. Anad. Fish. Br. Admin. Rept. 77-12.

Hoopaugh, D.A. (ed.). 19978. King (Chinook) salmon spawning stocks in California's Central Valley, 1976. Anad. Fish. Br. Admin. Rept. 78-19.

Hoopaugh, D.A., and A.C. Knutson, Jr. (eds.). 1979. Chinook (King) salmon spawning stocks in California's Central Valley, 1977. Anad. Fish. Br. Admin. Rept.79-11.

Kano, R.M., R.L. Reavis and F. Fisher (eds.). 1996. Annual report. Chinook salmon spawning stocks in California's Central Valley, 1984. Inland Fish. Div. Admin. Rept. 96-3.

Kano, R.M. and R.L. Reavis (eds.). 1996. Annual report. Chinook salmon spawning stocks in California's Central Valley, 1985. Inland Fish. Div. Admin. Rept. 96-4.

Kano, R.M. and R.L. Reavis (eds.). 1997. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1986. Inland Fish. Div. Admin. Rept. 97-2.

Kano, R.M. and R.L. Reavis (eds.). 1997. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1987. Inland Fish. Div. Admin. Rept. 97-4.

Kano, R.M. (ed.). 1997. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1988. Inland Fish. Div. Admin. Rept. 97-10.

Kano, R.M. (ed.). 1998. Annual report. Chinook salmon spawner stocks in California's central Valley, 1989. Inland Fish. Div. Admin. Rept. 98-2.

Kano. R.M. (ed.). 1998. Annual report. Chinook salmon spawner stocks in California's Central Valley. 1990. Inland Fish. Div. Admin. Rept. 98-6.

Kano, R.M. (ed.). 1998. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1991. Inland Fish. Div. Admin. Rept. 98-8.

Kano, R.M. (ed.). 1998. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1992. Inland Fish. Div. Admin. Rept. 98-10.

Kano, R.M. (ed.). 1999. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1993. Inland Fish. Div. Admin. Rept. 99-1.

Kano, R.M. (ed.). 1999. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1994. Inland Fish. Div. Admin. Rept. 99-2.

Kano, R.M. (ed.). 1999. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1995. Inland Fish. Div. Admin. Rept. 99-7.

Kano, R.M. (ed.). 2000. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1996. Inland Fish. Div. Admin. Rept. 2000-1.

Kano, R.M. (ed.). 2003. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1997. Inland Fish. Div. Admin. Rept. 2003-1.

Kano, R.M. (ed.). 2003. Annual report. Chinook salmon spawner stocks in California's Central Valley, 1998. Inland Fish. Admin. Rept. 2003-2.

Killam, D. and C. Harvey Arrison. 2000. Chinook Salmon Spawner Populations for the Sacramento River System, 1999. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-12, Project No.18, Job 1.

Killam, D. and C. Harvey Arrison. 2001. Chinook Salmon Spawner Populations for the Sacramento River System, 2000. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-13, Project No. 18, Job 1.

Killam, D. and C. Harvey Arrison. 2002. Chinook Salmon Spawner Populations for the Sacramento River System, 2001. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-14, Project No. 8, Job 1.

Killam, D. and C. Harvey Arrison. 2003. Chinook Salmon Spawner Populations for the Sacramento River System, 2002. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-15, Project No. 8, Job 1.

Knutson, A.C., (ed.). 1980. Chinook (King) salmon spawning stocks in California's Central Valley, 1978. Anad. Fish. Br. Admin. Rept. 80-6.

Mahoney, J. 1962. 1960 King salmon spawning population estimates for the Sacramento-San Joaquin River system. Mar. Res. Br. Admin. Rept. 62-1.

Menchen, R.S. (ed.). 1963. King salmon spawning stocks in California's Central Valley, 1962. Mar. Res. Br. Admin. Rept. 63-3.

Menchen, R.S. (ed). 1964. King salmon spawning stocks in California's Central Valley, 1963. Mar. Res. Br. Admin. Rept. 64-3.

Menchen, R.S. (ed). 1965. King (Chinook) salmon spawning stocks in California's Central Valley, 1964. Mar. Res. Br. Admin, Rept. 65-2.

Menchen, R.S. (ed.). 1966. King (Chinook) salmon spawning stocks in California's Central Valley, 1965. Mar. Res. Br. Admin. Rept. 66-6.

Menchen, R.S. (ed.). 1967. King (Chinook) salmon spawning stocks in California's Central Valley, 1966. Mar. Res. Br. Admin. Rept. 67-13.

Menchen, R.S. (ed.). 1968. King (Chinook) salmon spawning stocks in California's Central Valley, 1967. Mar. Res. Br. Admin. Rept. 68-6.

Menchen, R.S. (ed.). 1969. King (Chinook) salmon spawning stocks in California's Central Valley, 1968. Anad. Fish. Br. Admin. Rept. 69-4.

Menchen, R.S. (ed.). 1970. King (Chinook) salmon spawning stocks in California's Central Valley, 1969. Anad. Fish. Br. Admin. Rept. 70-14.

Menchen, R.S. (ed.). 1972. King (Chinook) salmon spawning stocks in California's Central Valley, 1970. Anad. Fish. Br. Admin. Rept. 72-2.

Reavis, R.L., Jr. (ed.). 1981. Chinook (King) salmon spawning stocks in California's Central Valley, 1979. Anad. Fish. Br. Admin. Rept. 81-4.

Reavis, R.L., (ed). 1981. Chinook (King) salmon spawning stocks in California's Central Valley, 1980. Anad. Fish. Br. Admin. Rept. 81-7.

Reavis, R. (ed). 1983. Annual report. Chinook salmon spawning stocks in California's Central Valley, 1981. Anad. Fish. Br. Admin. Rept. 83-2.

Reavis, R., Jr. (ed.). 1984. Annual report. Chinook salmon spawning stocks in California's Central Valley, 1982. Anad. Fish. Br. Admin. Rept. 84-10.

Reavis, R., (ed.). 1986. Annual report. Chinook salmon spawning stocks in California's Central Valley, 1983. Anad. Fish. Br. Admin, Rept. 86-1.

Taylor, S.N. (ed.). 1973. King (Chinook) salmon spawning stocks in California's Central Valley, 1971. Anad. Fish. Br. Admin. Rept. 73-2.

Taylor, S.N. (ed.). 1974. King (Chinook) salmon spawning stocks in California's Central Valley, 1972. Anad. Fish. Br. Admin. Rept. 74-6.

Taylor, S.N. (ed.). 1974. King (Chinook) salmon spawning stocks in California's Central Valley, 1973. Anad. Fish. Br. Admin. Rept. 74-2.

Taylor, S.N. (ed.). 1976. King (Chinook) salmon spawning stocks in California's Central Valley, 1974. Anad. Fish. Br. Admin. Rept. 76-3.

MAINSTEM SACRAMENTO RIVER
CHINOOK SALMON AND STEELHEAD
LADDER COUNTS AT RED BLUFF DIVERSION DAM

SUMMARY

Stream: Mainstem Sacramento River at Red Bluff Diversion Dam

Target Species/run: Fall, winter, and spring-run Chinook salmon and steelhead

Monitoring Method: Video monitoring, trapping

Variable Measured: Dam passage estimates (May 15 – September 15)

Program Objective:

- To estimate number of Chinook salmon and steelhead passing the Dam from May 15 through September 15.

Lead Agency: California Department of Fish and Game and U.S. Fish and Wildlife Service

Contact: Doug Killam, CDFG, P.O. Box 578 Red Bluff CA 96080, 530-527-8893, dkillam@dfg.ca.gov

Program Duration: 1967 - present

Previous Methods Used: Balls Ferry trap and weir-after Shasta Dam completed. From 1967-1986, RBDD gates were in year-round, allowing total escapement estimates to be made from dam counts. Currently, RBDD gates are only in from May 15 hrough September 15, allowing passage estimates during that period, but not total escapement estimates for any run.

COST

Funding Source(s):

U.S. Fish and Wildlife Service and Department of Fish and Game**.** Department of Fish and Game funds are 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds. Sport Fish Restoration Act Grant F-51-R-16 Project 57- Job 1

Total Annual Cost: $ 50,000 (DFG)
$ 57,400 (USFWS)

Staffing:

DFG: 0.2 PY (Assoc. Fish Biologist)
0.4 PY (Fish and Wildlife Technician)

USFWS: 0.2 PY (Biologists)
0.7 PY (Technicians)

Funding End Date:

- DFG Sport Fish Restoration Grant - ongoing to 2008, Associate Biologist/Fish and Wildlife Technician

GEOGRAPHIC AREA

Reach Covered: Mainstem Sacramento River at Red Bluff Diversion Dam

Sampling Reaches: Red Bluff Diversion Dam

FIELD SAMPLING

Sampling Frequency: Continuous

Sampling Period: May 15 – September 15

Survey Transport: N/A

Sampling Parameters and Methods:

Physical:

- Water temperature

Biological:

- Count fish passage real-time or from video tapes
- Trap to collect biological information (run identification, sex, length, scale and tissue samples)

DATA ANALYSIS

Methods: Summarize count data by run.

Results: Weekly passage estimates by run, length/frequency and sex composition

DATA MANAGEMENT/STORAGE

Location: Red Bluff

Data Retrieval Contact: Doug Killam

Electronic Storage Format (Software): Access/Excel/Word

REPORTING

Escapement Estimate: Passage estimate available shortly after particular salmon run is finished.

Annual Report: Annual SFRA report available in September of each year

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

MAINSTEM SACRAMENTO RIVER
FALL AND LATE FALL-RUN CARCASS SURVEY

SUMMARY

Stream: Mainstem Sacramento River from Keswick Dam to Princeton

Target Species/run: Fall and late fall-run Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual Spawning Escapement Estimate, Hatchery Contribution Rate, Sex Ratio, Age Composition, Spawn Timing, Spawn Distribution, Spawn Success

Program Objectives:

- Estimate spawning escapement of fall and late fall-run Chinook
- Describe population characteristics of fall and late fall-run Chinook, including: spawn timing, spawn location, gender composition, origin (hatchery or natural), length, age, and spawning success

Lead Agency: California Department of Fish and Game

Contact: Doug Killam, CDFG, P.O. Box 578 Red Bluff CA 96080, 530-527-8893, dkillam@dfg.ca.gov

Program Duration: 1996 - present

Previous Methods Used: Balls Ferry trap and weir-after Shasta Dam completed, Counts at Red Bluff Diversion Dam

COST

Funding Source(s):

Department of Fish and Game and CALFED Ecosystem Restoration Program. Department of Fish and Game funds are 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds. Sport Fish Restoration Act Grant F-51-R-16 Project 57- Job 1

Total Annual Cost: $ 200,000

Staffing:

2.6 PY (PSMFC Technician)
0.3 PY (Fish and Wildlife Technician)
0.3 PY (Assoc. Fish Biologist)

Funding End Date:

- Sport Fish Restoration Grant - ongoing to 2008, Associate Biologist
- CALFED Ecosystem Restoration Program - 2008

GEOGRAPHIC AREA

Reach Covered: Sacramento River from Clear Creek to Keswick Dam

Sampling Reaches: Multiple sections within Reach Covered (above)

FIELD SAMPLING

Sampling Frequency: Weekly

Sampling Period: September through April

Survey Transport: Jet Boat

Sampling Parameters and Methods:

Physical:

- Water temperature
- Water clarity

Biological:

1) Count and tag carcasses with color-coded hog ring in jaw, and record individual id tag number for sample of fresh carcasses along with GPS location.
2) Record sex and age class (adult or grilse) of carcasses.
3) Return carcasses to flowing water just upstream from where they were collected.
4) Count and record age class (adult or grilse) of carcasses and chop with machete to remove from future surveys.
5) Record recovered tagged carcasses, age class (adult/grilse), week of tagging, and chop to remove from future surveys.
6) Collect otolith/scale/tissue samples as needed, measure standard lengths from representative sample of fresh carcasses, record GPS location on individual carcasses.
7) Remove head from every adipose-clipped carcass and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
8) Count carcasses with other marks/tags and record type of mark/tag.

DATA ANALYSIS

Methods: Total escapement estimates from mark-recapture data, using Jolly-Seber model

Results:
1) Total annual escapement estimates
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.
4) Summary of flow, water temperature, water clarity.
5) Hatchery contribution rate, based on coded-wire tag recoveries.

DATA MANAGEMENT/STORAGE

Location: Red Bluff

Data Retrieval Contact: Doug Killam

Electronic Storage Format (Software): Access/Excel/Word/ARCVIEW

REPORTING

Escapement Estimate: Shortly after each run is finished. Submitted to other agencies and PFMC, and GrandTab File.

Annual Report: Annual SFRA report available in September of each year

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

MAINSTEM SACRAMENTO RIVER
WINTER-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Upper Sacramento River

Target Species/run: Winter-run Chinook Salmon

Monitoring Method: Mark-recapture Carcass Survey

Variable Measured: Total Annual Spawning Escapement, Hatchery Escapement Estimate, Sex Ratio, Age Composition, Spawn Timing, Spawn Distribution, Spawn Success, Genetic Run Determination of Spawners

Program Objectives:

- Estimate escapement of Winter Chinook
- Describe population characteristics of winter Chinook, including: spawn timing, spawn location, gender composition, origin (hatchery or natural), length, age, and spawning success.
- Evaluate the winter Chinook supplementation program at Livingston Stone National Fish Hatchery in regards to demographic benefits and effects on population characteristics (listed above)
- Characterize the spawning population based on a genetic run determination

Lead Agency: Cooperative Project of U.S. Fish and Wildlife Service and the California Department of Fish and Game

Contact:

Kevin Niemela
U.S. Fish & Wildlife Service
Red Bluff Fish & Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043

Doug Killam
California Department of Fish and Game
Red Bluff Field Office
PO Box 578
Red Bluff, CA 96080
(530) 527-8893

Program Duration: 1996 - present

Previous Methods Used: None

COST

Funding Source(s): CALFED Ecosystem Restoration Program, CDFG, USFWS

Total Annual Cost: $ 345,000

Staffing: USFWS:
0.10 FTE (GS-11 Supervisory Fishery Biologist, Field Supervisor)
0.20 FTE (GS-9 Fishery Biologist, Data Analyst and Reporting)
0.33 FTE (GS-7 Fishery Biologist, Crew Leader)
1 FTE (GS-5 Fishery Biological Technician)

CDFG:
0.20 FTE (Associate Fishery Biologist)
1.33 FTE (Scientific Aid/Technician)

Funding End Date: CALFED ERP - 2008

GEOGRAPHIC AREA

Reach Covered: Upper Sacramento River, from Cottonwood Creek (RM 270) upstream to the Keswick Dam (RM 302), variable by year

Sampling Reaches:
1) Keswick Dam (RM 302) to ACID Dam (RM 298)
2) ACID Dam to Highway 44 Bridge (RM 296)
3) Highway 44 Bridge (RM 296) to Clear Creek Powerlines
4) Clear Creek Powerlines to Cottonwood Creek (RM 273)

FIELD SAMPLING

Sampling Frequency: 7 days/week

Sampling Period: May 1 through September 4

Survey Transport: Jet Boat

Sampling Parameters and Methods:

Physical: Temperature
Water Clarity (secchi)

Biological:

1. Count and tag carcasses with color-coded hog rings
2. Record biological data including gender, fork length, spawn condition, carcass condition, adipose fin status, other tag types and numbers (e.g. floy tags), etc.
3. Record information on recovered tagged carcasses
4. Collect otolith, scale, and tissue samples
5. Collect heads from all adipose-fin clipped carcasses
6. Record GPS location of individual carcasses

DATA ANALYSIS

Methods: Escapement estimated with Jolly-Seber and Peterson Models. Data expanded to account for survey biases.

Results:

1. Annual escapement of adults and grilse by river mile
2. Spatial and temporal spawning distribution
3. Size and gender composition of the spawning population
4. Flow, water temperature, and water clarity
5. Coded-wire tag data including release and recovery dates
6. Genetic run identification
7. Comparisons of hatchery vs. natural origin winter Chinook salmon
8. Recapture data for floy tagged winter Chinook salmon

DATA MANAGEMENT/STORAGE

Location: U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, CA
California Department of Fish and Game, Red Bluff Field Station, Red Bluff, CA

Data Retrieval Contact:
Kevin Niemela (USFWS) and Doug Killam (CDFG)

Electronic Storage Format (Software): Microsoft Excel, Access, Word, ARCVIEW

REPORTING

Escapement Estimate: January

Annual Report: December 31 – California Bay Delta Authority

Other Reporting: N/A

REFERENCES

Killam, Douglas. 2004. Sacramento River Winter-run Chinook salmon escapement survey April-September 2003. California Department of Fish and Game, Sacramento River Salmon and Steelhead Assessment Project, Technical Report No. 04-1.

Snider, B., B. Reavis, and S. Hill. 2000. 1999 Upper Sacramento River winter-run Chinook salmon escapement survey May-August 1999. California Department of Fish and Game, Habitat Conservation Division, Technical Report No. 00-1.

Snider, B., B. Reavis, and S. Hill. 2001. Upper Sacramento River winter-run Chinook salmon escapement survey May-August 2000. California Department of Fish and Game, Stream Evaluation Program, Technical Report No. 01-1.

Snider, B., B. Reavis, R.G. Titus, and S. Hill. 2002. Upper Sacramento River winter-run Chinook salmon escapement survey May-August 2001. California Department of Fish and Game, Stream Evaluation Program, Technical Report No. 02-1.

University of California – Davis Bodega Marine Laboratory. 2001. Genetic maintenance of hatchery- and natural-origin winter-run Chinook salmon – Final Report. Cooperative agreement of University of California – Davis and U.S. Fish & Wildlife Service numbers 1448-11330-97-J194, 1448-11330-97-J045, and 1448-11330-97-J094. University of California – Davis, Bodega Marine Laboratory, Bodega Bay, California.

USFWS. 2001. Upper Sacramento River winter Chinook salmon carcass survey. Prepared for the California Bay-Delta Authority Ecosystem Restoration Program, Project # ERP-01-N46. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, CA.

USFWS. 2002. Upper Sacramento River winter Chinook salmon carcass survey. Prepared for the California Bay-Delta Authority Ecosystem Restoration Program, Project # ERP-01-N46. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, CA.

USFWS. 2003 - Draft. Upper Sacramento River winter Chinook salmon carcass survey. Prepared for the California Bay-Delta Authority Ecosystem Restoration Program, Project# ERP-01-N46. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, CA.

ANTELOPE CREEK
SPRING-RUN CHINOOK SNORKEL SURVEY

SUMMARY

Stream: Antelope Creek

Target Species/run: Spring-run Chinook salmon

Monitoring Method: Snorkel survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual spring-run population

Lead Agency: Calif. Dept. Fish and Game

Contact: Colleen Harvey Arrison
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1992 - present

Previous Methods Used: none

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $ 52,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.2 PY Associate Fishery Biologist
0.2 PY PSMFC Technicians
0.01 PY CDFG Fishery Technician

Funding End Date: CALFED ERP funding through 2009

GEOGRAPHIC AREA

Reach Covered: North fork: McClure Place to confluence
South fork: SF Gun Club to confluence
North and South forks to Little Grapevine Creek

FIELD SAMPLING

Sampling Frequency: Single pass

Sampling Period: 4th week in July

Survey Transport: 4WD, snorkel

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow transects measured bimonthly May - Sep

Biological:
Count number of salmon observed per survey reach. Team of 2-3 snorkelers swim downstream and count adult salmon in all pool and riffle habitat. Highest count observed is recorded.

DATA ANALYSIS

Methods: Total number observed is the annual total count

Results:
1. Annual escapement count
2. Distribution of holding fish
3. Comparable population trends over time

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, Grand Tab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

BEEGUM CREEK
SPRING-RUN CHINOOK SNORKEL SURVEY

SUMMARY

Stream: Beegum Creek

Target Species/run: Spring-run Chinook salmon

Monitoring Methods: Snorkel survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual spring-run spawning population

Lead Agency: Calif. Dept. Fish and Game

Contact: Doug Killam
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-8893
dkillam@dfg.ca.gov

Program Duration: 1973-present (some years no survey)

Previous Methods Used: none

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $ 5,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.1 PY Associate Fishery Biologist
0.1 PY PSMFC Technicians

Funding End Date: CALFED ERP funding through 2009

GEOGRAPHIC AREA

Reach Covered: North fork (0.5 mi) upstream from the North and South Fork confluence to Hwy. 36 Bridge

FIELD SAMPLING

Sampling Frequency: Single pass

Sampling Period: Tri-annually

Survey Transport: 4WD, snorkel

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological:
Count number of salmon observed per survey reach. Team of 1-2 snorkelers swim downstream and count adult salmon in all pool and riffle habitat. Highest count observed is recorded.

DATA ANALYSIS

Methods: Total number observed is the annual total count.

Results:
1. Annual escapement estimate
2. Spatial distribution of holding fish
3. Comparable population trends over time

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Doug Killam

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, GrandTab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

MILL CREEK
SPRING-RUN CHINOOK REDD SURVEY

SUMMARY

Stream: Mill Creek

Target Species/run: Spring-run Chinook salmon

Monitoring Method: Redd survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual spring-run spawning population

Lead Agency: Calif. Dept. Fish and Game

Contact: Colleen Harvey Arrison
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1947-present

Previous Methods Used: Ladder counts, electronic fish counters, carcass survey with undocumented expansion

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $ 52,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.2 PY Associate Fishery Biologist
0.2 PY PSMFC Technicians
0.02 PY CDFG Fishery Technician

Funding End Date: CALFED ERP funding through 2009

GEOGRAPHIC AREA

Reach Covered: Lassen National Park boundary to Little Mill Creek confluence

FIELD SAMPLING

Sampling Frequency: Single survey at peak spawning period

Sampling Period: October 1-15

Survey Transport: 4WD, foot

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological:

1. Team of 2 observers walk downstream on opposing sides of the creek channel and count number of complete redds.
2. Count and record age class and sex of fresh and non-fresh carcasses.
3. Record forklength of carcasses to the nearest cm.
4. Collect otolith and tissue samples from carcasses as requested by researchers.
5. Check carcass for fin clips, marks or tags.

DATA ANALYSIS

Methods: Total redds counted multiplied by two (assumes a 1:1 redd to female and female to male ratio).

Results:

1) Annual escapement estimate.
2) Spatial spawning distribution.
3) Population trend over time.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, Grand Tab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

MILL CREEK
SPRING-RUN CHINOOK HYDROACOUSTIC STUDY
(PILOT PROGRAM)

SUMMARY

Stream: Mill Creek

Target Species/run: Spring-run Chinook salmon

Monitoring Method: Hydroacoustic: DTX split-beam echosounding and Dual frequency IDentification SONar (DIDSON)

Variable Measured: Adult escapement

Program Objectives: To evaluate the feasibility of two different hydroacoustic methods, DIDSON and split-beam, to monitor adult spring-run Chinook salmon escapement in Mill Creek.

Lead Agency: U.S. Fish and Wildlife Service

Contact: Brenda Olson, 10950 Tyler Road, Red Bluff, CA 96080, (530) 527-3043, Brenda_Olson@fws.gov

Program Duration: One-year contract, April 2006 through July 2006.

Previous Methods Used: Ladder counts, electronic fish counter, redd counts, carcass counts with undocumented expansions.

COST

Funding Source(s): Anadromous Fish Restoration Program (AFRP)

Total Annual Cost: $159,742
(Permanent and temporary personnel, operating, equipment)

Staffing: 0.5 PY Scientist:
Senior Scientist (3 days)
DIDSON Scientist (52 days)
DTX split-beam Scientist (40 days)
Analyst (30 days)

0.2 PY Technician:
Fisheries Technician (50 days)

Funding End Date: December 15, 2006

GEOGRAPHIC AREA

Reach Covered: Sampling site at Sherwood Bridge, Los Molinos, CA. Creek mile 2.0 (N 40.04565° by W 122.0951°)

Sampling Reaches: Single sampling location

FIELD SAMPLING

Sampling Frequency: DIDSON and split-beam – daily.

Sampling Period: DIDSON: partially operational 3/29/06 through 4/15/06, almost fully operational from 4/16 through 6/23. DTX split-beam was offline for most of the early study period due to high flow levels but almost fully operational from 4/28/06 through 7/15/06.

Survey Transport: none

Sampling Parameters and Methods:

Physical: Water temperature (thermograph and telemetered gages)
Water flow (USGS and DWR telemetered gages)

Biological: Large fish targets ≥ 60 cm were assumed to be adult spring-run Chinook salmon with the DIDSON; and ≥ 40 dB for split beam. Daily and hourly passage estimates of adult salmon.

DATA ANALYSIS

Methods:

1) Split-beam echosounding target counts
2) DIDSON target counts

Results:

1) Split-beam gross target count – 947 chinook sized targets (≥ 40 dB)
2) DIDSON net upstream target count – 1,222 ≥ 60 cm

DATA MANAGEMENT/STORAGE

Location:

LGL Northwest Research Associates, 72 Cascade Mall Dr., North Bonneville, WA 98639

Data Retrieval Contact:

Peter Johnson

Electronic Storage Format (Software):

Split-beam – Biosonics, Visual Analyzer, .DT4 file format
DIDSON – Sound Metrics, DIDSON Control and Display, .ddf file format

REPORTING

Escapement Estimate: In Process

Annual Report: In Process

Other Reporting: N/A

REFERENCES

In Process

MILL CREEK
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Mill Creek

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual fall-run spawning population

Lead Agency: Calif. Dept. Fish and Game

Contact:
Colleen Harvey Arrison
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1952-present

Previous Methods Used: Ladder counts, Peterson and Schaefer analysis of tag-recapture data, carcass surveys with undocumented expansion

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $ 36,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.1 PY Associate Fishery Biologist
0.2 PY PSMFC Technicians
0.02 PY CDFG Fishery Technician

Funding End Date: CALFED ERP funding through 2009.

GEOGRAPHIC AREA

Reach Covered: 2 miles upstream of the Upper Diversion Dam to confluence

FIELD SAMPLING

Sampling Frequency: Weekly.

Sampling Period: 2nd week in October through December

Survey Transport: 4WD, foot

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological:

For each carcass encountered:

1. Check for jaw tags, floy tags, radio tags and adipose clips.
    b. If carcass jaw tagged from a previous week, chop in-half and record as "recovery" under appropriate tag color.
    c. If carcass adipose clipped,
        i. Record forklength (cm)
        ii. Fill out "head tag" data card
        iii. Cut salmon head behind the eye socket. Place head in bag with head tag.
        iv. Record fish as "carcass chop" under appropriate size class and sex.
2. If carcass has no jaw tags, ad-clips, opaque eyes, or not near running water, chop in-half and record as "carcass chop" under appropriate size class and sex.
3. If carcass is fresh, and has at least one clear eye, place a color-coded hog ring in the upper jaw and release back into running water. Record as "carcass tagged" on data card under appropriate size class and sex.
4. Dissect, retrieve and read CWT's from heads collected from ad-clipped fish.

DATA ANALYSIS

Methods:

Escapement estimated using the Schaefer or seasonal Peterson models. Model used depends on population size and carcass recovery conditions.

Results:

1. Annual escapement estimates.
2. Length frequency, age and sex composition of spawning population.
3. Spatial and temporal spawning distribution.
4. Comparable population trends over time.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, Grand Tab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

DEER CREEK
SPRING-RUN CHINOOK SNORKEL SURVEY

SUMMARY

Stream: Deer Creek

Target Species/run: Spring-run Chinook salmon

Monitoring Method: Snorkel survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual spring-run spawning population

Lead Agency: Calif. Dept. Fish and Game

Contact:
Colleen Harvey Arrison
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1940 - present

Previous Methods Used: Partial weir and ladder counts, electronic fish counters, carcass surveys with undocumented expansion

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $48,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.2 PY Associate Fishery Biologist
0.15 PY PSMFC Technicians
0.01 PY CDFG Fishery Technician

Funding End Date: CALFED ERP funding through 2009

GEOGRAPHIC AREA

Reach Covered: Upper Deer Creek Falls to Dillon Cove

FIELD SAMPLING

Sampling Frequency: Single pass snorkel survey

Sampling Period: 1st week in August

Survey Transport: 4WD, snorkel, foot

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological: Snorkel counts:
a) Count number of salmon observed per survey reach. Team of 2-3 snorkelers swim downstream and count adult salmon in all pool and riffle habitat. Highest count observed is recorded.

DATA ANALYSIS

Methods: Snorkel counts: total number observed is the annual total count.

Results:
1. Annual escapement estimates or counts for spring-run Chinook.
2. Spatial distribution of holding fish.
3. Comparable population trends over time.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, Grand Tab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

DEER CREEK
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Deer Creek

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual fall-run spawning population

Lead Agency: Calif. Dept. Fish and Game

Contact: Colleen Harvey Arrison
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1952-present

Previous Methods Used: Peterson and Schaefer analysis of tag-recapture data, carcass surveys with undocumented expansion

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $36,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.1 PY Associate Fishery Biologist
0.2 PY PSMFC Technicians
0.02 PY CDFG Fishery Technician

Funding End Date: CALFED ERP funding through 2009

GEOGRAPHIC AREA

Reach Covered: USGS gage to monastery

FIELD SAMPLING

Sampling Frequency: Weekly

Sampling Period: 2nd week in October through December

Survey Transport: 4WD, foot

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological:

For each carcass encountered:

1. Check for jaw tags, floy tags, radio tags and adipose clips.
    a. If carcass jaw tagged from a previous week, chop in-half and record as "recovery" under appropriate tag color.
    b. If carcass adipose clipped,
        i. Record forklength (cm)
        ii. Fill out "head tag" data card
        iii. Cut salmon head behind the eye socket. Place head in bag with head tag.
        iv. Record fish as "carcass chop" under appropriate size class and sex.
2. If carcass has no jaw tags, ad-clips, opaque eyes, or not near running water, chop in-half and record as "carcass chop" under appropriate size class and sex.
3. If carcass is fresh, and has at least one clear eye, place a color-coded hog ring in the upper jaw and release back into running water. Record as "carcass tagged" on data card under appropriate size class and sex.
4. Dissect, retrieve and read CWT's from heads collected from ad-clipped fish.

DATA ANALYSIS

Methods: Escapement estimated using the Schaefer or seasonal Peterson models. Model used depends on population size and carcass recovery conditions.

Results:
1. Annual escapement estimate for fall-run Chinook.
2. Length frequency, age and sex composition of spawning population.
3. Spatial and temporal spawning distribution.
4. Comparable population trends over time.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, Grand Tab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

CLEAR CREEK
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Clear Creek

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual fall-run spawning population

Lead Agency: Calif. Dept. Fish and Game

Contact:
Colleen Harvey Arrison
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1953 - present

Previous Methods Used: Peterson and Schaefer analysis of carcass tag-and-recapture data, carcass counts with undocumented expansions

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $32,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 0.1 PY Associate Fishery Biologist
0.15 PY PSMFC Technicians
0.02 PY CDFG Fishery Technician

Funding End Date: CALFED ERP funding through 2009.

GEOGRAPHIC AREA

Reach Covered: Saeltzer Dam site to 4.2 miles downstream

FIELD SAMPLING

Sampling Frequency: Weekly

Sampling Period: 2nd week in October through December

Survey Transport: 4WD, foot

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological: For each carcass encountered:

2. Check for jaw tags, floy tags, radio tags and adipose clips.
    a. If carcass jaw tagged from a previous week, chop in-half and record as "recovery" under appropriate tag color.
    b. If carcass adipose clipped,
        i. Record forklength (cm)
        ii. Fill out "head tag" data card
        iii. Cut salmon head behind the eye socket. Place head in bag with head tag.
        iv. Record fish as "carcass chop" under appropriate size class and sex.
3. If carcass has no jaw tags, ad-clips, opaque eyes, or not near running water, chop in-half and record as "carcass chop" under appropriate size class and sex.
4. If carcass is fresh, and has at least one clear eye, place a color-coded hog ring in the upper jaw and release back into running water. Record as "carcass tagged" on data card under appropriate size class and sex.
5. Dissect, retrieve and read CWT's from heads collected from ad-clipped fish.

DATA ANALYSIS

Methods: Escapement estimated using the Schaefer or seasonal Peterson models. Model used depends on population size and carcass recovery conditions.

Results: 1. Annual escapement estimates or counts for fall-run Chinook.
2. Length frequency, age and sex composition of spawning population.

3. Spatial and temporal spawning distribution.
4. Comparable population trends.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, Grand Tab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

CLEAR CREEK
FALL-RUN CHINOOK REDD MAPPING

SUMMARY

Stream: Clear Creek

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Digitizing spawning areas on ortho-rectified aerial photos.

Variable Measured: Location and surface area of fall Chinook redds and redd aggregates.

Program Objectives:

- To evaluate inter-annual changes in the location and quantity of spawning habitat used by fall Chinook.
- To evaluate the effectiveness of spawning habitat restoration activities.

Lead Agency: US Fish and Wildlife Service

Contact:
Matt Brown
US Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 2000 – present

Previous Methods Used: Redd counts per 1000 feet (CDFG & USFWS).

COST

Funding Source: CVPIA

Total Cost: $10,000
(Personnel, operating, equipment)

Staffing:
Field: 2 (Fishery Biologists) – 0.1 PY

Funding End Date: Based on annual appropriations.

GEOGRAPHIC AREA

Reach Covered: Clear Creek Road Bridge to the USFWS rotary screw trap (River Mile 8.5-1.7

Sampling Reaches: Two reaches: Reach 5 (RM 8.5-6.5) and Reach 6 (RM 6.5-1.7)

FIELD SAMPLING

Sampling Frequency: Once per year

Sampling Period: Two days in December

Survey Transport: Walking

Sampling Parameters and Methods:

Physical:

9) In the field, draw the area of redds and redd aggregates on copies of current aerial photos.
10) In the office using GIS computer software, draw polygons representing the spawning area used by fall Chinook and calculate total spawning area within stream segments of interest.

DATA ANALYSIS

Methods: GIS spatial analysis.

Results: Annual surface area used for spawning by fall Chinook. Data are summarized by 1) consecutive 1,000 ft intervals, 2) key restoration reaches, and 3) annual grand total.

DATA MANAGEMENT/STORAGE

Location: Red Bluff Fish and Wildlife Office
Red Bluff

Data Retrieval Contact: Matt Brown (see contact information above)

Electronic Storage Format (Software): ArcMap

REPORTING

Annual summaries: June 30th

Other Reporting: October 2004

CLEAR CREEK
SPRING-RUN CHINOOK SNORKEL SURVEY

SUMMARY

Stream: Clear Creek

Target Species/run: Spring-run Chinook salmon

Monitoring Method: Snorkel survey

Variable Measured: Spring Chinook escapement index (i.e. number of adult spring Chinook observed during an August survey). Also, number of spring Chinook redds and carcasses.

Program Objectives:

- To determine the annual relative abundance of spring Chinook salmon in Clear Creek.
- To evaluate the temporal and spatial distribution of immigrating and spawning adult spring Chinook.
- To evaluate relationships to environmental conditions such as water temperature, flow, physical barriers, and spawning gravel.

Lead Agency: US Fish and Wildlife Service

Contact: Matt Brown
US Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 1999 – present

Previous Methods Used: None.

COST

Funding Source: CVPIA

Total Cost: $133,000
(Personnel, operating, equipment)

Staffing:

Field: 3 (Fishery Biologists) – 1.5 PY

Funding End Date: Based on annual appropriations.

GEOGRAPHIC AREA

Reach Covered: Whiskeytown Dam to the USFWS rotary screw trap (river mile 18.1-1.7).

Sampling Reaches: Six reaches

FIELD SAMPLING

Sampling Frequency: Monthly from April-August
Twice a month from September-early November

Sampling Period: Late April through early November

Survey Transport: Dry or wet suits

Sampling Parameters and Methods:

Physical: Water Temperature
Water Turbidity

Biological:

1) Count and GPS live Chinook, redds, and carcasses.
2) Count live steelhead/rainbow trout (small, medium, large)
3) Carcasses: Collect scales, tissue samples, and heads from adipose-fin clipped Chinook. Record sex and fork length. Recover coded-wire tags from ad-clipped fish.
4) Redds: Record redd dimensions, depth, velocity, and substrate size.

DATA ANALYSIS

Methods: Graphic and tabular data presentation

Results:

1) Spring Chinook escapement index (August count).
2) Immigration timing.
3) Spatial and temporal spawning distribution.
4) Degree of separation of fall-run and spring-run Chinook
5) Summary of flow, water temperature, and water clarity.
6) Coded-wire tag data, including release and recovery data.

DATA MANAGEMENT/STORAGE

Location: Red Bluff Fish and Wildlife Office
Red Bluff

Data Retrieval Contact: Matt Brown (see contact information above)

Electronic Storage Format (Software): Lotus 1-2-3 / Excel

REPORTING

Escapement Index: September 15th

Biennial Report: August 30 (every other year).

Other Reporting: N/A

REFERENCES

Newton, J. M., and M. R. Brown. 2004. Adult spring Chinook salmon monitoring in Clear Creek, California,1999-2002. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

CLEAR CREEK
LATE-FALL CHINOOK AND STEELHEAD REDD SURVEY

SUMMARY

Stream: Clear Creek

Target Species/run: Late-fall Chinook salmon and steelhead/rainbow trout

Monitoring Method: Redd survey

Variable Measured: Number of Steelhead/rainbow trout redds. Number of late-fall Chinook live adults, redds, and carcasses.

Program Objectives:

- To determine the annual relative abundance of steelhead/rainbow trout and late-fall Chinook in Clear Creek.
- To evaluate the temporal and spatial spawning distribution of steelhead/rainbow trout and late-fall Chinook.
- To evaluate relationships to environmental conditions such as water temperature, flow, physical barriers, and spawning gravel.

Lead Agency: US Fish and Wildlife Service

Contact: Matt Brown
US Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 1999 – present

Previous Methods Used: None.

COST

Funding Source: CVPIA

Total Cost: $53,000
(Personnel, operating, equipment)

Staffing:

Field: 3 (Fishery Biologists) – 0.4 PY

Funding End Date: Based on annual appropriations.

GEOGRAPHIC AREA

Reach Covered: Whiskeytown Dam to the USFWS rotary screw trap (river mile 18.1-1.7).

Sampling Reaches: Six reaches

FIELD SAMPLING

Sampling Frequency: About monthly.

Sampling Period: December through April

Survey Transport: Inflatable kayaks

Sampling Parameters and Methods:

Physical: Water Temperature
Water Turbidity

Biological:

1) Count and GPS steelhead/rainbow trout redds.
2) Count and GPS live Chinook, redds, and carcasses.
3) Chinook carcasses: Collect scales, tissue samples, and heads from adipose-fin clipped Chinook. Record sex and fork length. Recover coded-wire tags from ad-clipped fish.
4) Redds: Record redd dimensions, depth, velocity, and substrate size of Chinook and Steelhead/rainbow trout redds.

DATA ANALYSIS

Methods: Graphic and tabular data presentation

Results:

1) Steelhead/rainbow trout and late-fall Chinook escapement indices (redd counts).
2) Spatial and temporal spawning distribution of steelhead and late-fall Chinook
3) Summary of flow, water temperature, and water clarity.
4) Coded-wire tag data, including release and recovery data.
5) Redd size for steelhead and late-fall Chinook (average and range).

DATA MANAGEMENT/STORAGE

Location: Red Bluff Fish and Wildlife Office
Red Bluff

Data Retrieval Contact: Matt Brown (see contact information above)

Electronic Storage Format (Software): Lotus 1-2-3 / Excel

REPORTING

Escapement Index: June 30th

Semi annual Report: Periodic

Other Reporting: N/A

COW CREEK
FALL-RUN CHINOOK VIDEO MONITORING

SUMMARY

Stream: Cow Creek

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Video monitoring at weir

Variable Measured: Annual adult spawning escapement

Program Objectives: Estimate annual return of fall-run Chinook to Cow Creek

Lead Agency: Calif. Dept. Fish and Game

Contact: Doug Killam
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-8893
dkillam@dfg.ca.gov

Program Duration: 2006 - on

Previous Methods Used: Redd surveys, live fish counts-sporadic (none since 1984)

COST

Funding Source(s):

- U.S. Fish and Wildlife Service
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.
- Western Shasta Resource Conservation District (AFRP Grant)

Total Annual Cost: $ 20,000

Staffing:

DFG: 0.1 Associate Fishery Biologist
0.1 PY Fishery Technician

USFWS: 0.1 PY Supervisory Fishery Biologist

WSRCD 0.4 PY Technician

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: Cow Creek Watershed

FIELD SAMPLING

Sampling Frequency: Continuous

Sampling Period: Late August through November

Survey Transport: 4WD

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological:

- Continuous video taping (VHS) of fish passing.
- Enumeration of fish passage from video tapes.

DATA ANALYSIS

Methods: Enumeration of fish passage from video tapes.

Results:

1. Annual escapement estimate for fall-run Chinook salmon.
2. Immigration timing.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Doug Killam

Electronic Storage Format (Software): Access database, Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, GrandTab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

Killam, D. 2007. Results of the 2006 Cow Creek video station, fall-run Chinook salmon escapement. SRSSAP Technical Report No. 07-1.

BATTLE CREEK
FALL-RUN CHINOOK VIDEO MONITORING

SUMMARY

Stream: Battle Creek

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Video monitoring at weir

Variable Measured: Total annual adult spawning escapement to Battle Creek and Coleman National Fish Hatchery

Program Objectives: Estimate annual return of fall-run Chinook to lower Battle Creek

Lead Agency: Calif. Dept. Fish and Game

Contact: Doug Killam
Calif. Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-8893
dkillam@dfg.ca.gov

Program Duration: 2003-present

Previous Methods Used: Mark-recapture carcass survey.

COST

Funding Source(s):

- CALFED Ecosystem Restoration Program
- U.S. Fish and Wildlife Service
- Department of Fish and Game: 75% Sport Fish Restoration Program Federal Grant; 25% state of CA match from non-dedicated Fish and Game Preservation and State General Funds.

Total Annual Cost: $ 33,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

DFG: 0.1 Associate Fishery Biologist
0.1 PY Fishery Technician

USFWS: 0.1 PY Supervisory Fishery Biologist
0.4 PY Biological Technician/Fish Counter

Funding End Date: CALFED ERP funding through 2009.

GEOGRAPHIC AREA

Reach Covered: Coleman National Fish Hatchery to 4 miles downstream

FIELD SAMPLING

Sampling Frequency: Continuous.

Sampling Period: Late August through November

Survey Transport: 4WD

Sampling Parameters and Methods:

Physical: Water temperature (thermograph)
Water flow (USGS and DWR telemetered gages)

Biological:

- Continuous video taping (VHS) of fish passing.
- Enumeration of fish passage from video tapes.

DATA ANALYSIS

Methods: Enumeration of fish passage from video tapes.

Results:

1. Annual escapement estimate for fall-run Chinook salmon.
2. Immigration timing.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game, Red Bluff Field Office

Data Retrieval Contact: Doug Killam

Electronic Storage Format (Software): Access database, Excel Spreadsheet

REPORTING

Escapement Estimate: PFMC, GrandTab

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: CA Dept. Fish and Game, Inland Fisheries Division Administrative Reports: Chinook salmon spawner stocks in California's Central Valley; Annual reports available 1953 thru 1999.

REFERENCES

See page I-4.

BATTLE CREEK
SPRING-RUN CHINOOK, STEELHEAD PASSAGE MONITORING
COLEMAN NATIONAL FISH HATCHERY BARRIER WEIR

SUMMARY

Stream: Battle Creek

Target Species/run: Spring-run Chinook and Steelhead Trout

Monitoring Method: Weir trapping- manual passage; underwater video passage monitoring; barrier weir jumper video monitoring

Variable Measured: Upper Battle Creek adult spawning escapement, passage estimates by run

Program Objectives:

- Estimate number of adult Chinook and Steelhead returning
- Age, size, and gender of returning adults
- Timing of migration
- Potential limiting factors such as temperature and turbidity
- To collect tissue samples for genetic analysis
- To collect coded-wire tags from hatchery fish.

Lead Agency: U.S. Fish and Wildlife Service

Contact:
Matt Brown
U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 1995 – Present (barrier weir trap and underwater video)
2002 – 2005 (jumper video monitoring)

Previous Methods Used: None

COST

Funding Source(s): California Bay-Delta Authority (formerly CALFED)

Total Annual Cost: $115,000

Staffing:

Field: 2 FTE Fish Biologists

Funding End Date: August 2006

GEOGRAPHIC AREA

Reach Covered: Trap located at the Coleman National Fish Hatchery Barrier Weir, RM 5.8 from Sacramento River.

Sampling Reaches: One location only

FIELD SAMPLING

Sampling Frequency: Daily (7 days a week) Trapping 8 hrs a day; 24hr/day video; jumper video daylight hours only

Sampling Period: March 1 – May 31 weir trapping; June 1 - July 31 underwater video monitoring; jumper video August – December.

Survey Transport: none

Sampling Parameters and Methods:

Physical:

- Water Temperature – hand held thermometer and logger
- Water clarity/turbidity during trapping and video monitoring
- Barrier Weir Trap with netted false bottom, use hand winch, raise up every half hour to sample.

Biological:

Weir Trap

1. Every half hour sample trap, enumerate all non-salmonids and manually pass upstream.
2. Each salmonid, place in CO_2 tank, place on measuring board, and record FL, gender and ripeness.
3. For all adipose fin clipped Chinook, sacrifice for CWT retrieval and take photo.
4. For all non-adipose fin clipped Chinook, take a genetic sample, and place in recovery tank or tube, then release upstream.
5. For all adipose fin clipped steelhead, scan for CWT, if present, sacrifice as above, if absent, transfer to Coleman National Fish Hatchery.
6. For all non-adipose fin clipped steelhead, take a genetic sample, and place in recovery tank or tube, then release upstream.

Underwater Video Monitoring

1. Record fish passage 24 hr / Day with time lapse.
2. View all tapes enumerating each species
3. Quality Assurance / Quality Control of video viewing: re-view 1 out of every 5 tapes.

Jumper Video Monitoring

1. Video tape entire barrier weir apron and falls during daylight hours.
2. View all tapes counting number of salmonid escapees over the barrier weir.

DATA ANALYSIS

Methods: Escapement/passage estimate; Graphic and tabular data presentation

Results:

1. Coded-wire tag data, including release and recovery data
2. Genetic analysis on collected samples
3. Passage/escapement estimates for each run of Chinook
4. Passage estimates for rainbow trout/steelhead
5. Passage timing (time of day and date)
6. Evaluating potential impacts of delay at the barrier weir.
7. Evaluating potential passage (jumping or swimming) over barrier weir relating to flow

DATA MANAGEMENT/STORAGE

Location: Red Bluff, Fish and Wildlife Office

Data Retrieval Contact: Matt Brown

Electronic Storage Format (Software): Lotus 1-2-3 / Excel / Word Perfect / PDF

REPORTING

Escapement Estimate: Annual Report to California Bay-Delta Authority (formerly CALFED).

Annual Report: Annual Report to California Bay-Delta Authority (formerly CALFED).

Other Reporting: Data files sent out on request; "Greensheets" for BCWG; Quarterly Reports.

REFERENCES

Alston, N. O., Newton, J. M., and Brown, M. R.. 2007. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2003 through November 2004. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Alston, N.O., M. R. Brown, and J. M. Newton. 2006. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2004 through November 2005. Data Draft USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M.R., and J.M. Newton. 2002. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from March through October 2001. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M.R., N.O. Alston, J.M. Newton. 2004. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from March through November 2002. Draft USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M. R., and N. O. Alston. 2007. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2002 through November 2003. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

BATTLE CREEK
SPRING-RUN CHINOOK, STEELHEAD SNORKEL SURVEY

SUMMARY

Stream: Battle Creek

Target Species/run: Spring Run Chinook and Steelhead Trout

Monitoring Method: Snorkel Surveys

Variable Measured: Upper Battle Creek adult spawning population

Program Objectives:

- Location of spawning
- Timing of spawning
- To evaluate relationships to environmental conditions and potential limiting factors such as water temperature, flow, turbidity, physical barriers, and spawning gravel.
- Collect tissue samples from adult salmonids for genetic analysis
- Evaluate the Interim Flow Agreement

Lead Agency: U.S. Fish and Wildlife Service

Contact:

Matt Brown
U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 2001 - Present

Previous Methods Used: 1995 - 1998

COST

Funding Source(s): California Bay-Delta Authority (formerly CALFED)

Total Annual Cost: $200,383

Staffing:

Field: 3.2 FTE Fish Biologists

Funding End Date: November 2006

GEOGRAPHIC AREA

Reach Covered: Starting at the Mainstem of BC RM 2.8, 13.8 miles to confluence of the forks. NF 5.3 miles long, SF 2.5 miles long. Total of 21.6 miles.

Sampling Reaches:
R1) NF Eagle Canyon Dam to Wildcat Dam
R2) NF Wildcat dam to confluence
R3) SF Coleman Diversion Dam to confluence
R4) MS confluence of forks to Barn Beat
R5) MS Barn Beat to Spring Branch
R6) MS Spring Branch to CNFH Barrier Weir
R7) MS CNFH Barrier Weir to Lower Rotary Screw Trap

FIELD SAMPLING

Sampling Frequency: Once or twice a month (4 days to complete survey)

Sampling Period: May 1 – mid November

Survey Transport: Vehicles to sites, dry suits and wet suits

Sampling Parameters and Methods:

Physical:
Temperature: hand held thermometer and logger
Water clarity: turbidimeter
Flow: CFS

Biological:

1. Three crew members per reach, swim downstream 3 abreast.
2. Observing and obtaining live Chinook counts for each reach and totaling for the survey. GPS each sighting.
3. Live rainbow trout/steelhead counts in size categories: small= larger than YOY, less than 16”, medium= 16”-22”, large = greater than 22”.
4. Take genetic samples off all salmonid carcasses and GPS location.
5. Locate all redds, identify species, measure salmonid redds, including velocity.

DATA ANALYSIS

Methods: Spawning Population

Results:

1. Spatial and temporal spawning distribution
2. Summary of flow, water temperature, and water clarity
3. Coded-wire tag data, including release and recovery data
4. Genetic analysis on collected samples
5. Spawning population

DATA MANAGEMENT/STORAGE

Location: Red Bluff, Fish and Wildlife Office

Data Retrieval Contact: Matt Brown

Electronic Storage Format (Software): Lotus 1-2-3 / Excel / Word Perfect / PDF

REPORTING

Escapement Estimate: Annual Report to California Bay-Delta Authority (formerly CALFED)

Annual Report: Annual Report to California Bay-Delta Authority (formerly CALFED)

Other Reporting: Data files sent out on request; "Greensheets" for BCWG; Quarterly Reports.

REFERENCES

Alston, N. O., Newton, J. M., and Brown, M. R.. 2007. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2003 through November 2004. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Alston, N.O., M. R. Brown, and J. M. Newton. 2006. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2004 through November 2005. Data Draft USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M.R., and J.M. Newton. 2002. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from March through October 2001. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M.R., N.O. Alston, J.M. Newton. 2004. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from March through November 2002. Draft USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M. R., and N. O. Alston. 2007. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2002 through November 2003. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

BATTLE CREEK
STEELHEAD REDD SURVEY

SUMMARY

Stream: Battle Creek

Target Species/run: Steelhead trout

Monitoring Method: Redd Surveys

Variable Measured: Upper Battle Creek adult steelhead spawning population

Program Objectives:

- Location of spawning
- Timing of spawning
- Collect tissue samples from adult salmonids for genetic analysis
- Evaluate the Interim Flow Agreement
- To evaluate relationships to environmental conditions and potential limiting factors such as water temperature, flow, turbidity, physical barriers, and spawning gravel.

Lead Agency: U.S. Fish and Wildlife Service

Contact:
Matt Brown
U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 2002 - 2006

Previous Methods Used: none

COST

Funding Source(s): California Bay-Delta Authority (formerly CALFED)

Total Annual Cost: $53,000

Staffing:

Field: 0.8 FTE Fish Biologists

Funding End Date: November 2006

GEOGRAPHIC AREA

Reach Covered: Starting at the Mainstem of BC RM 2.8, 13.8 miles to confluence of the forks. NF 5.3 miles long, SF 2.5 miles long. Total of 21.6 miles.

Sampling Reaches:
R1) NF Eagle Canyon Dam to Wildcat Dam
R2) NF Wildcat dam to confluence
R3) SF Coleman Diversion Dam to confluence
R4) MS confluence of forks to Barn Beat
R5) MS Barn Beat to Spring Branch
R6) MS Spring Branch to CNFH Barrier Weir
R7) MS CNFH Barrier Weir to Lower Rotary Screw Trap

FIELD SAMPLING

Sampling Frequency: Twice a month (5 days to complete survey)

Sampling Period: November through April

Survey Transport: Vehicles to sites, inflatable kayaks

Sampling Parameters and Methods:

Physical:
Water Temperature – hand held thermometer and logger
Water clarity – turbidimeter
Flow – CFS
Weather – abundant rain

Biological:

1. Three crew members per reach, kayak downstream 3 abreast, on reaches that are too shallow to kayak, snorkel/walk is attempted.
2. Locate all redds, identify species, measure dimensions, depth, velocity, and substrate size of salmonid redds.
3. Take genetic samples from all salmonid carcasses and GPS location.

DATA ANALYSIS

Methods: Spawning population in graphic and tabular data presentation.

Results:

1. Spatial and temporal spawning distribution of steelhead
2. Summary of flow, water temperature, and water clarity.
3. Coded-wire tag data, including release and recovery data.
4. Redd size for steelhead (average and range).
5. Steelhead/rainbow trout escapement indices (redd counts).

DATA MANAGEMENT/STORAGE

Location: Red Bluff, Fish and Wildlife Office

Data Retrieval Contact: Matt Brown

Electronic Storage Format (Software): Lotus 1-2-3 / Excel / Word Perfect / PDF

REPORTING

Escapement Estimate: Annual Report to California Bay-Delta Authority (formerly CALFED)

Annual Report: Annual Report to California Bay-Delta Authority (formerly CALFED)

Other Reporting: Data files sent out on request; "Greensheets" for BCWG; Quarterly Reports.

REFERENCES

Alston, N. O., Newton, J. M., and Brown, M. R.. 2007. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2003 through November 2004. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M.R., and J.M. Newton. 2002. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from March through October 2001. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M.R., N.O. Alston, J.M. Newton. 2004. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from March through November 2002. Draft USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M. R., and N. O. Alston. 2007. Monitoring adult Chinook salmon, rainbow trout, and steelhead in Battle Creek, California, from November 2002 through November 2003. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

BUTTE CREEK
FALL AND SPRING-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Butte Creek

Target Species/run: Adult spring and fall-run Chinook salmon

Monitoring Method: Mark/recapture carcass surveys

Variables Measured:
1. Annual in-river escapement
2. Ocean/Inland contribution rates**,** age structure, and straying rates

Program Objectives:
1. Estimate spawner escapement of fall and spring-run Chinook
2. Estimate pre-spawning mortality of spring-run Chinook
2. Determine age at spawning
3. Determine contribution to, and impacts of ocean and sport harvest
4. Develop estimates of straying from and to other watersheds

Lead Agency: California Department of Fish & Game

Contact:
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Sacramento Valley Central Sierra Region
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Clint Garman
California Department of Fish & Game
Sacramento Valley Central Sierra Region
2545 Zanella Wy. Suite F
Chico, CA 95928
(530) 895-5110
cgarman@dfg.ca.gov

Program Duration: 1995-present; pre-project methodologies are described in the Appendices of the Spring-Run Status Review (DFG 1998)

Previous Methods Used: Snorkel surveys

COST

Funding Source(s): CALFED Ecosystem Restoration Program, AFRP, CDFG, PG&E

Total Annual Cost: $ 80,000

Staffing:

Field: 0.92 PY, Field Technician (based on 1500hrs)
0.30 PY, Biologist funded by grant
0.30 PY, Biologist, CDFG
0.20 PY, Associate Biologist, CDFG

Funding End Date: Funded by CALFED, AFRP, and CDFG through 2008

GEOGRAPHIC AREA

Reach Covered: Quartz Bowl to Western Canal Siphon

Sampling Reaches: Quartz Bowl to Western Canal

FIELD SAMPLING

Sampling Frequency: Weekly

Sampling Period: June 15 – December 31

Survey Transport: Foot/Swim

Sampling Parameters and Methods:

Physical: Water Temperature

Biological: Standard mark/recapture methodology. Each fresh carcass is measured to the nearest mm FL, sexed, tagged with a colored ribbon attached to the lower jaw using a hog ring, and returned to the water near the location where collected. In addition, tissue samples are taken from the first 10 fresh carcasses encountered. Clean scissors were used to cut a small piece of tissue from the caudal fin. Adipose fin-clipped carcasses are measured to the nearest mm FL, tissue sample collected, heads removed and placed into a zip-lock bag. Carcasses that are not tagged are chopped in half, removing them from being counted during future surveys. On each subsequent survey, carcasses are checked for jaw tags, with jaw-tagged carcasses recorded as "recovered".

DATA ANALYSIS

Methods: Escapement estimate using Schaefer model
Pre-spawn mortality carcass survey – Estimate mortality using Schaefer model

Results: Total annual escapement estimate – including an estimate of pre-spawning mortality
Spatial and temporal holding and spawning distribution
Length frequency and sex composition of spawning population
Recovery of coded-wire tag information

DATA MANAGEMENT/STORAGE

Location: California Department of Fish & Game-Chico office, IEP database, PFMC website

Data Retrieval Contact: Tracy McReynolds (see contact information above)

Electronic Storage Format (Software): Microsoft Excel and Microsoft Access

REPORTING

Escapement Estimate: Carcass estimate – Annually in November
Pre-spawn mortality estimate – Annually in September

Annual Report: April 15 – CALFED Bay Delta Authority

Other Reporting: Annual report to NOAA - Section 10 permit for take of an endangered species
Annual report to NOAA – 4d permit to sample threatened species
PG&E Pre-Spawn Mortality Report

REFERENCES

Hill, K.A., and J.D. Webber. 1999. Butte Creek Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Juvenile Outmigration and Life History, 1995-1998. Calif. Dept. of Fish & Game, Inland Fisheries Admin. Report No. 99-5, 1999. 46pp.

Ward, P.D. and T.R. McReynolds. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 1998-2000. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-2, 2004. 61pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2000-2001. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-3, 2004. 47pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2001-2002. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-4, 2004. 53pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2002-2003. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-5, 2004. 43pp.

Ward, P.D., T. R. McReynolds and C. E. Garman. 2004. Butte Creek Spring-Run Chinook Salmon, Oncorhynchus tshawytscha, Pre-spawn Mortality Evaluation 2003. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-5. 91 pp

BUTTE AND BIG CHICO CREEKS
SPRING-RUN CHINOOK AND STEELHEAD SNORKEL SURVEY

SUMMARY

Stream: Butte and Big Chico Creeks

Target Species/run: Adult spring-run Chinook salmon and steelhead

Monitoring Method: Snorkel survey

Variables Measured:
1. Annual in-river escapement
2. Ocean/Inland contribution rates**,** age structure, and straying rates

Program Objectives:
1. Estimate spawner escapement
2. Determine age at spawning
4. Determine contribution to, and impacts of ocean and sport harvest
4. Develop estimates of straying from and to other watersheds

Lead Agency: California Department of Fish & Game

Contact:
Tracy McReynolds
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Sacramento Valley Central Sierra Region
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Clint Garman
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Program Duration: 1995-present; pre-project methodologies are described in the Appendices of the Spring-Run Status Review (DFG 1998)

Previous Methods Used: Snorkel surveys, mark-recapture carcass surveys

COST

Funding Source(s): CALFED Ecosystem Restoration Program, AFRP, CDFG

Total Annual Cost: $ 10,000

Staffing:

Field: 0.02 PY, Field Technician (based on 1500hrs)
0.02 PY, Biologist funded by grant
0.02 PY, Biologist, CDFG
0.03 PY, Associate Biologist, CDFG

Funding End Date: Funded by CALFED, AFRP, and CDFG through 2008

GEOGRAPHIC AREA

Reach Covered: Quartz Bowl to Covered Bridge

Sampling Reaches: Quartz Bowl to Covered Bridge

FIELD SAMPLING

Sampling Frequency: Annually

Sampling Period: 4 days in July

Survey Transport: Foot/Swim

Sampling Parameters and Methods:

Physical: Water Temperature

Biological: The survey is conducted over four days each covering a discrete reach. Each pool is observed only once by each of four surveyors, with each of the four individual independent estimates recorded. Additionally, if subsequent analysis of the entire data set reveals significant outliers, such are excluded from the calculation of the population estimate. In such instances, the average for the pool only reflects the remaining recorded observations. The individual estimates are then averaged. The annual total escapement estimate is then calculated by summing the averages for all survey reaches.

DATA ANALYSIS

Methods: Escapement estimate by direct observation

Results: Total annual escapement estimate
Spatial holding distribution

DATA MANAGEMENT/STORAGE

Location: California Department of Fish & Game-Chico office, IEP database, PFMC website

Data Retrieval Contact: Tracy McReynolds (see contact information above)

Electronic Storage Format (Software): Microsoft Excel and Microsoft Access

REPORTING

Escapement Estimate: Annually in August

Annual Report: April 15 – CALFED Bay Delta Authority

Other Reporting: Annual report to NOAA - Section 10 permit for take of an endangered species
Annual report to NOAA – 4d permit to sample threatened species

REFERENCES

Hill, K.A., and J.D. Webber. 1999. Butte Creek Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Juvenile Outmigration and Life History, 1995-1998. Calif. Dept. of Fish & Game, Inland Fisheries Admin. Report No. 99-5, 1999. 46pp.

Ward, P.D. and T.R. McReynolds. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 1998-2000. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-2, 2004. 61pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2000-2001. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-3, 2004. 47pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2001-2002. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-4, 2004. 53pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2002-2003. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-5, 2004. 43pp.

Ward, P.D., T. R. McReynolds and C. E. Garman. 2004. Butte Creek Spring-Run Chinook Salmon, Oncorhynchus tshawytscha, Pre-spawn Mortality Evaluation 2003. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-5. 91 pp

YUBA RIVER
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Yuba River

Target Species/run: Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement (in-river)

Program Objectives:

- To estimate the in-river Chinook salmon spawning population each year in the lower Yuba River,
- To evaluate temporal and spatial spawning distribution, relationships to environmental conditions, and population characteristics (origin, length, age, sex composition, and spawning success) of the Chinook salmon spawning population in the lower Yuba River.

Lead Agency: California Department of Fish and Game

Contact: Duane Massa
California Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-2883

Program Duration: Mid 1950's – present.

Previous Methods Used: None.

COST

Funding Source: Department of Fish and Game

Total Cost: $50,000 (annual operations)

*It is anticipated that the cost of future (2010) escapement surveys can be reduced by approximately 50% due to the implementation of the Vaki River Watcher (ladder counts) at Daguerre Point Dam and development of comparisons between escapement survey and ladder counts.

Staffing: 0.3 PY Fishery Biologist
Field: 0.75 PY Scientific Aide

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: Mouth of Narrows Canyon to Simpson Lane Bridge.

Sampling Reaches:
1) Mouth of Narrows Canyon to Hwy 20 Bridge
2) Hwy 20 Bridge to Daguerre Point Dam.
3) Daguerre Point Dam to Simpson Lane Bridge

FIELD SAMPLING

Sampling Frequency: Weekly; reaches surveyed on three consecutive days.

Sampling Period: October 1 through December 22 (12 weeks)

Survey Transport: Boat

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (secchi disk)
Flow (California Data Exchange Center)

Biological:

1) Count and tag all fresh (clear-eyed) carcasses with color-coded hog ring in lower jaw.
2) Record sex and age class (adult or grilse) of fresh carcasses.
3) Return fresh carcasses to flowing water just upstream from where they were collected.
4) Count and record age class (adult or grilse) of non-fresh carcasses and chop with machete to remove from future surveys.
5) Record recovered tagged carcasses, age class (adult/grilse), week of tagging, and chop to remove from future surveys.
6) Remove head from adipose-clipped carcasses and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
7) Count carcasses with other marks/tags and record type of mark/tag.
8) Determine percent egg retention (spawning success of females).

DATA ANALYSIS

Methods: Escapement estimated using a Schaefer mark-recovery method (Schaefer, 1951) as modified by Taylor (1974).

Results:

1) Total annual escapement estimate of adults and grilse by reach.
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.
4) Summary of flow, water temperature, water clarity.
5) Coded-wire tag data, including release and recovery data.
6) Determine percent egg retention (spawning success of females)..

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
Sacramento Valley Central Sierra Region
1701 Nimbus Road
Rancho Cordova, CA 05670

Data Retrieval Contact: Duane Massa (see contact information above)

Electronic Storage Format (Software): Excel.

REPORTING

Escapement Estimate: January

Annual Report: April

Other Reporting: N/A

REFERENCES

DFG, 1991. Lower Yuba River Fisheries Management Plan. Department of Fish and Game. Stream Evaluation Report, Report No. 91-1. Ranch Cordova, CA.

Jones & Stokes Associates. 1992. 1991 fall-run Chinook salmon spawning escapement in the Yuba River. June. (JSA 91-219.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1994. 1992 fall-run Chinook salmon spawning escapement in the Yuba River. February. (JSA 91-219.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1995. 1993 and 1994 fall Chinook salmon spawning escapements in the Yuba River. February. (JSA 94-223.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1996. 1995 fall Chinook salmon spawning escapements in the Yuba River. July. (JSA 95-076.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1997. 1996 fall Chinook salmon spawning escapements in the Yuba River. July. (JSA 95-076.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1998. 1997 fall-run Chinook salmon spawning escapements in the Yuba River. June 12, 1998. (JSA 97-238.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1999. 1998 fall-run Chinook salmon spawning escapements in the Yuba River. March 23, 1999. (JSA 97-238.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 2000. 1999 fall-run Chinook salmon spawning escapements in the Yuba River. August 2000. (J&S 97-238.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 2001. 2000 fall-run Chinook salmon spawning escapements in the Yuba River. June 2001. (J&S 00-402.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 2002. 2001 fall-run Chinook salmon spawning escapements in the Yuba River. May 2002. (J&S 00-402.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 2003. 2002 fall-run Chinook salmon spawning escapements in the Yuba River. June 2003. (J&S 00-402.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

Nelson, J., K. Hill. 1994. Chinook Salmon Spawning Stoke Estimate, Yuba River 1994. File Report Department of Fish and Game , Rancho Cordova, CA.

Schaefer, M.B. 1951. Estimation of the size of animal populations by marking experiments. U.S. Fish and Wildlife Bulletin, 52, 52: 189-203.

Taylor, S.N. 1974. Kin (Chinook) salmon spawning stocks in California's Central Valley, 1973. California Department of Fish and Game, Anadromous Fisheries Administrative Report. No. 74-12. 32p.

YUBA RIVER
FALL, LATE-FALL, AND SPRING-RUN CHINOOK, STEELHEAD PASSAGE AT DAGUERRE POINT DAM

SUMMARY

Stream: Yuba River

Target Species/run: Fall, late-fall, spring-run Chinook, steelhead

Monitoring Method: Vaki River-Watcher System: Automated fish counters (infra-red image, digital photograph, individual enumeration), located in Daguerre Point Dam's two fish ladders.

Variable Measured: Continuous monitoring of adult salmonid passage through Daguerre Point Dam's two fish ladders.

Program Objectives:

- Continuous monitoring of adult salmonid passage through Daguerre Point Dam's two fish ladders.
- To evaluate temporal distribution, relationships to environmental conditions, and population characteristics (number, length, sex composition, age-class) of the spring-, fall-, and late fall-run Chinook salmon populations, as well as Central Valley steelhead trout, in the lower Yuba River above Daguerre Point Dam.
- Potentially replace approximately 2/3 of effort required to conduct annual escapement survey.
- Evaluate straying rates of non-native salmonids (adipose fin clipped Chinook salmon and Central Valley steelhead trout) into the lower Yuba River.

Lead Agency: California Department of Fish and Game

Contact: James Navicky
California Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-2926
jnavicky@dfg.ca.gov

Program Duration: 2003 – present

Previous Methods Used: Manual Ladder Traps.

COST

Funding Source: The Anadromous Fish Restoration Program (AFRP) has funded the project, with the Department of Fish and Game contributing 0.3 PY (Fishery Biologist) as in-kind cost share.

Total Cost: $ 40,000 – Temporary personnel, operating, equipment
$ 14,000 – Permanent personnel

Staffing: 0.3 PY (Fishery Biologist - Department of Fish and Game)
Field: 0.6 PY Scientific Aide

Funding End Date: Future funding unknown.

GEOGRAPHIC AREA

Reach Covered: Englebright Dam to Daguerre Point Dam (approximately 12 river miles).

Sampling Reaches Englebright Dam to Daguerre Point Dam (approximately 12 river miles).

FIELD SAMPLING

Sampling Frequency: Continuous

Sampling Period: Continuous

Survey Transport: 4x4 Truck

Sampling Parameters and Methods:

Physical: Temperature (Vaki River-Watcher)
Flow (California Data Exchange Center)

Biological:

1) Enumerate adult passage of spring-, fall-, and late fall-run Chinook salmon and Central Valley steelhead trout at Daguerre Point Dam's two fish ladders.
2) Record sex (during spawning season), age class (adult or grilse), and origin (adipose fin clipped vs. non-clipped) of Chinook salmon; as well as, origin (adipose fin clipped vs. non-clipped) of Central Valley steelhead trout.

DATA ANALYSIS

Methods: Evaluate infra-red images, digital photographs, and individual counts using the Vaki River-Watcher Access database.

Results:

1) Total annual passage of fall-, late fall- and spring-run Chinook salmon (adults and grilse) and steelhead ascending Daguerre Point Dam.
2) Temporal distribution.
3) Length/frequency and sex composition of spawning population.
4) Summary of flow, water temperature, water clarity.
5) Presence/absence of adipose fin.

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
Sacramento Valley – Central Sierra Region

Data Retrieval Contact: James Navicky (see contact information above)

Electronic Storage Format (Software): WinAri database (software provided by Vaki)

REPORTING

Escapement Estimate: February (preliminary) for annual recording period (March through February

Annual Report: June

Other Reporting: Quarterly

FEATHER RIVER
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Feather River

Target Species/run: Fall/Spring-run Chinook Salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement (in-river)
CWT recovery rate

Program Objectives:

- To estimate the in-river fall/spring run Chinook spawning population each year in the lower Feather River
- To evaluate temporal and spatial spawning distribution, relationships to environmental conditions, and population characteristics (origin, length, age, sex composition, and spawning success) of the fall/spring run Chinook spawning population in the lower Feather River.

Lead Agency: California Department of Water Resources

Contact: Alicia Seesholtz
Department of Water Resources
3251 S Street
Sacramento CA 95816
(916) 227-7539
aseeshol@water.ca.gov

Program Duration: 2000 – present (DFG ran the program up until 1999)

Previous Methods Used: Mostly carcass mark-recapture survey, but with substantially less effort and with no formalized sampling design

COST

Funding Source: CDWR

Total Cost: $300,000/year

Staffing:

Field: 3.5 PY (Scientific Aide)
0.75 PY (Fishery Biologist)

Funding End Date: None.

GEOGRAPHIC AREA

Reach Covered: Fish Barrier Dam to Gridley Bridge

Sampling Reaches: 16 mile river segment is stratified into approximately 50 individual riffle-pool sequences. Population estimates are generated separate for the low flow channel (Fish Barrier Dam to Thermalito Outlet) and for the high flow channel (Thermalito Outlet to Gridley Bridge)

FIELD SAMPLING

Sampling Frequency: Weekly; four consecutive days

Sampling Period: September 1st through December 15th (14 weeks)

Survey Transport: Two or more jet boats

Sampling Parameters and Methods:

Physical: Water clarity (categorical)
Weather (categorical)

Biological:

1) Count (chop) and tag all fresh (clear-eyed) carcasses with color-coded hog ring in upper jaw.
1. Record sex and age class (adult or grilse) of fresh carcasses.
2. Return fresh carcasses to flowing water in the vicinity where they were collected.
3. Count and record age class (adult or grilse) of non-fresh carcasses and chop with machete to remove from future surveys.
4. Record recovered tagged carcasses, age class (adult/grilse), week of tagging, and chop to remove from future surveys.
5. Collect otoliths from weekly random subsamples
6. Sex, measure standard length, examine for egg retention, sample for CWT from weekly representative subsample of fresh carcasses (up to 500 per week).
7. Remove head from adipose-clipped carcasses and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
8. Count carcasses with other marks/tags and record type of mark/tag.

DATA ANALYSIS

Methods: Escapement estimated with Schaefer model

Results:

1) Total annual escapement estimate of adults and grilse by reach.
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.
4) Spatial and temporal distribution of egg retention
5) Coded-wire tag data, including release and recovery data.

DATA MANAGEMENT/STORAGE

Location: California Department of Water Resources
Sacramento

Data Retrieval Contact: Alicia Seesholtz (see contact information above)
Electronic Storage Format (Software): Microsoft Access and Excel

REPORTING

Escapement Estimate: January (preliminary for PFMC)

Annual Report: Final report available by early fall

Other Reporting: N/A

AMERICAN RIVER
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: American River

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement (in-river)

Program Objectives:

- Estimate the in-river fall-run Chinook spawning population each year in the lower American River,
- Evaluate temporal and spatial spawning distribution, relationships to environmental conditions, and population characteristics (origin, length, age, sex composition, and spawning success) of the fall-run Chinook spawning population in the lower American River.
- Determine percent egg retention (spawning success of females).
- Recover coded-wire tagged heads from fresh carcasses.
- Collect scale samples from fresh carcasses for age determination.

Lead Agency: California Department of Fish and Game

Contact: Mike Healey
California Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-4334
mhealey@dfg.ca.gov

Program Duration: Mid 1950's – present.

Previous Methods Used: None.

COST

Funding Source: DFG, USBR, and Water Forum

Total Cost: $ 100,000
(Personnel, operating, equipment)

Staffing: 0.3 PY (Associate Fishery Biologist - DFG)
Field: 1.5 PY (PSMFC technician - crew leader)
1.6 PY (PSMFC fishery technicians)
2.0 PY (CDFG Scientific Aides)

Funding End Date: Annual funding.

GEOGRAPHIC AREA

Reach Covered: Nimbus Fish Weir (just below Nimbus Dam) toWatt Avenue Bridge

Sampling Reaches:

1) Nimbus Fish Weir to Elmanto Access (3.4 mi.)
2) Elmanto Access to Goethe Park Footbridge (3.5 mi.)
3) Goethe Park Footbridge to Watt Avenue Bridge (6.0 mi.)

FIELD SAMPLING

Sampling Frequency: Weekly; reaches surveyed on four consecutive days.

Sampling Period: October 15 through January 15 (15 weeks)

Survey Transport: Jet Boat

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (secchi disk)

Biological:

1) Count and tag all fresh (clear-eyed) carcasses with color-coded hog ring in lower jaw.
2) Record sex and age class (adult or grilse) of fresh carcasses.
3) Return fresh carcasses to flowing water just upstream from where they were collected.
4) Count and record age class (adult or grilse) of non-fresh carcasses and chop with machete to remove from future surveys.
5) Record recovered tagged carcasses, age class (adult/grilse), week of tagging, and chop to remove from future surveys.
6) Remove head from adipose-clipped carcasses and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
7) Count carcasses with other marks/tags and record type of mark/tag.
8) Determination of degree of egg retention.

DATA ANALYSIS

Methods: Escapement estimated using a Schaefer mark-recovery method (Schaefer, 1951) as modified by Taylor (1974).

Results:

1) Total annual escapement estimate of adults and grilse by reach.
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.
4) Summary of flow, water temperature, water clarity.
5) Coded-wire tag data, including release and recovery data.

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
Sacramento Valley Central Sierra Region
1701 Nimbus Road
Rancho Cordova, CA 05670

Data Retrieval Contact: Mike Healey (see contact information above)

Electronic Storage Format (Software): Excel

REPORTING

Escapement Estimate: January (preliminary for PFMC)

Annual Report: April

Other Reporting: N/A

REFERENCES

Healey, M.P. Lower American River Chinook salmon escapement survey, October 2003-January. Department of Fish and Game, Rancho Cordova, CA. File Memorandum, April 7, 2004.

Schaefer, M.B. 1951. Estimation of the size of animal populations by marking experiments. U.S. Fish and Wildlife Bulletin, 52, 52: 189-203.

Taylor, S.N. 1974. King (Chinook) salmon spawning stocks in California's Central Valley, 1973. California Department of Fish and Game, Anadromous Fisheries Administrative Report. No. 74-12. 32p.

AMERICAN RIVER
STEELHEAD REDD SURVEY

SUMMARY

Stream: American River

Target Species/run: Steelhead

Monitoring Method: Redd survey and live adult counts

Variable Measured: Number of in-river spawners, spawning distribution and timing, percent hatchery/wild spawners

Program Objectives:

Answer the following questions:

- How many steelhead spawn in the American River each year?
- How do flows affect steelhead spawning locations, timing, and egg to fry survival?
- What proportion of in-river spawning steelhead is of natural origin?

Lead Agency: US Bureau of Reclamation

Contact: John Hannon
US Bureau of Reclamation, MP-150
2800 Cottage Way
Sacramento, CA 95825
(916) 978-5524
jhannon@mp.usbr.gov

Program Duration: 2001 - present

Previous Methods Used: None

COST

Funding Source(s): US Bureau of Reclamation's Science and Technology Program

Total Annual Cost: $35,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field and reporting: 0.25 FTE (biologists)
0.2 FTE (technician)

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: Nimbus Dam to Paradise Beach (river mile 5 to 23)

Sampling Reaches: Data is collected and summarized spatially so can be aggregated into any reaches desired.

FIELD SAMPLING

Sampling Frequency: Every two weeks, river generally surveyed in two field days, protocol is still being refined

Sampling Period: December 20 through first week in April (2004 and 2005 extend through June on a trial basis)

Survey Transport: Jet boat, walking, and snorkeling

Sampling Parameters and Methods:

Physical: 1) water depth
2) water velocity (Global Water velocity meter)
3) dominant substrate (visually estimated in pot, on tailspill, and adjacent to redd),
4) redd dimensions (pot length, pot width, pot depth, tailspill length, tailspill widths)
5) redd location (differentially corrected GPS),
6) redd age,
7) water clarity (secchi disk)

Biological: 1) species making redd (steelhead, lamprey, Chinook, sucker, pikeminnow)
2) total fish length (visually estimated)
3) ad-clipped/unclipped
4) fungus or injury
5) fish holding on redd or not on redd
6) scales and tissue sample from any dead steelhead

DATA ANALYSIS

Methods: In-river spawners estimated using the area under the curve method and using redd counts, sex ratio, and number of redds per female. Distribution and habitat use analyzed in GIS.

Results:
1) In-river spawning escapement estimate with comparison of methods (redd count vs fish count (AUC))
2) Spatial and temporal spawning distribution
3) Estimated proportion of in-river spawners of hatchery origin
4) Effects of flow management on egg to fry survival and spawning locations
5) Physical characteristics of steelhead redds
6) Pacific lamprey peak redd count.

DATA MANAGEMENT/STORAGE

Location: US Bureau of Reclamation, mid-Pacific Regional Office, Sacramento

Data Retrieval Contact: John Hannon

Electronic Storage Format (Software): ESRI shapefile and Excel

REPORTING

Escapement Estimate: Preliminary estimate in May

Annual Report: September 30

Other Reporting: N/A

REFERENCES

Hannon, J. and B. Deason. 2004. American River steelhead (*Oncorhynchus mykiss*) spawning 2001 – 2004. US Bureau of Reclamation. Sacramento. 43 p.

Hannon, J., M. Healey, and B. Deason. 2003. American River steelhead (*Oncorhynchus mykiss*) spawning 2001 – 2003. US Bureau of Reclamation. Sacramento. 36 p.

Hannon, J., and M. Healey. 2002. American River steelhead redd surveys, 2001 – 2002. US Bureau of Reclamation. Sacramento. 19 p.

MOKELUMNE RIVER
FALL-RUN CHINOOK, STEELHEAD PASSAGE

SUMMARY

Stream: Mokelumne River

Target Species/run: Fall-run Chinook salmon; steelhead

Monitoring Method: Video monitoring; live trapping at Woodbridge Dam (carcass surveys on an experimental basis only); redd surveys

Variable Measured: Annual adult salmonid spawning escapement

Program Objectives:

- To monitor fish passage at the fish ladders at Woodbridge Irrigation District Dam
- To describe the relationship between fall run Chinook salmon, and steelhead, escapement attributes and environmental variables measured on the lower Mokelumne River
- To provide an annual escapement estimate for the lower MokelumneRiver
- To assess spawning distribution

Lead Agency: East Bay Municipal Utility District

Contact:

Michelle Workman
Fisheries Biologist II
East Bay Municipal Utility District
1 Winemasters Way Ste K
Lodi, CA. 95240
(209)365-1486
mworkman@ebmud.com

Program Duration: 1990 - Present

Previous Methods Used: Direct ladder counts, trap counts, carcass surveys

COST

Funding Source(s): East Bay Municipal Utility District

Total Annual Cost: Approximately $266,000 annually
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 1 PY Fisheries Biologist II; 4 PY Fisheries and Wildlife Technicians

Funding End Date: N/A

GEOGRAPHIC AREA

Reach Covered: All video/trap data collected at Woodbridge Irrigation District Dam (WIDD); redd surveys conducted from the Fish Guidance Fence below Camanche Dam downstream to the Elliott Road bridge in Lockeford, California.

Sampling Reaches: Single station (WIDD)

FIELD SAMPLING

Sampling Frequency: Video monitoring is 24 hours per day, 7 days per week, year-round. Trapping is 2-4 weeks in November with traps checked 2-6 times per day (based on abundance) 7 days per week. Redd surveys conducted weekly between September 1 and April 30, depending on timing of upstream migration of fall-run Chinook and steelhead.

Sampling Period: All year

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Temperature and Dissolved Oxygen (YSI 55 DO meter); Turbidity (Hach P2100 Turbidimeter); cloud cover, wind speed, precipitation

Biological: Record species, sex, fork length, presence or absence of adipose fin clip, hook scar, laceration, predator wound, fungal infection for each fish that passes upstream through the video monitoring station. Live-trapped fish are also assessed for these parameters. In redd surveys, redds are enumerated, marked and location recorded in a GIS database.

DATA ANALYSIS

Methods: Summarize data into daily, weekly, monthly totals sorted by sex and stage (adult v. grilse).

Results:

1. Total escapement estimate of adults and grilse
2. Run-timing
3. Weekly sex/age composition of run
4. Length frequency
5. Diurnal and Nocturnal passage summary

6. Comparison of river flow, temperature, turbidity, precipitation to run timing
7. % of run with hook scars, adclips, injuries and/or anomalies
8. Distribution of redds

DATA MANAGEMENT/STORAGE

Location: East Bay Municipal Utility District, Lodi, Ca.

Data Retrieval Contact: Michelle Workman (see contact information above)

Electronic Storage Format (Software): Oracle database with Access interface, GIS database (redd locations)

REPORTING

Escapement Estimate: Available February 1.

Annual Report: Covers Aug 1-July 31; Final product due Oct. 1 each year.

Other Reporting: N/A

REFERENCES

Marine, K.R. and D.A. Vogel. 2000. Monitoring of the upstream spawning migration of chinook salmon and steelhead during August 1999 through March 2000. The Mokelumne River Chinook Salmon and Steelhead Monitoring Program 1998-1999. Natural Resource Scientists, Inc. Red Bluff, California. 48pp. (plus appendices)

Workman, M.L. 2001. Lower Mokelumne River Upstream Fish Migration Monitoring conducted at Woodbridge Irrigation District Dam August 2000 through April 2001. Unpublished EBMUD report. Lodi Fisheries and Wildlife Division. 21pp + Appendix.

Workman, M.L. 2002. Lower Mokelumne River Upstream Fish Migration Monitoring conducted at Woodbridge Irrigation District Dam August 2001 through July 2002. Unpublished EBMUD report. Lodi Fisheries and Wildlife Division. 20pp + Appendix.

Workman, M.L. 2003. Lower Mokelumne River Upstream Fish Migration Monitoring conducted at Woodbridge Irrigation District Dam August 2002 through July 2003. Unpublished EBMUD report. Lodi Fisheries and Wildlife Division. 18pp + Appendix.

MOKELUMNE RIVER
FALL-RUN CHINOOK, STEELHEAD REDD SURVEY

SUMMARY

Stream: Mokelumne River

Target Species/run: Fall-run Chinook salmon; steelhead

Monitoring Method: Redd survey

Variable Measured: In-river spawner and redd counts, spawning distribution and timing

Program Objectives:

- Enumerate number of salmonid redds in lower Mokelumne River
- Asses use of spawning enhancement gravels
- Calculate percent of total escapement spawning in-river
- To assess spawning distribution (spatial and temporal)

Lead Agency: East Bay Municipal Utility District

Contact:

Jose Setka
Fisheries Biologist II
East Bay Municipal Utility District
500 San Pablo Dam Road
Orinda, CA 94563
(510) 287-2034
jsetka@ebmud.com

Program Duration: 1990 - Present

Previous Methods Used: carcass surveys

COST

Funding Source(s): East Bay Municipal Utility District

Total Annual Cost: $ 40,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 1 PY Fisheries Biologist II; 1 PY Fisheries and Wildlife Technicians; 1 intern

Funding End Date: N/A

GEOGRAPHIC AREA

Reach Covered: Camanche Dam to Elliott Road (approximately 10 miles)

Sampling Reaches: Camanche Dam to Mackville Road
Mackville Road to Elliott Road

FIELD SAMPLING

Sampling Frequency: Redd surveys conducted 1-2 per week between September 1 and April 30, depending on timing of upstream migration of fall-run Chinook and steelhead.

Sampling Period: September - March

Survey Transport: Canoe

Sampling Parameters and Methods:

Physical: Temperature, velocities, size, substrate, cover, redd location

Biological: Redd numbers, number of fish, species

DATA ANALYSIS

Methods: In-river spawners estimated using ladder and hatchery escapements, along with redd counts, sex ratio, and number of redds per female. Distribution and habitat use analyzed in GIS.

Results:

1) Number of redds.
2) Percentage of total escapement spawning within river.
3) Sex ratio and females per redd
4) Number of redds in enhancement gravels
5) Historic data on redd physical parameters (1990-1998)
6) Temporal and spatial distribution of redds

DATA MANAGEMENT/STORAGE

Location: East Bay Municipal Utility District, Orinda, CA

Data Retrieval Contact: Jose Setka (see contact information above)

Electronic Storage Format (Software): GIS database (ArcGIS)

REPORTING

Redd Count Estimate: Available April 1.

Annual Report: Covers September 1-March 31; Final product due August. 1 each year.

Other Reporting: N/A

REFERENCES

Hagar, J. 1991. Upstream migration and spawning of fall run chinook salmon in the Mokelumne River, 1990. EBMUD, Orinda, CA. pp. 21.

Hartwell, R. 1992. Upstream migration and spawning of fall run chinook salmon in the Mokelumne River, 1991. EBMUD, Orinda, CA pp. 22

---------- 1993. Upstream migration and spawning of fall run chinook salmon in the Mokelumne River, 1992. EBMUD, Orinda, CA pp. 22

---------- 1994. Upstream migration and spawning of fall run chinook salmon in the Mokelumne River, 1993. EBMUD, Orinda, CA pp. 31

---------- 1995. Upstream migration and spawning of fall run chinook salmon in the Mokelumne River, 1994. EBMUD, Orinda, CA pp. 19

---------- 1996. Upstream migration and spawning of fall run chinook salmon in the Mokelumne River, 1995. EBMUD, Orinda, CA pp. 28

Setka, J. 1997. 1996 Lower Mokelumne River chinook salmon (Oncorhynchus tshawytscha) spawning survey report. EBMUD Fisheries and Wildlife Division, Orinda CA. pp. 55.

----------. 1998. Lower Mokelumne River chinook salmon (*Oncorhynchus tshawytscha*) spawning survey report for Fall/Winter 1997. EBMUD Fisheries and Wildlife Division, Orinda CA. pp. 28.

----------. 2000. Fall-run chinook salmon and steelhead trout spawning survey, September 1999 through January 2000 Mokelumne River, California. EBMUD Fisheries and Wildlife Division, Orinda CA. pp. 27.

----------. 2001. Fall-run chinook salmon and steelhead trout spawning survey, September 2000 through March 2001 Mokelumne River, California. EBMUD Fisheries and Wildlife Division, Orinda CA. pp. 26.

Setka, J. and J. Bishop. 2003. Fall-run chinook salmon and steelhead trout spawning survey, September 2002 through March 2003 Mokelumne River, California. EBMUD Fisheries and Wildlife Division, Orinda CA. pp. 26.

STANISLAUS RIVER
FALL-RUN CHINOOK, STEELHEAD PASSAGE
(ALASKAN WEIR)

SUMMARY

Stream: Stanislaus River

Target Species/run: Fall-run Chinook Salmon / *O. mykiss*

Monitoring Method: Alaskan Weir and Vaki Infrared Scanner and Underwater Camera

Variable Measured: Annual adult escapement; run timing; biological characteristics

Program Objectives:

- Assess the effects of environmental variables on run timing and escapement.
- Enumerate adult escapement and compare to current methodology.

Lead Agency: United States Fish and Wildlife Service (USFWS)

Contact:

J.D. Wikert
Anadromous Fish Restoration Program
U.S. Fish & Wildlife Service
4001 N. Wilson Way, Stockton, CA 95205
(209) 946-6400, extension 307
Fax: 209-946-6355
Email: John_Wikert@fws.gov

Program Duration: August 1, 2002 - present

Previous Methods Used: CDFG Carcass Surveys (on-going)

COST

Funding Source(s): USFWS and CALFED

Total Annual Cost: $150,000
Weir cost $50,000
Vaki cost $40,000

Staffing:

Field:

4 PY (Fisheries Technicians)
1.6 PY (Fisheries Biologist)

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: Below Goodwin Dam to river mile 31.4 near the town of Riverbank, CA

Sampling Reaches: Weir is operated at river mile 31.4 just below Jacob Meyer's Park (Army Corps).

FIELD SAMPLING

Sampling Frequency:

Scanner and camera operation are continuous and trapping occurs under conditions stipulated by State permit.

Sampling Period: September 1 through April 30

Survey Transport:

None

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Turbidity (instantaneous)
Dissolved Oxygen (instantaneous)
Water Velocity (instantaneous)

Biological:

1. Identify and enumerate all species passing upstream or downstream though scanner and camera chute.
2. Evaluate sex and origin (hatchery versus wild).
3. Trap, identify and enumerate steelhead when turbidity is over 4 NTU.
4. Collect length, weight and scale samples from all trapped salmonids.
5. Visually assess proximal upstream and downstream species composition and density by snorkel survey.
6. Collect and analyze all *O. mykiss* carcasses found at site. Workup includes scale and otolith analysis.

DATA ANALYSIS

Methods: Various

Results:

1. Total annual escapement estimate
2. Summary of flow, water temperature, dissolved oxygen, and turbidity
3. Biological characteristics

DATA MANAGEMENT/STORAGE

Location: Cramer Fish Sciences, Oakdale, California
CDFG, Region IV, Fresno

Data Retrieval Contact: Jesse Anderson
Cramer Fish Sciences
636 Hedburg Way, Suite 22
Oakdale, CA 95361
(209) 847-7786
anderson@fishsciences.net

Electronic Storage Format (Software): Access database and Excel Spreadsheets

REPORTING

Escapement Estimate:

2003-2004 estimate - 4,829

2004-2005 Pending

Annual Report:

Demko, D., Simpson, M., Sonke, C. 2003. Use of a Portable Resistance Board Weir to Count and Characterize Runs of Anadromous Salmonids in the Stanislaus River. Interagency Ecological Program. Vol. 16 #4. pgs 40-43.

Other Reporting: Frequent activity summary and bi-weekly e-mail updates posted online and located at www.stansislausriver.com

STANISLAUS RIVER
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Stanislaus River

Target Species/run: Fall-run Chinook Salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement (in-river)

Program Objectives:

- To estimate the in-river fall-run Chinook spawning population each year in the lower Stanislaus River,
- To evaluate temporal and spatial spawning distribution, relationships to environmental conditions, and population characteristics (origin, length, age, sex composition, and spawning success) of the fall-run Chinook spawning population in the lower Stanislaus River.

Lead Agency: California Department of Fish and Game

Contact: Jason Guignard
California Department of Fish and Game
Stanislaus River Restoration Center
737 N. Old La Grange Road
La Grange, CA
(209) 853-2533
jguignard@dfg.ca.gov

Program Duration: 1953 – present

Previous Methods Used: None.

COST

Funding Source: CDFG, United States Bureau of Reclamation

Total Cost (Personnel, operating, equipment):

$ 70,000 (including overhead)

Staffing:

Field: 0.6 PY (Scientific Aide—2 @ 4 months each)
0.6 PY (Fishery Biologist)

Funding End Date: June 30, 2005

GEOGRAPHIC AREA

Reach Covered: Goodwin Dam to Riverbank

Sampling Reaches:
1) Goodwin Dam to Knight's Ferry
2) Knight's Ferry to Horseshoe Recreation Area
3) Horseshoe Recreation Area to Oakdale Recreation Area
4) Oakdale Recreation Area to Riverbank

FIELD SAMPLING

Sampling Frequency: Weekly; reaches surveyed on two consecutive days.

Sampling Period: October 1 through December 31 (12 weeks)

Survey Transport: Drift boat or skiff

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (secchi disk)

Biological:
1) Count, measure and tag all fresh (clear-eyed) and decayed (not fresh but body still intact) carcasses with number coded hog ring in lower jaw.
2) Record location, sex, decay status, age class (adult or grilse) of all tagged carcasses.
3) Return tagged carcasses to flowing water just upstream from where they were collected.
4) Count skeleton carcasses (body not intact) and chop with machete to remove from future surveys.
5) Record number for all recovered tagged carcasses, identify recovery location, and chop to remove from future surveys.
6) Collect otolith/scale/tissue samples, measure standard lengths from representative sample of fresh carcasses (approximately 30/week).
7) Remove head from adipose-clipped carcasses and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
8) Count carcasses with other marks/tags and record type of mark/tag.

DATA ANALYSIS

Methods: Escapement estimated with Schaefer and Jolly-Seber Models

Results:
1) Total annual escapement estimate of adults and grilse by reach.
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.
4) Summary of flow, water temperature, water clarity.
5) Coded-wire tag data, including release and recovery data.

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
La Grange

Data Retrieval Contact: Jason Guignard (see contact information above)

Electronic Storage Format (Software): Data maintained in an Access database

REPORTING

Escapement Estimate: January (preliminary for PFMC)

Annual Report: March 31 Report to USBR

Other Reporting: N/A

REFERENCES

Guignard, Jason. Annual Report, Fiscal Year 2003-2004. San Joaquin Drainage Chinook Salmon and Steelhead Habitat Restoration Program: Annual Adult Escapement in the San Joaquin River Tributaries. Sport Fish Restoration Act, Project F-51-R-6 Project No. 26, Job 2.

TUOLUMNE RIVER
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Tuolumne River

Target Species/run: Fall-run Chinook Salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement (in-river)

Program Objectives:

- To estimate the in-river fall-run Chinook spawning population each year in the lower Tuolumne River,
- To evaluate temporal and spatial spawning distribution, relationships to environmental conditions, and population characteristics (origin, length, age, sex composition, and spawning success) of the fall-run Chinook spawning population in the lower Tuolumne River.

Lead Agency: California Department of Fish and Game

Contact: Dennis Blakeman
California Department of Fish and Game
Tuolumne River Restoration Center
737 N. Old La Grange Road
La Grange, CA
(209) 853-2533
dblakeman@dfg.ca.gov

Program Duration: 1953 – present

Previous Methods Used: None.

COST

Funding Source: DFG, City & County of San Francisco, and Turlock/Modesto Irrigation Districts

Total Cost (Personnel, operating, equipment):

$ 70,000 (including overhead)

Staffing:

Field: 0.6 PY (Scientific Aide—2 @ 4 months each)
0.6 PY (Fishery Biologist)

Funding End Date: June 30, 2005

GEOGRAPHIC AREA

Reach Covered: La Grange to Fox Grove

Sampling Reaches:
1) La Grange to Basso Bridge
2) Basso Bridge to Turlock State Recreation Area
3) Turlock State Recreation Area to Fox Grove

FIELD SAMPLING

Sampling Frequency: Weekly; reaches surveyed on two consecutive days.

Sampling Period: October 1 through December 31 (12 weeks)

Survey Transport: Drift boat or skiff

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (secchi disk)

Biological:
1) Count, measure and tag all fresh (clear-eyed) and decayed (not fresh but body still intact) carcasses with number-coded hog ring in lower jaw.
2) Record location, sex, decay status, age class (adult or grilse) of all tagged carcasses.
3) Return tagged carcasses to flowing water just upstream from where they were collected.
4) Count skeleton carcasses (body not intact) and chop with machete to remove from future surveys.
5) Record number for all recovered tagged carcasses, identify recovery location, and chop to remove from future surveys.
6) Collect otolith/scale/tissue samples, measure standard lengths from representative sample of fresh carcasses (approximately 30/week).
7) Remove head from adipose-clipped carcasses and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
8) Count carcasses with other marks/tags and record type of mark/tag.

DATA ANALYSIS

Methods: Escapement estimated with Schaefer and Jolly-Seber Models

Results:
1) Total annual escapement estimate of adults and grilse by reach.
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.
4) Summary of flow, water temperature, water clarity.
5) Coded-wire tag data, including release and recovery data.

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
La Grange

Data Retrieval Contact: Dennis Blakeman (see contact information above)

Electronic Storage Format (Software): Data maintained in Access Data Base

REPORTING

Escapement Estimate: January (preliminary for PFMC)

Annual Report: March 31 FERC #2299 Annual Report

Other Reporting: N/A

REFERENCES

Blakeman, Dennis. Annual Report, Fiscal Year 2003-2004. San Joaquin Drainage Chinook Salmon and Steelhead Habitat Restoration Program: Annual Adult Escapement in the San Joaquin River Tributaries. Sport Fish Restoration Act, Project F-51-R-6 Project No. 26, Job 2.

MERCED RIVER
FALL-RUN CHINOOK CARCASS SURVEY

SUMMARY

Stream: Merced River

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Mark-recapture carcass survey

Variable Measured: Annual adult spawning escapement (in-river)

Program Objectives:

- To estimate the in-river fall-run Chinook spawning population each year in the lower Merced River,
- To evaluate temporal and spatial spawning distribution, relationships to environmental conditions, and population characteristics (origin, length, age, sex composition, and spawning success) of the fall-run Chinook spawning population in the lower Merced River.

Lead Agency: California Department of Fish and Game

Contact: Tim Heyne
California Department of Fish and Game
Merced River Restoration Center
737 N. Old La Grange Road
La Grange, CA
(209) 853-2533
theyne@dfg.ca.gov

Program Duration: 1953 – present

Previous Methods Used: None.

COST

Funding Source: Department of Fish and Game, Sportfish Restoration Act

Total Cost (Personnel, operating, equipment):

$ 70,000 (including overhead)

Staffing:

Field: 0.6 PY (Scientific Aide—2 @ 4 months each)
0.6 PY (Fishery Biologist)

Funding End Date: June 30, 2009

GEOGRAPHIC AREA

Reach Covered: Crocker-Huffman Dam to Santa Fe Road

Sampling Reaches:
1) Crocker-Huffman Dam to Snelling Road
2) Snelling Road to Highway 59
3) Highway 59 to Shaffer Bridge
4) Shaffer Bridge to Santa Fe Road

FIELD SAMPLING

Sampling Frequency: Weekly; reaches surveyed on two consecutive days.

Sampling Period: October 1 through December 31 (12weeks)

Survey Transport: Drift boat or skiff

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (secchi disk)

Biological:
1) Count, measure and tag all fresh (clear-eyed) and decayed (not fresh but body still intact) carcasses with number-coded hog ring in lower jaw.
2) Record location, sex, decay status, age class (adult or grilse) of all tagged carcasses.
3) Return tagged carcasses to flowing water just upstream from where they were collected.
4) Count skeleton carcasses (body not intact) and chop with machete to remove from future surveys.
5) Record number for all recovered tagged carcasses, identify recovery location, and chop to remove from future surveys.
6) Collect otolith/scale/tissue samples, measure standard lengths from representative sample of fresh carcasses (approximately 30/week).
7) Remove head from adipose-clipped carcasses and retain in individually labeled plastic bags for later detection, removal, and decoding of coded-wire tags.
8) Count carcasses with other marks/tags and record type of mark/tag.

DATA ANALYSIS

Methods: Escapement estimated with Schaefer and Jolly-Seber Models

Results:
1) Total annual escapement estimate of adults and grilse by reach.
2) Spatial and temporal spawning distribution.
3) Length/frequency and sex composition of spawning population.

4) Summary of flow, water temperature, water clarity.
5) Coded-wire tag data, including release and recovery data.

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
La Grange

Data Retrieval Contact: Tim Heyne (contact information above)

Electronic Storage Format (Software): Data maintained in Access Data Base

REPORTING

Escapement Estimate: January (preliminary for PFMC)

Annual Report: October 1 Annually

Other Reporting: N/A

REFERENCES

Johnson, Ken. Annual Report, Fiscal Year 2003-2004. San Joaquin Drainage Chinook Salmon and Steelhead Habitat Restoration Program: Annual Adult Escapement in the San Joaquin River Tributaries. Sport Fish Restoration Act, Project F-51-R-6 Project No. 26, Job 2

Section II

Central Valley Juvenile Salmonid Monitoring Programs

MAINSTEM SACRAMENTO RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAPS AT RED BLUFF DIVERSION DAM

SUMMARY

Stream: Mainstem Sacramento River at Red Bluff Diversion Dam

Target Species/run: Fall, winter, spring-run Chinook, steelhead

Monitoring Method: Four, eight foot diameter rotary-screw traps (RST)

Variable Measured: Abundance and outmigration timing
Juvenile Production Index (JPI) for winter-run

***Program Objectives*:** Estimate JPI's and compare/contrast to NOAA Fisheries JPE's using carcass survey and ladder count data

Lead Agency: U.S. Fish and Wildlife Service

Contact: Bill Poytress
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
bill_poytress@fws.gov

***Program Duration*:** July 1994 - July 2000 & October 2001 to present

Previous Methods Used: N/A

COST

Funding Source(s): California Bay-Delta Authority

Total Annual Cost: $750,000

Staffing:

Field: 1 FTE (GS-11 Supervisory Fishery Biologist, Field Supervisor)
1 FTE (GS-9 Supervisory Fishery Biologist, Data Management Specialist)
1 FTE (GS-7 Fishery Biologist, Data Management Assistant)
1 FTE (GS-7 Fishery Biologist, Crew Leader)
3 FTE (GS-5 Fishery Biologists, Field Crew)
3 FTE (GS-5 Biological Science Technicians, Field Crew)

Funding End Date: December 30, 2006

GEOGRAPHIC AREA

Reach Covered: N/A

Sampling Reaches: N/A

Sampling occurs at RBDD (RK391)

FIELD SAMPLING

Sampling Frequency: continuous, 24 h daily, seven days weekly

Sampling Period: year round

Survey Transport: multiple boats to access traps and for movement and deployment of traps

Sampling Parameters and Methods:

Physical:
water temperature (temp logger)
river depth (staff)
depth of cone submerged
water velocity (flow meter)
water turbidity (turbidimeter)
categorize debris type and volume

Biological:
enumerate and identify all fish
Measure fork length
Mark fish and release for trap efficiency modeling

DATA ANALYSIS

Methods: JPI's estimated using the trap efficiency method

Results:
Daily, weekly, monthly and annual JPI"s with C.I.
Spatial and temporal emigration pattern
Length frequency distributions
Life-history characteristics
Summaries of physical parameters (flow, temps, turbs and etc.)

DATA MANAGEMENT/STORAGE

Location: Red Bluff Fish and Wildlife Office, Red Bluff, CA

Data Retrieval Contact: Bill Poytress

Electronic Storage Format Microsoft Access

REPORTING

Escapement Estimate: JPI

Annual Report: June 30 (CALFED annually)

Other Reporting:

- Winter-run Chinook project work team meetings (updates on production)
- Data Assessment Team weekly conference call (provide passage estimates)
- Interagency Ecological Program (export data weekly for posting on website)
- Bi-weekly summaries of passage (interested parties)

REFERENCES

Gaines, P.D. and C.D. Martin. 2004. Feasibility of dual marking age-0 Chinook salmon for mark-recapture studies. North American Journal of Fisheries Management 24:1456-1459.

Gaines, P.D. and W.R. Poytress. 2003. Brood-year 2002 winter Chinook juvenile production indices with comparisons to adult escapement. Report of U.S. Fish and Wildlife Service to California Bay-Delta Authority, San Francisco, CA.

Gaines, P.D. and W.R. Poytress. 2004. Brood-year 2003 winter Chinook juvenile production indices with comparisons to adult escapement. U.S. Fish and Wildlife Service report to California Bay-Delta Authority. San Francisco, CA.

Gaines, P.D. and C.D. Martin. 2002. Abundance and seasonal, spatial and diel distribution patterns of juvenile salmonids passing the Red Bluff Diversion Dam, Sacramento River. Red Bluff Research Pumping Plant Report Series, Volume 14. U.S. Fish and Wildlife Service, Red Bluff, CA.

Martin, C.D., P. D. Gaines and R.R. Johnson. 2002. Estimating the abundance of Sacramento River juvenile winter chinook salmon with comparisons to adult escapement. Red Bluff Research Pumping Plant Report Series, Volume 5. U. S. Fish and Wildlife Service, Red Bluff, CA.

Poytress, W. R., M.J. Dragan and M.P. Gorman. 2006. Brood-year 2004 winter Chinook juvenile production indices with comparisons to juvenile production estimates derived from adult escapement. Report of U.S. Fish and Wildlife Service to California Bay-Delta Authority, San Francisco, CA.

MAINSTEM SACRAMENTO RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP AT GCID DIVERSION

SUMMARY

Stream: Upper Sacramento River

Target Species/run: All Chinook salmon runs, steelhead

Monitoring Method: One eight-foot diameter rotary screw trap

Variable Measured: Juvenile salmonid emigration

Program Objectives:

- Export daily monitoring data to the Interagency Ecological Program (IEP) Delta Operations Group for use in real-time management of Delta water project operations for the protection of winter and spring-run Chinook salmon. Used as a guide for restoration activities and operational decisions for state and federal export facilities and Environmental Water Account assets.
- Provide long-term juvenile salmonid emigration monitoring information to help identify onset of juvenile salmonid emigration, duration of migration, size(s) at migration, racial composition, relative abundance, and population trends.
- Supplement monitoring data from other out-migrant monitoring projects being conducted in the Sacramento River Basin.

Lead Agency: California Department of Fish and Game

Contact: Diane Coulon
California Department of Fish and Game
GCID Fish Screen Facility
P.O. Box 117
Hamilton City, CA 95951
(530) 865-9331

Program Duration: Variable monitoring conducted at this site since 1920's.
On-going, year-round monitoring with current gear consistent since 1991.

Previous Methods Used: Beach seine, fyke net

COST

Funding Sources: Department of Fish and Game
CalFed Bay-Delta Program

Total Annual Cost: $102,400

Staffing:

Field: 1.0 PY - Environmental Scientist
0.8 PY - Scientific Aide

Funding End Date: June, 2009

GEOGRAPHIC AREA

Reach Covered: Upper Sacramento River

Sampling Reaches: GCID fish screen facility bypass channel at River Mile 205.5

FIELD SAMPLING

Sampling Frequency: Every 24 hours

Sampling Period: Year-round continuous sampling

Survey Transport: Dodge Ram 1500 p/u

Sampling Parameters and Methods:

Physical: Optic Stowaway temp logger (Celsius)
LaMotte turbidity meter (NTU)
Global Water flow probe (fps)
Visual estimate of debris found in trap (light, medium, heavy)
Visual estimate of cloud cover (percent)

Biological:

1) One eight-foot rotary screw trap operated continuously year-round. Sampling conducted a minimum of once per day, more frequently if conditions warrant.
2) Fish netted from trap live-well and placed in buckets of river water.
3) A minimum of 50 individual salmonids from each race measured to the nearest mm fork length. Remaining salmon visually grouped as to race and counted. Salmon race determined by size-at-time criteria (DFG, Northern California-North Coast Region, unpublished data, see Johnson et al., 1992). All adipose-clipped or marked salmon recorded.
4) The first ten of each non-salmonid fish species measured to the nearest mm fork length and remainder counted. All species recorded.

DATA MANAGEMENT/STORAGE

Location: Department of Fish and Game GCID fish screen facility office
7854 County Road 204
Orland, CA 95963

Data Retrieval Contact: Diane Coulon
California Department of Fish and Game
P.O. Box 117
Hamilton City, CA 95951
(530) 865-9331
dcoulon@dfg.ca.gov

All data exported to the IEP server in Sacramento.

Electronic Storage Format (Software): Microsoft Access

REPORTING

Draft annual reports 2000 - 2004
Monthly reports 1996 to present

REFERENCES

CDFG. 1929. Division of Fish and Game, Department Natural Resources. Seining operations below Glenn-Colusa Irrigation District headgates. Report No. 106 Glenn Colusa Canal, August 1929. 13 pp.

Coulon, D.M. and Dixon, R. 2004. Monitoring of juvenile anadromous salmonid emigration in the Sacramento River near Hamilton City, California, July 2000 through June 2002. Draft Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report (unpublished). 21 pp.

Johnson, R.R., F.W. Fisher, and D.D. Weigand. 1992. Use of growth data to determine the spatial and temporal distribution of four runs of juvenile Chinook salmon in the Sacramento River, California. U.S. Fish and Wildlife Service, Report AFF-FRO-92-15, Red Bluff, CA.

CLEAR CREEK
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Clear Creek

Target Species/run: Winter, Spring, Fall, Late-fall Chinook Salmon and Steelhead.

Monitoring Method: Rotary Screw Trapping

Variable Measured: Annual juvenile population indices

Program Objectives:

This ongoing monitoring project has three primary objectives: 1) to determine an annual juvenile passage index (JPI) for Chinook salmon (*Oncorhynchus tshawytscha*) and rainbow trout/steelhead (*O. mykiss*), for inter-year comparisons; 2) obtain juvenile salmonid life history information including size, condition, emergence, and emigration timing, and potential factors limiting survival at various life stages; and 3) collect tissue samples from adult and juvenile salmonids for genetic and otolith analyses.

Lead Agency: United States Fish and Wildlife Service

Contact: Matt Brown
U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Service
10950 Tyler Road
Red Bluff, Ca. 96080
(530) 527-3043 xx 238
matt_brown@fws.gov

Program Duration: 1998 - Present

Previous Methods Used: Fyke net trapping by CDFG near the confluence of the Sacramento River 1982 – Nick Villa

COST

Funding Source(s): CVPIA 1998-2001 California Bay-Delta Authority (formerly CALFED) 2001- Present

Total Annual Cost: $283,388 for lower trap
$73,348 for upper trap

Staffing:

Field: 5 FTE's for lower trap and 1.5 FTE's for upper trap.

Funding End Date: June 2004 for upper trap and June 2005 for lower trap

GEOGRAPHIC AREA

Reach Covered: Whiskeytown Dam river mile (RM) 18.1 to lower Clear Creek Greenway RM 1.7

Sampling Reaches:

1) Lower Clear Creek (LCC) RM 1.7

2) Upper Clear Creek (UCC) RM 8.3

FIELD SAMPLING

Sampling Frequency: LCC trap sampled throughout the year, UCC trap sampled daily through June 2004

Sampling Period: LCC Annually; UCC October through June

Survey Transport: 4WD truck

Sampling Parameters and Methods:

Physical: Temperature recorded by electronic temp loggers
Water clarity measured using nephalometric turbidimeter

Biological:
1) Count and measure daily catch
2) Measure and assign run designation to Chinook salmon
3) Return live fish below sampling site
4) Collect genetic samples from Chinook salmon
5) Collect otolith samples from Steelhead trout
6) Conduct weekly mark and recapture trials to measure trap efficiencies

DATA ANALYSIS

Methods: Population indices measured by dividing daily catch by mark and recapture trial trap efficiencies

Results: 1) Annual passage index by run of Chinook salmon and steelhead trout
2) Fork length frequency and distribution
3) Summary of water temperature, flow and turbidity
4) Emigration timing
5) Mark and recapture weekly trial results
6) Genetic analysis results
7) Otolith analysis results

DATA MANAGEMENT/STORAGE

Location: U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
Red Bluff, California

BDAT monitoring website http://baydelta.ca.gov

Data Retrieval Contact: (see contact information above)

Electronic Storage Format (Software): Microsoft Access Database format

REPORTING

Annual Report: June 30 to California Bay-Delta Authority (formerly CALFED)
CBDA – Quarterly reports

Other Reporting: N/A

REFERENCES

Brown, M.R., and J.T. Earley. 2004. Juvenile salmonid monitoring in Clear Creek, California, from July 2002 to July 2003. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Gaines, P.D, R.E. Null, and M.R. Brown. 2003. Estimating the abundance of Clear Creek juvenile Chinook salmon and steelhead trout by the use of rotary screw trap. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California. Progress Report (Vol. 1) February 2003.

Greenwald, G.M., J.T. Earley, and M.R. Brown. 2003. Juvenile salmonid monitoring in Clear Creek, California, from July 2001 to July 2002. USFWS Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

CLEAR CREEK
JUVENILE CHINOOK SALMON
SNORKEL SURVEY

SUMMARY

Stream: Clear Creek

Target Species/run: Juvenile Chinook salmon

Monitoring Method: Direct snorkel observations

Variable Measured: Densities of juvenile Chinook

Program Objectives:

- To evaluate the benefit of a large-scale stream channel restoration project on the quality and quantity of juvenile Chinook habitat.

Lead Agency: US Fish and Wildlife Service

Contact:
Matt Brown
US Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043
matt_brown@fws.gov

Program Duration: 1999, 2000, 2003, 2005

Previous Methods Used: None.

COST

Funding Source: CVPIA

Total Cost: $80,000
(Personnel, operating, equipment)

Staffing:
Field: 2 (Fishery Biologists)

Funding End Date: Need funding for future monitoring.

GEOGRAPHIC AREA

Reach Covered: Clear Creek Stream Channel Restoration Project reach and vicinity (river mile 4.5-1.7).

Sampling Reaches: Three sub-reaches: 1) the newly constructed stream channel, upstream control reach, and downstream control reach.

FIELD SAMPLING

Sampling Frequency: Weekly

Sampling Period: February through April

Survey Transport: Dry suit

Sampling Parameters and Methods:

Biological:

Density of juvenile Chinook in shoreline areas, backwaters, and side channels.

DATA ANALYSIS

Methods: Graphic and tabular data presentation and standard statistical tests.

Results: Average juvenile Chinook densities (by week) within the restored stream channel compared to upstream and downstream control reaches.

DATA MANAGEMENT/STORAGE

Location: Red Bluff Fish and Wildlife Office
Red Bluff

Data Retrieval Contact: Matt Brown (see contact information above)

Electronic Storage Format (Software): Excel

REPORTING

Annual summaries: September 30th of the following year.

Other Reporting: N/A

BATTLE CREEK
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Battle Creek

Target Species/run: Winter, Spring, Fall, Late-fall Chinook Salmon and Steelhead Trout

Monitoring Method: Rotary Screw Trap

Variable Measured: Annual juvenile population indices

Program Objectives:

This ongoing monitoring project has three primary objectives: 1) to determine an annual juvenile passage index (JPI) for Chinook salmon (*Oncorhynchus tshawytscha*) and rainbow trout/steelhead (*O. mykiss*), for inter-year comparisons; 2) obtain juvenile salmonid life history information including size, condition, emergence, and emigration timing, and potential factors limiting survival at various life stages; and 3) collect tissue samples from adult and juvenile salmonids for genetic and otolith analyses.

Lead Agency: United States Fish and Wildlife Service

Contact: Matt Brown
U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Service
10950 Tyler Road
Red Bluff, Ca. 96080
(530) 527-3043 xx 238
matt_brown@fws.gov

Program Duration: 1998 - Present

Previous Methods Used: None

COST

Funding Source(s): CVPIA 1998-2001 California Bay-Delta Authority (formerly CALFED) 2001- Present

Total Annual Cost: $343,522 (1998-2006, two traps), $134,903 (2007-present, one trap)

Staffing:

Field: 4 FTE's (Biologist)

Funding End Date: June 2006

GEOGRAPHIC AREA

Reach Covered: Eagle Canyon Dam river mile (RM) 5.25 on the North Fork Battle Creek and Coleman Dam RM 2.54 on the South Fork Battle Creek to the confluence RM 16.61 down to upper Battle Creek RST RM 5.9 and Lower Battle Creek RST RM 2.8.

Sampling Reaches:

1) Lower Battle Creek (LBC) RM 2.8 (1998-2006)

2) Upper Battle Creek (UBC) RM 5.9 (1998-present)

FIELD SAMPLING

Sampling Frequency: Traps sampled daily

Sampling Period: Traps sampled all year round

Survey Transport: 4WD truck

Sampling Parameters and Methods:

Physical: Temperature recorded by electronic temp loggers
Water clarity measured using nephalometric turbidimeter

Biological:
1) Count and measure daily catch
2) Measure and assign run designation to Chinook salmon
3) Return live fish below sampling site
4) Collect genetic samples from Chinook salmon
5) Collect otolith samples from Steelhead trout
6) Conduct weekly mark and recapture trials to measure trap efficiencies

DATA ANALYSIS

Methods: Population indices measured by dividing daily catch by mark and recapture trial trap efficiencies

Results:
1) Annual passage index by run of Chinook salmon ant steelhead trout
2) Fork length frequency and distribution
3) Summary of water temperature, flow and turbidity
4) Emigration timing
5) Mark and recapture weekly trial results
6) Genetic analysis results
7) Otolith analysis results

DATA MANAGEMENT/STORAGE

Location: U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
Red Bluff, California

BDAT monitoring website http://baydelta.ca.gov

Data Retrieval Contact: (see contact information above)

Electronic Storage Format (Software): Microsoft Access Database format

REPORTING

Annual Report: June 30 to California Bay-Delta Authority (formerly CALFED)
Greensheet reporting quarterly to Battle Creek Working Group
CBDA – Quarterly reports

REFERENCES

Brown, M. R. and J. T. Earley. 2003. Juvenile salmonid monitoring in Battle Creek, California, from July 2001 to July 2002. USFWS Data Draft Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Brown, M. R. and J. T. Earley. 2004. Juvenile salmonid monitoring in Battle Creek, California, from July 2002 to July 2003. USFWS Data Draft Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

Whitton, K. S., J. M. Newton, D. J. Colby and M. R. Brown. 2006. Juvenile salmonid monitoring in Battle Creek, California, from September 1998 to February 2001. USFWS Data Summary Report. U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, Red Bluff, California.

DEER AND MILL CREEKS
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Mill and Deer Creeks

Target Species/run: Spring and fall-run Chinook salmon, steelhead

Monitoring Method: Rotary screw trapping

Variable Measured: Emergence timing, size at emigration, emigration timing.

Program Objectives: Monitor emigration timing as well as size, growth and relative abundance

Lead Agency: CA Dept Fish and Game

Contact: Colleen Harvey Arrison
California Dept. Fish and Game
P.O. Box 578
Red Bluff, CA 96080
(530) 527-9490
charvey@dfg.ca.gov

Program Duration: 1994-present

Previous Methods Used: Juvenile emergence and rearing: electrofishing and seining—discontinued in 2002 due to personnel cuts.
Juvenile outmigration: incline plane trap, incomplete counts.

COST

Funding Source(s): DWR/USBR Operations, DFG

Total Annual Cost: $ 100,000
(Permanent and temporary personnel, operating, equipment)

Staffing:
Field: 0.4 PY Associate Fishery Biologist
1.0 PY Fishery Technicians (Temporary)
0.3 PY DFG Fishery Technician (Permanent)

Funding End Date: ongoing

GEOGRAPHIC AREA

Reach Covered: Shasta and Tehama Counties, Mill and Deer Creeks

Sampling Reaches: Mill Creek: Lassen National Park Boundary to upper diversion dam.
Deer Creek: Upper Deer Creek falls to upper diversion dam.

FIELD SAMPLING

Sampling Frequency: Juvenile outmigration: daily
Water flow and temperature monitoring: hourly

Sampling Period: Juvenile outmigration: October thru May
Flow and temperature: continuous

Survey Transport: 4WD vehicle, foot

Sampling Parameters and Methods:

Physical: Water temperature: thermograph recording at 1 hour intervals.
Water clarity: daily turbidimeter readings
Water flow: USGS and DWR telemetered gages, summarized into daily means.

Biological: Fish size, growth and relative abundance, emigration timing.

DATA ANALYSIS

Methods: Summarize counts, life stage and length distribution of juvenile outmigrants on a bimonthly basis.

Results: Juvenile salmon:
a) length frequency analysis and condition factors
b) relative abundance by time period and life stage
c) estimated emergence timing using water temperature records at a range of elevations.

DATA MANAGEMENT/STORAGE

Location: Dept. Fish and Game, Red Bluff field office

Data Retrieval Contact: Colleen Harvey Arrison

Electronic Storage Format (Software): Access database, Excel spreadsheet

REPORTING

Annual Report: Sport Fish Restoration Act Annual Reporting

Other Reporting: Biennial Reports to the Fish and Game Commission
Biweekly reporting of juvenile screw trap catches to IEP's Juvenile Chinook Salmon Protection Process, CALFED DAT Team.

REFERENCES

California Department of Fish and Game (CDFG). 2004. Spring-run Chinook salmon 2002-2003 Biennial Report for the Fish and Game Commission.

California Department of Fish and Game (CDFG). 2001. Spring-run Chinook salmon annual report for the Fish and Game Commission.

California Department of Fish and Game (CDFG). 2000. Spring-run Chinook salmon annual report for the Fish and Game Commission.

California Department of Fish and Game (CDFG). 1998. Report to the Fish and Game Commission: A status review of the spring-run Chinook salmon (*Oncorhynchus Tshawytscha)* in the Sacramento River Drainage.

Harvey-Arrison, C. 2003. Spring-run Chinook Salmon (*Oncorhynchus Tshawtscha)* Life History Investigations in Mill and Deer Creeks, Tehama County for the 1999 Brood Year. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-15, Project No. 18, Job 2.

Harvey-Arrison, C. 2001. Spring-run Chinook Salmon (*Oncorhynchus Tshawtscha)* Life History Investigations in Mill and Deer Creeks, Tehama County for the 1998 Brood Year. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-13, Project No. 18, Job 2.

Harvey-Arrison, C. 1999. Juvenile Spring-run Chinook Salmon Emergence, Rearing and Outmigration Patterns in Deer and Mill Creeks, Tehama County, for the 1997 Brood Year. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-11, Project No. 18, Job 2.

Harvey, C. 1998. Juvenile Spring-Run Chinook Salmon Evergence, Rearing and Outmigration Patterns in Deer and Mill Creeks, Tehama County, for the 1996 Brood Year. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-10, Project No. 35, Job 2.

Harvey, C. 1997. Juvenile Spring-run Chinook Salmon Emergence, Rearing and Outmigration Patterns in Deer and Mill Creeks, Tehama County, for the 1995 Brood Year. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-9, Project # 35, Job 2.

Harvey, C. 1996. Juvenile Spring-Run Chinook Salmon Emergence, Rearing and Outmigration Patterns in Deer and Mill Creeks, Tehama County, for the 1994 Brood Year. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-8, Project # 35, Job 2.

Harvey, C. 1995. Juvenile Spring-run Chinook Salmon Emergence, Rearing and Outmigration Patterns in Deer Creek and Mill Creek, Tehama County for the 1993 Broodyear. Sport Fish Restoration Act Annual Progress Report for Project F-51-R-7, Project No. 35, Job 2.

STONY CREEK
JUVENILE CHINOOK SALMON AND STEELHEAD
BEACH SEINE/FYKE NET

SUMMARY

Stream: Stony Creek, Glenn County, CA.

Target Species/run: All races of Chinook salmon and Steelhead
Endemic and introduced fish species

Monitoring Method: Beach seine and fyke nets

Variable Measured: Presence and absence of special status anadromous fish.

Program Objectives:

Lead Agency: U.S. Bureau of Reclamation

Contact: Richard Corwin
U.S. Bureau of Reclamation
Red Bluff Division
P. O. Box 159
Red Bluff, CA
(530) 528-0512
rcorwin@mp.usbr.gov

Program Duration: 2001- present

Previous Methods Used: None

COST

Funding Source(s): U.S. Bureau of Reclamation

Total Annual Cost:
$ 150,000 annually

Staffing:
Field: 1 PY (Biological Technician)
1 PY (Fisheries Biologist)

Funding End Date: N/A

GEOGRAPHIC AREA

Reach Covered: Stream mile 14.0 (just upstream and downstream of the Constant Head Orifice)
Stream mile 19.5 (North Canal)

Sampling Reaches: 1) Entrance to the Constant Head Orifice (CHO) of the Tehama Colusa Canal
2) North Canal

FIELD SAMPLING

Sampling Frequency: Daily, from April 1st to May 15th at the CHO.
Daily, once diversion starts in March or April until June 15th at the North Canal.

Sampling Period: March through June

Survey Transport: Trucks

Sampling Parameters and Methods:

Physical: Temperature (grab and thermogragh)
Turbidity
Dissolved oxygen
Stream discharge

Biological:

1) Measure fork length and weight

DATA ANALYSIS

Methods: Summary statistics

Results:

1) Relative abundance at sampling sites.
2) Size-Frequency distributions.
3) Length distributions.
4) Number of introduced species.
5) Summary of flow, water temperature, conductivity, dissolved oxygen, turbidity.

DATA MANAGEMENT/STORAGE

Location: U.S. Bureau of Reclamation
Red Bluff Division

Data Retrieval Contact: Richard Corwin (see contact information above)

Electronic Storage Format (Software): Microsoft Access
Microsoft Excel

REPORTING

Annual Report: Annual reports submitted to NOAA Fisheries, U.S. Fish and Wildlife Service, California Department of Fish and Game, California Department of Water Resources, and other interested parties.

Final Report: N/A

Other Reporting: N/A

REFERENCES

U. S. Bureau of Reclamation. 2003. Barrier Analysis for the Northside Diversion Dam, Stony Creek, Glenn County, California. Mid-Pacific Region, Northern California Area Office, California. December.

U. S. Bureau of Reclamation. 1998. Lower Stony Creek Fish, Wildlife, and Water use Management Plan. Mid-Pacific Region, Northern California Area Office, California. November.

BUTTE CREEK
SPRING AND FALL-RUN CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Butte Creek

Target Species/run: Juvenile Spring and Fall-run Chinook Salmon, Steelhead

Monitoring Method: 1. Rotary screwtrap
2. Coded-wire tagging/marking program

Variable Measured: 1. Relative juvenile abundance and collection for coded-wire tagging.
2. Ocean/inland contribution rates**,** age structure, and straying rates

Program Objectives:

- Identify and monitor time of alevin emergence, monitor and document juvenile size at emigration
- Develop a measure of juvenile relative abundance
- Document rearing and emigration patterns
- Determine contribution to and impacts of ocean and sport harvest
- Develop estimates of straying from and to other watersheds

Lead Agency: California Department of Fish & Game

Contact:

Tracy McReynolds
California Department of Fish & Game
Sacramento Valley Central Sierra Region
2545 Zanella Wy. Suite F
Chico, CA 95928
(530) 895-5111
tmcreynolds@dfg.ca.gov

Clint Garman
California Department of Fish & Game
Sacramento Valley Central Sierra Region
2545 Zanella Wy. Suite F
Chico, CA 95928
(530) 895-5110
cgarman@dfg.ca.gov

Program Duration: 1995-present.

Previous Methods Used: Pre-project methodologies are described in the Appendices of the Spring-Run Status Review (DFG 1998).

COST

Funding Source(s): CALFED, AFRP, CDFG

Total Annual Cost: $ 315,387 (All funding sources)

Staffing:

Field: 1.95 PY, Field Technician (based on 1500hrs)
0.72 PY, Biologist funded by grant
0.78 PY, Biologist, CDFG
0.74 PY, Associate Biologist, CDFG

Funding End Date: Funded by CALFED, AFRP, and CDFG

GEOGRAPHIC AREA

Reach Covered: Quartz Bowl to Sutter Bypass (Sacramento Slough)

Sampling Reaches: Parrot-Phelan Dam, Sutter Bypass

FIELD SAMPLING

Sampling Frequency: Daily

Sampling Period: January 1 – March 30

Survey Transport: Automobile

Sampling Parameters and Methods:

Physical: Temperature, turbidity, velocity

Biological: All fish are netted from the trap live-boxes. The first 10 of each non-salmonid species are identified to species, measured to the nearest mm FL, and released. The remainder are counted and released. A random sub-sample of 50 YOY salmon juveniles is placed into a bucket containing a weak, standardized solution of MS-222 and anaesthetized. All yearling salmon are selected and measured. Yearlings are not part of the sub-sample. Upon immobilization, juveniles are individually measured to the nearest mm fork length (FL). Thirty salmon of this group that measured greater than 40mm are then transferred to a wetted container on an Ohaus electronic scale and individually weighed. After full

recovery, all salmon are released downstream of the trap or they are placed in holding pens for subsequent tagging with a CWT.

Fish are tagged using a Northwest Marine Technology Injector Model MKIV. Fish are anaesthetized in MS-222, adipose fin-clipped, tagged with a half-length (0.5 mm) tag in the rostrum and placed through the QCD. Any mis-tagged rejected fish were re-tagged. All but a group of 100 tagged fish are recovered in fresh water and released. The remaining fish are held for 24 hours and re-run through the QCD to obtain a 24-hour tag shedding rate and then released.

DATA ANALYSIS

Methods:

1. Relative abundance estimate determined by rotary screwtrap totals
2. Direct count of the total number of CWT released

Results: 1. Relative abundance of juvenile spring-run
2. Annual release group size

DATA MANAGEMENT/STORAGE

Location: California Department of Fish & Game-Chico Office, IEP database, PSMFC database.

Data Retrieval Contact: Tracy McReynolds or Clint Garman (see Contact Information above)

Electronic Storage Format (Software): Microsoft Excel and Microsoft Access

REPORTING

Annual Report: April 15 – CALFED Bay Delta Authority

Other Reporting: Annual report to NOAA - Section 10 permit for take of an endangered species

REFERENCES

Hill, K.A., and J.D. Webber. 1999. Butte Creek Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Juvenile Outmigration and Life History, 1995-1998. Calif. Dept. of Fish & Game, Inland Fisheries Admin. Report No. 99-5, 1999. 46pp.

Ward, P.D. and T.R. McReynolds. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 1998-2000. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-2, 2004. 61pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2000-2001. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-3, 2004. 47pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2001-2002. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-4, 2004. 53pp.

Ward, P.D., T.R. McReynolds, and C.E. Garman. 2004. Butte Creek and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation, 2002-2003. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-5, 2004. 43pp.

Ward, P.D., T. R. McReynolds and C. E. Garman. 2004. Butte Creek Spring-Run Chinook Salmon, Oncorhynchus tshawytscha, Pre-spawn Mortality Evaluation 2003. Calif. Dept. of Fish and Game, Inland Fisheries Admin. Report No. 2004-5. 91 pp

LOWER SACRAMENTO RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP AT KNIGHTS LANDING

SUMMARY

Stream: Sacramento River at Knights Landing

Target Species/run: Spring, fall, late-fall, and winter-run Chinook salmon; steelhead.

Monitoring Method: Rotary screw trap

Variable Measured: Annual juvenile salmonid emigration (catch per unit effort)

Program Objectives:

- To estimate juvenile salmonid emigration each year in the lower Sacramento River,
- To evaluate temporal distribution, relationships to environmental conditions, and population characteristics (length, age, health, and smolting index) of juvenile salmonids (spring-, fall-, late fall-, and winter-run Chinook salmon, Central Valley steelhead trout) in the lower Sacramento River.
- Utilize information gained to adaptively manage water operations in the lower Sacramento River.

Lead Agency: California Department of Fish and Game

Contact: Joe Johnson or Robert Vincik
California Department of Fish and Game
Sacramento Valley-Central Sierra Region
Lower Sacramento River Juvenile Salmonid Emigration Program
8175 Alpine Avenue Suite F
Sacramento CA 95826
(916) 227-4553 jrjohnson@dfg.ca.gov (Joe)
(916) 227-6842 rvincik@dfg.ca.gov (Robert)

Program Duration: On-going.

Previous Methods Used: RST, fyke netting.

COST

Funding Source: Interagency Ecological Program (IEP), DFG

Total Cost: $ 110,000
(Personnel, operating, equipment)

Staffing: 0.8 PY (Environmental Scientist – range B)
2.5 PY (Temporary Technician)

Funding End Date: On-going.

GEOGRAPHIC AREA

Reach Covered: Lower Sacramento River at Knights Landing

Sampling Reaches: 8.5 miles downstream of the town of Knights Landing

FIELD SAMPLING

Sampling Frequency: Continuous, traps checked daily or twice daily

Sampling Period: October 1 through June 30

Survey Transport: Pick-up Truck, Pontoon boat

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (turbidity meter)
Water velocity (meter)
Flow (California Data Exchange Center)

Biological:

1) Estimate/enumerate the passage of juvenile salmonids (by species and run) at Knights Landing utilizing two 8' rotary screw traps and trap efficiency tests (mark-recovery methods).
2) Measure and record length (nearest millimeter) and weight (nearest 0.1 gram) of juvenile salmonids.
3) Evaluate the health of juvenile salmonids (weight vs. length relationship).
4) Evaluate the smolting index (life history) of juvenile salmonids.

DATA ANALYSIS

Methods: Passage estimated using a mark-recovery method (Roper, 2000; Martin 2001)

Results:

1) Outmigration (passage) estimate of juvenile salmonids by species
2) and run.
3) Temporal outmigration distribution of juvenile salmonids by species and run.
4) Length/frequency of juvenile salmonid populations.
5) Relative health of juvenile salmonids by species and run.
6) Smolting index (life history) of juvenile salmonids.
7) Summary of flow, water temperature, water clarity.

DATA MANAGEMENT/STORAGE

Location:

California Department of Fish and Game
Sacramento Valley-Central Sierra Region
8175 F Alpine Avenue
Sacramento, CA 95826

Data Retrieval Contact: Robert Vincik (see contact information above)

Electronic Storage Format (Software): Excel spreadsheets and Access database, StatGraphics analysis.

REPORTING

Passage Estimate: July (draft)

Annual Report: December. Technical Report from the Lower Sacramento River Juvenile Salmonid Emigration Program (North Central Region)

Other Reporting: N/A

REFERENCES

Martin, C.D., P.D. Gaines and R.R. Johnson. 2001. Estimating the abundance of Sacramento River juvenile winter Chinook salmon with comparisons to adult escapement. Red Bluff Research Pumping Plant Report Series, Volume 5. U.S. Fish and Wildlife Service, Red Bluff, CA.

Roper, B.B, and D.L. Scarnecchia 2000. Key Strategies for Estimating Population Sizes of Emigrating Salmon Smolts with a Single Trap. Department of Fish and Wildlife Resources, University of Idaho.

Snider, B. and R.G. Titus. 2000. Timing, composition, and abundance of juvenile anadromous salmonid emigration in the Sacramento River near Knights Landing, October 1998 – September 1999. California Department of Fish and Game, Native Anadromous Fish and Watershed Branch. Stream Evaluation Program Technical Report No. 00-6. December 2000.

SACRAMENTO-SAN JOAQUIN DELTA
JUVENILE CHINOOK SALMON
KODIAK AND MIDWATER TRAWL AT SACRAMENTO

SUMMARY

Stream: Mainstem Sacramento River

Target Species/run: Spring-, Fall-, late Fall-, and winter-run Chinook salmon

Monitoring Method: Mid-water trawl; Kodiak trawl

Variable Measured: Abundance and length of juvenile Chinook salmon

Program Objectives:

1. To monitor long-term abundance and distribution of all races of juvenile chinook salmon entering the Delta from upstream.
2. To create an index of relative abundance of all races of juvenile chinook salmon entering the Delta from upstream.
3. To monitor the abundance of juvenile chinook salmon for use in decisions regarding operations of the Delta Cross Channel (DCC) gates and water export levels.
4. To monitor long-term abundance and distribution of special status species, sport fish, native and non-native fish.
5. Special 24 hour efficiency trawls after Feather River hatchery releases.

Lead Agency: U.S. Fish and Wildlife Service

Contact: Paul Cadrett
Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205
(209) 946-6400 x312

Program Duration: 1976 to present (no data 1982-1987)

Previous Methods Used: none

COST

Funding Source(s): Interagency Ecological Program (IEP)

Total Annual Cost: $482,714
(Permanent and temporary personnel, operating, equipment)

Staffing:

0.3 PY, Supervisory Fishery Biologist - $27,176
1 PY, Fishery Biologist – $45,293 + 81,527
4 PY, Permanent Field Technician – $125,790 (perm, term, temp)
0.5 PY, Temporary Field Technician

Funding End Date: On-going

GEOGRAPHIC AREA

Reach Covered: Sacramento River, 5 km downstream of Sacramento

Sampling Reaches: 5 km downstream of Sacramento

FIELD SAMPLING

Sampling Frequency: 3 days per week

Sampling Period: All year

Survey Transport: Pick-up truck to Sherwood Harbor then by boat to sampling area

Sampling Parameters and Methods:

Physical: secchi depth, conductivity, water temperature

Biological:

1. Count juvenile salmonids by species and race using kodiak and mid-water trawls
2. Measure and record length (to nearest mm) of juvenile salmonids

DATA ANALYSIS

Methods: Convert catch data to catch per unit effort (CPUE) index based on volume of water sampled

Results:

1. Mean CPUE by week, month, and year
2. Length-frequency of juvenile salmonid populations by species and run

DATA MANAGEMENT/STORAGE

Location: Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205

Data Retrieval Contact:

Paul Cadrett
Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205
(209) 946-6400 x312

Electronic Storage Format (Software): Access database

REPORTING

Count Estimate: Real-time, on-going

Annual Report: Early the following year

Other Reporting: Data posted on BDAT website**,** IEP Newsletter articles, poster/oral presentations, technical reports, journal articles

PUBLICATIONS

Brandes, P.L. 1996. Results of 1996 coded-wire tag smolt survival experiments in the San Joaquin River Delta. Interagency Ecological Program Newsletter. 9(4):13-16

Brandes, P.L., and Pierce, M.M. 1998. 1997 salmon smolt survival studies in the South Delta. Interagency Ecological Program Newsletter. 11(1):29-38.

Brandes P.L., McLain J.S. 2001. Juvenile chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary. In: Brown RL, editor. Contributions to the Biology of Central Valley Salmonids. Fish Bulletin 179. Volume 2. Sacramento (CA): California Department of Fish and Game. p 39-136.

Brandes, P., Perry, K., Chappell, E., McLain, J., Greene, S., Sitts, R., McEwan, D., and Chotkowski, M., Interagency Ecological Program. 2000. Delta Salmon Project Work Team Delta Juvenile Salmon Monitoring Program Review. Stockton, CA

Kjelson, M.A., Brandes, P.L. 1989. The use of smolt survival estimates to quantify the effects of habitat changes on salmonid stocks in the Sacramento-San Joaquin River, California, p. 100-115. In C.D. Levings, L.B. Holtby, and M.A. Henderson [ed.] Proceedings of the National Workshop on the effects of habitat alteration on salmonid stocks. Can. Spec. Publ. Fish. Aquatic. Sci. 105.

Kjelson, M., Greene, S., and Brandes, P.L. 1989. A model for estimating mortality and survival of fall-run chinook salmon smolts in the Sacramento River Delta between Sacramento and Chipps Island. U.S. Fish and Wildlife Service, Stockton, CA. 50pp.

Kjelson, M.A., Raquel, P.F., and Fisher, F.W. 1981. Influences of freshwater inflow on chinook salmon (Oncorhynchus tshawystcha) in the Sacramento-San Joaquin Estuary. pp. 88-108. In (R.D. Cross and D.L. Williams, eds.) Proceedings of the National Symposium on Freshwater Inflow to Estuaries. U.S. Fish and Wildlife Service, FWS/OBS-81-04.

Kjelson, M.A., Raquel, P.F., and Fisher, F.W. 1982. Life history of fall-run juvenile chinook salmon, Oncorhynchus tshawyscha, in the Sacramento-San Joaquin Estuary, California, p. 393-411. In V.S. Kennedy [ed.] Estuarine Comparisons. Academic Press, New York, NY.

McLain, J.S. 1998. Relative efficiency of the midwater and Kodiak trawl at capturing juvenile chinook salmon in the Sacramento River. Interagency Ecological Program Newsletter. 11(4): 26-29.

McLain, J.S., and Burmester, R. 1999. Juvenile fall-run and winter-run chinook salmon abundance. Interagency Ecological Program Newsletter. 12(2) 35-38.

U.S. Fish and Wildlife Service. 1987. Exhibit 31: The needs of chinook salmon, Oncorhynchus tshawystcha in the Sacramento-San Joaquin Estuary. Presented to the State Water Resources Control Board for the 1987 Water Quality/Water Rights Proceedings on the San Francisco Bay/Sacramento-San Joaquin Delta.

U.S. Fish and Wildlife Service. 1994. 1993 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1995. 1994 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1997. 1995 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1999. 1996 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 2000. 1997/98 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 2000. 1999 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

FEATHER RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Feather River (Below Oroville Dam)

Target Species/run: Chinook Salmon (fall and spring), Steelhead

Monitoring Method: Rotary Screw Trap

Variable Measured: Emigration timing, abundance

Program Objectives: Understand emigration timing/cues

Lead Agency: DWR

Contact: Jason Kindopp
460 Glen Dr.
Oroville, CA 95966
jkindopp@water.ca.gov

Program Duration: Ongoing

Previous Methods Used: none

COST

Funding Source(s): DWR

Total Annual Cost: $250,000

Staffing:
Field: (4 temporary staff-f/t for 6 months)

Funding End Date: ongoing

GEOGRAPHIC AREA

Reach Covered: Fish Barrier Dam to Honcut Creek

Sampling Reaches: One trap at end of the LFC (Low Flow Channel) and two traps located near Honcut Creek in the HFC (High Flow Channel)

FIELD SAMPLING

Sampling Frequency: Daily servicing, trap efficiency continuous-as possible

Sampling Period: Dec. 1-June (when possible)

Survey Transport: Boat

Sampling Parameters and Methods:

Physical: Temperature, Turbidity, Trap revolutions, etc.

Biological: Meausure 50 salmonids of each species, measure 20 of all other species. Count all species, etc.

DATA ANALYSIS

Methods: Emigration Estimate adapted from Roper and Scarnecchia (2000). Regression for emigration cues. Standard reduction for length frequencies, distributions, etc.

Results: Emigration estimate for fall-run, spring run when data is available.

DATA MANAGEMENT/STORAGE

Location: Feather River Program-Oroville
BDAT-Sacramento

Data Retrieval Contact: Jason Kindopp (DES-Oroville) Chris Fox: 916-227-1308 (DES-Sacramento)

Electronic Storage Format (Software): Access Database (Oroville)
BDAT (Sacramento)

REPORTING

Emigration Estimate: September (as possible)

Annual Report: December

Other Reporting: FERC Relicensing EWG as necessary

REFERENCES

DWR. 1999a. Feather River Study, Chinook Salmon Emigration Survey, March through June 1996. Sacramento (CA). California Department of Water Resources. 24 p.

DWR. 1999b. Feather River Study, Chinook Salmon Emigration Survey, October through December 1996. Sacramento (CA). California Department of Water Resources. 17 p.

DWR. 2002. Emigration of Juvenile Chinook Salmon in the Feather River, 1998-2001. Sacramento (CA). California Department of Water Resources. 26p.

DWR. 2003. River Flow Effects on Emigrating Juvenile Salmonids in the Lower Feather River: Study Plan F-10, Task 4A. Oroville Facilities Relicensing FERC Project No. 2100. California Department of Water Resources.

Seesholtz, A., B.J. Cavallo, J. Kindopp and R. Kurth. 2004. Juvenile Fishes of the Lower Feather River: Distribution, Emigration Patterns, and Associations with Environmental Variables. Pages 141-166 *in* F. Feyrer, R.L. Brown, and J.J. Orsi, editors. Early life history of fishes in the San Francisco Estuary and Watershed. American Fisheries Society, Symposium 39, Bethesda.

FEATHER RIVER
JUVENILE CHINOOK SALMON
STRANDING AND REDD DEWATERING SURVEY

SUMMARY

Stream: Feather River (Below Oroville Dam)

Target Species/run: Spring and fall-run Chinook salmon

Monitoring Method: Beach Seining, Snorkeling, Electrofishing (as necessary)

Variable Measured: Relative abundance of stranded salmonids (as compared to emigration estimate) and dewatered redds.

Program Objectives: Quantify relative abundance of stranded salmonids and dewatered redds. Identify most critical stranding and isolation areas.

Lead Agency: DWR

Contact: Ryon Kurth, 460 Glen Dr. Oroville 95966; rkurth@water.ca.gov
Jason Kindopp, 460 Glen Dr. Oroville 95966; jkindopp@water.ca.gov

Program Duration: Ongoing

Previous Methods Used: none

COST

Funding Source(s): DWR

Total Annual Cost: $75,000

Staffing:

Field: 2 temporary staff-p/t all year
1 biologist-.25 time

Funding End Date: ongoing

GEOGRAPHIC AREA

Reach Covered: Fish Barrier Dam (FBD) to Shanghai Bench

Sampling Reaches: FBD to Shanghai

FIELD SAMPLING

Sampling Frequency: As necessary

Sampling Period: Year Round

Survey Transport: Boat, Airplane (as necessary)

Sampling Parameters and Methods:

Physical: Temperature, stranded area

Biological: Count and estimate relative abundance of stranded salmonids and/or redds via beach seine, snorkeling or electrofishing.

DATA ANALYSIS

Methods: Expand stranding estimates to un-sampled areas.

Results: Relative abundance of stranded juveniles and de-watered redds. Identification of most critical stranding areas and flows.

DATA MANAGEMENT/STORAGE

Location: Feather River Program-Oroville

Data Retrieval Contact: Ryon Kurth: 530-534-2505 (DES-Oroville) or Jason Kindopp 530-534-2381 (DES-Oroville)

Electronic Storage Format (Software): Access Database (Oroville)

REPORTING

Annual Report: March to NOAA Fisheries (as possible)

Other Reporting: FERC relicensing EWG (as necessary)

REFERENCES

DWR. 2002. Redd Dewatering and Juvenile Steelhead and Spring-run Salmon Stranding in the Lower Feather River, 2000-2001. California Department of Water Resources. 5 p.

DWR. 2004. Redd Dewatering and Juvenile Steelhead and Chinook Salmon Stranding in the Lower Feather River, 2002-2003. Interim Report. Study Plan F-10, Task 3C. FERC Project No. 2100. California Department of Water Resources.

FEATHER RIVER
JUVENILE STEELHEAD
GROWTH AND HABITAT UTILIZATION

SUMMARY

Stream: Feather River (Below Oroville Dam)

Target Species/run: Steelhead

Monitoring Method: Snorkel, Electrofishing, Enclosures

Variable Measured: Distribution, Relative abundance, Habitat Use, Growth

Program Objectives: Understand distribution, habitat utilization, growth and basic life-history of steelhead in the Feather River.

Lead Agency: DWR

Contact: Jason Kindopp, 460 Glen Dr. Oroville 95966; jkindopp@water.ca.gov
Ryon Kurth, 460 Glen Dr. Oroville 95966; rkurth@water.ca.gov

Program Duration: Ongoing

Previous Methods Used: None

COST

Funding Source(s): DWR

Total Annual Cost: $150,000

Staffing:

Field: 4 temporary staff-f/t for 3 months
2 biologists-.25 time

Funding End Date: ongoing

GEOGRAPHIC AREA

Reach Covered: Fish Barrier Dam (FBD) to Honcut Creek (HC)

Sampling Reaches: Several locations between FBD and HC

FIELD SAMPLING

Sampling Frequency:

Snorkel: Monthly;
E-Fish: Bi-weekly to monthly
Enclosures: Weekly

Sampling Period: June 1-Sept. 15

Survey Transport: Boat

Sampling Parameters and Methods:

Physical: Temperature, invertebrate production.

Biological: Measure, weigh and individually mark (with PIT tag or elastomer tag) all juvenile steelhead. Measure and/or count all salmon.

DATA ANALYSIS

Methods: Quantify individual growth rates. Quantify variables influencing growth. Logistic Regression to i.d. habitat utilization, etc.

Results: Identification of accelerated growth in specific areas of the LFC. Identification of preferred habitat for age-0 steelhead. Identification of areas of heavy age-0 steelhead abundance.

DATA MANAGEMENT/STORAGE

Location: Feather River Program-Oroville and Sacramento

Data Retrieval Contact: Ryon Kurth: 530-534-2505 (DES-Oroville) or Jason Kindopp 530-534-2381 (DES-Oroville)

Electronic Storage Format (Software): Access Database (Oroville)

REPORTING

Annual Report: February to NOAA Fisheries

Other Reporting: FERC Relicensing EWG (as necessary)

REFERENCES

DWR. 2004. Distribution and Habitat Use of Juvenile Steelhead and Other Fishes of the Lower Feather River: Study Plan F-10, Task 3A. FERC Project No. 2100. California Department of Water Resources.

DWR. 2004. Growth Investigations of Wild and Hatchery Steelhead in the Lower Feather River: Study Plan F-10, Task 3B. FERC Project No. 2100. California Department of Water Resources.

YUBA RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Yuba River

Target Species/run: Spring, Fall, late Fall-run Chinook Salmon; Central Valley Steelhead Trout

Monitoring Method: Rotary Screw Trap

Variable Measured: Annual juvenile salmonid outmigration (passage)

Program Objectives:

- To estimate juvenile salmonid outmigration (passage) each year in the lower Yuba River,
- To evaluate temporal distribution, relationships to environmental conditions, and population characteristics (length, age, health, and smolting index) of juvenile salmonids (spring-, fall-, late fall-run Chinook salmon, Central Valley steelhead trout) in the lower Yuba River.
- Evaluate the effects of in-stream flow requirements in the lower Yuba River.
- Utilize information gained to adaptively manage water operations in the lower Yuba River. Identify and monitor time of alevin emergence, monitor and document juvenile size at emigration
- Determine contribution to and impacts of ocean and sport harvest
- Develop estimates of straying from and to other watersheds

Lead Agency: California Department of Fish and Game

Contact: Ian Drury
California Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-2030
idrury@dfg.ca.gov

Program Duration: 1999 – present.

Previous Methods Used: In the past the Department gained a portion of this data through seine surveys, and the operation of the Hallwood-Cordua fish screen.

COST

Funding Source: The Anadromous Fish Restoration Program (AFRP) is funding the project, with the Department of Fish and Game contributing 0.3 PY (Fishery Biologist) as in-kind cost share.

Total Cost: $200,000 (Average annual operations over contract period).
(Personnel, operating, equipment)

Staffing: 0.3 PY (Fishery Biologist) In-kind cost share by Department of Fish and Game.
Field: 1.5 PY Scientific Aide

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: Englebright Dam to Hallwood Boulevard (approximately 18 river miles).

Sampling Reaches: Englebright Dam to Hallwood Boulevard (approximately 18 river miles).

FIELD SAMPLING

Sampling Frequency: Continuous

Sampling Period: October 1 through June 30 (36 weeks)

Survey Transport: Pick-up Truck

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (turbidity meter)
Flow (California Data Exchange Center)

Biological: All fish are netted from the trap live-boxes. The first 10 of each non-salmonid species are identified to species, measured to the nearest mm FL, and released. The remainder are counted and released. A random sub-sample of 50 YOY salmon juveniles is placed into a bucket containing a weak, standardized solution of MS-222 and anaesthetized. All yearling salmon are selected and measured. Yearlings are not part of the sub-sample. Upon immobilization, juveniles are individually measured to the nearest mm fork length (FL). Thirty salmon of this group that measured greater than 40mm are then transferred to a wetted container on an Ohaus electronic scale and individually

weighed. After full recovery, all salmon are released downstream of the trap or they are placed in holding pens for subsequent tagging with a CWT.

Fish are tagged using a Northwest Marine Technology Injector Model MKIV. Fish are anaesthetized in MS-222, adipose fin-clipped, tagged with a half-length (0.5 mm) tag in the rostrum and placed through the QCD. Any mis-tagged rejected fish were re-tagged. All but a group of 100 tagged fish are recovered in fresh water and released. The remaining fish are held for 24 hours and re-run through the QCD to obtain a 24-hour tag shedding rate and then released.

Specific information:

1) Estimate/enumerate the passage of juvenile salmonids (by species and run) at Hallwood Boulevard utilizing a rotary screw trap(s) and trap efficiency tests (mark-recovery methods).
2) Measure and record length (nearest millimeter) and weight (nearest 0.1 gram) of juvenile salmonids.
3) Evaluate the health of juvenile salmonids (weight vs. length relationship).
4) Evaluate the smolting index (life history) of juvenile salmonids.
5) Determine contribution to and impacts of ocean and sport harvest
6) Develop estimates of straying from and to other watersheds

DATA ANALYSIS

Methods: Passage estimated using a mark-recovery method (Roper, 2000; Martin 2001)

Results:

1) Outmigration (passage) estimate of juvenile salmonids by species
2) and run.
3) Temporal out-migration distribution of juvenile salmonids by species and run.
4) Length/frequency of juvenile salmonid populations.
5) Relative health of juvenile salmonids by species and run.
6) Smolting index (life history) of juvenile salmonids.
7) Summary of flow, water temperature, water clarity.
8) Number of fish coded wire tagged

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
Sacramento Valley Central Sierra Region
1701 Nimbus Road
Rancho Cordova, CA 05670

Data Retrieval Contact: Ian Drury (see contact information above)

Electronic Storage Format (Software): Excel spreadsheets and Access database.

REPORTING

Passage Estimate: July (draft)

Annual Report: December

Other Reporting: N/A

REFERENCES

Martin, C.D., P.D. Gaines and R.R. Johnson. 2001. Estimating the abundance of Sacramento River juvenile winter Chinook salmon with comparisons to adult escapement. Red Bluff Research Pumping Plant Report Series, Volume 5. U.S. Fish and Wildlife Service, Red Bluff, CA.

Roper, B.B, and D.L. Scarnecchia 2000. Key Strategies for Estimating Population Sizes of Emigrating Salmon Smolts with a Single Trap. Department of Fish and Wildlife Resources, University of Idaho.

AMERICAN RIVER
JUVENILE FALL-RUN CHINOOK AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: American River

Target Species/run: Fall-run Chinook salmon; steelhead.

Monitoring Method: Rotary screw trap (RST)

Variable Measured: Annual juvenile salmonid emigration

Program Objectives:

- To estimate juvenile salmonid emigration each year in the lower American River,
- To evaluate temporal distribution, relationships to environmental conditions (instream flow, water temperature), and population characteristics (length, age, health, and smolting index) of juvenile salmonids (fall-run Chinook salmon, Central Valley steelhead trout) in the lower American River.
- Utilize information gained to adaptively manage water operations on the lower American River.

Lead Agency: California Department of Fish and Game

Contact: Mike Healey
California Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, CA 95670
(916) 358-4334
mhealey@dfg.ca.gov

Program Duration: Approximately 1993 to present.

Previous Methods Used: Beach seining.

COST

Funding Source: USBR, Water Forum, DFG

Total Cost: $125,000 (Annual operations)

Staffing: 0.3 PY Biologist
Field: 1.0 PY Scientific Aide

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: Nimbus Dam to Watt Avenue.

Sampling Reaches: Nimbus Dam to Watt Avenue.

FIELD SAMPLING

Sampling Frequency: Continuous

Sampling Period: January 1 through June 30 (24 weeks)

Survey Transport: Pick-up Truck

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (turbidity meter)
Flow (California Data Exchange Center)

Biological:

1) Estimate/enumerate the passage of juvenile salmonids (by species) at Watt Avenue utilizing a rotary screw trap(s) and trap efficiency tests (mark-recovery methods).
2) Measure and record length (nearest millimeter) and weight (nearest 0.1 gram) of juvenile salmonids.
3) Evaluate the health of juvenile salmonids (weight vs. length relationship).
4) Evaluate the smolting index (life history) of juvenile salmonids.

DATA ANALYSIS

Methods: Passage estimated using a mark-recovery method (Roper, 2000; Martin 2001)

Results:

1) Out-migration (passage) estimate of juvenile salmonids by species.
2) Temporal out-migration distribution of juvenile salmonids by species.
3) Length/frequency of juvenile salmonid populations.
4) Relative health of juvenile salmonids by species.
5) Smolting index (life history) of juvenile salmonids.
6) Summary of flow, water temperature, water clarity.

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
Rancho Cordova, CA

Data Retrieval Contact: Mike Healey (see contact information above)

Electronic Storage Format (Software): Excel spreadsheets and Access database.

REPORTING

Passage Estimate: July (draft)

Annual Report: December

Other Reporting: N/A

REFERENCES

Martin, C.D., P.D. Gaines and R.R. Johnson. 2001. Estimating the abundance of Sacramento River juvenile winter Chinook salmon with comparisons to adult escapement. Red Bluff Research Pumping Plant Report Series, Volume 5. U.S. Fish and Wildlife Service, Red Bluff, CA.

Roper, B.B, and D.L. Scarnecchia 2000. Key Strategies for Estimating Population Sizes of Emigrating Salmon Smolts with a Single Trap. Department of Fish and Wildlife Resources, University of Idaho.

Snider, B. and R.G. Titus. 2002. Lower American River Juvenile Salmonid Emigration Survey, October 1998-September 1999. Department of Fish and Game Stream Evaluation Program Technical Report No. 02-2. September 2002.

MOKELUMNE RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP/INCLINE PLANE TRAP

SUMMARY

Stream: Mokelumne River

Target Species/run: Fall-run Chinook salmon; steelhead

Monitoring Method: Rotary Screw Trap/ Incline Plane bypass trap

Variable Measured: Juvenile salmonid outmigration estimate

Program Objectives:

- Monitor the abundance and emigration patterns of naturally produced anadromous salmonids past Woodbridge Irrigation District Dam on the Lower Mokelumne River
- Monitor movement patterns and timing of all fish species utilizing the LMR from December through July
- Coded-wire tag a portion of naturally produced YOY Chinook salmon
- Monitor the migration patterns of a volitional release of juvenile hatchery reared Chinook salmon

Lead Agency: East Bay Municipal Utility District

Contact:

Michelle Workman
Fisheries Biologist II
East Bay Municipal Utility District
1 Winemasters Way Ste K
Lodi, CA. 95240
(209)365-1486
mworkman@ebmud.com

Program Duration: 1990 - Present

Previous Methods Used: Fyke traps

COST

Funding Source(s): East Bay Municipal Utility District

Total Annual Cost: Approximately $132,000 annually
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field: 1 PY Fisheries Biologist II; 4 PY Fisheries and Wildlife Technicians

Funding End Date: N/A

GEOGRAPHIC AREA

Reach Covered: Screw traps are located and data is collected at Woodbridge Irrigation District Dam (WIDD)

Sampling Reaches: Single station (WIDD)

FIELD SAMPLING

Sampling Frequency: Rotary screw traps are checked at sunrise and sunset Monday-Friday throughout the monitoring period

Sampling Period: Mid-December through July

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Temperature and Dissolved Oxygen (YSI 55 DO meter); Turbidity (Hach P2100 Turbidimeter); cloud cover, wind speed, precipitation, flow velocity into cone, rotations per minute (RPM)

Biological: Record species, fork length, weight, and condition for 50 of each salmonid and 20 of each non-salmonid caught per trap check.

DATA ANALYSIS

Methods: Estimates made of total emigration based on calibrations using hatchery fish. 95% CI determined for the season for Chinook and steelhead. Regression analysis of fish number and environmental variables (flow, temperature, turbidity, precipitation). Comparison of condition factors for juvenile salmon lifestages (fry, parr, silvery parr, smolt)

Results:

1. Estimate of juvenile salmon and steelhead emigrating out of the Mokelumne River
2. Summary of coded wire tagging of natural production
3. Relationship of emigration patterns with flow, temperature, precipitation, turbidity
4. Proportion of diurnal and nocturnal migration
5. Comparison of seasonal data to historic data

DATA MANAGEMENT/STORAGE

Location: East Bay Municipal Utility District, Lodi, Ca.

Data Retrieval Contact: Michelle Workman (see contact information above)

Electronic Storage Format (Software): Oracle database with Access interface

REPORTING

Outmigration Estimate: Available August 1.

Annual Report: Covers December -July 31; Final product due Sept. 1 each year.

Other Reporting: N/A

MOKELUMNE RIVER
JUVENILE FISH COMMUNITY
SEINE AND ELECTROFISHING

SUMMARY

Stream: Lower Mokelumne River

Target Species/run: All fish species present

Monitoring Method: Seine; backpack electrofishing; boat electrofishing

Variable Measured: Count; length; lifestage; weight

Program Objectives:

- Year-round monitoring of fish community in the lower Mokelumne River;
- Monitoring of juvenile salmonid abundance, growth, feeding habits.

Lead Agency: East Bay Municipal Utilities District (EBMUD)

Contact: Joe Merz
EBMUD Fisheries and Wildlife Office
1 Winemasters Way Suite K2
Lodi, CA 95240

Program Duration: Continuous

Previous Methods Used: None.

COST

Funding Source(s): EBMUD

Total Annual Cost: $ 144,000

Staffing:

Supervising Biologist – 0.1 PY
Fishery Biologist - 0.1 PY
Fisheries Technician - 0.1 PY

Funding End Date: Undetermined

GEOGRAPHIC AREA

Reach Covered: Mokelumne River from San Joaquin River to base of Camanche Dam

Sampling Reaches: 6

FIELD SAMPLING

Sampling Frequency: Electrofishing: 4 times annually;
Seining: Monthly, January through June

Sampling Period: See above

Survey Transport: Truck; 18 ft jet boat; 21 ft electrofishing boat

Sampling Parameters and Methods:

Physical: Habitat type; seining only (depth, velocity); temperature; dissolved oxygen; area sampled

Biological: Fish species; length; weight; life stage; physical anomalies; some diet work

DATA MANAGEMENT/STORAGE

Location: EBMUD Office, Oakland

Data Retrieval Contact: Joe Miyamoto, EBMUD

Electronic Storage Format (Software): Oracle

REPORTING

Escapement Estimate: N/A

Annual Report: N/A

Other Reporting: Reports typically cover a 5-year period.

REFERENCES

Merz, J.E., and M. Saldate. 2005. Lower Mokelumne River Fish Community Survey, 1 January 1997 through 30 June 2004. East Bay Municipal Utility District, Fisheries and Wildlife Office, Lodi, California.

Merz, J. E. and J. D. Setka. 2004. Riverine habitat characterization of the lower Mokelumne River, California. July 2004. Mimeo Report. East Bay Municipal Utility District, 1 Winemasters Way, Suite K, Lodi, CA 95240.

Merz, J. E., and J. D. Setka. 2004. Evaluation of a Spawning Habitat Enhancement Site for Chinook Salmon in a Regulated California River. North American Journal of Fisheries Management: Vol. 24, No. 2, pp. 397–407.

Merz, J. E. 2002. Seasonal feeding habits, growth and movement of steelhead trout in the lower Mokelumne River, California. California Fish and Game 88(3):95-111.

Merz, J. E. 2002. Comparison of diets of prickly sculpin and juvenile fall-run Chinook salmon in the lower Mokelumne River, California. The Southwestern Naturalist 47(2):195-204.

Merz, J. E. 2001. Diet of juvenile fall-run Chinook salmon in the lower Mokelumne River, California. California Fish and Game 87:102-114.

Merz, J.E., and M.L. Workman. 1997. Lower Mokelumne River fish community survey. Deember 15, 1996 through June 30, 1997. East Bay Municipal Utility District, Lodi, California.

CALAVERAS RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
ROTARY SCREW TRAP

SUMMARY

Stream: Calaveras River

Target Species/run: *O. mykiss* and Chinook salmon

Monitoring Method: Rotary screw trap

Variable Measured: Determine timing, abundance, and biological characteristics of downstream migrating juvenile salmonids annually.

Program Objectives:

- Estimate the number of juvenile Chinook and *O. mykiss* migrating out of the Calaveras River annually.
- Monitor environmental variables that may influence time, size, and number of migrants.

Lead Agency: FISHBIO Environmental

Contact: Andrea Fuller
P.O. Box 342
Mi Wuk Village, CA 95346
(209) 596-4509

Program Duration: 2002-present

Previous Methods Used: None.

COST

Funding Source(s): Stockton East Water District

Total Annual Cost: $65,000
(Permanent and temporary personnel, operating, equipment)

Staffing:

Field:

2 PY (fisheries technician)
0.6 PY (fisheries biologist)

Funding End Date: On-going

GEOGRAPHIC AREA

Reach Covered: Below New Hogan Dam to Shelton Road Bridge.

Sampling Reaches: A 5-ft rotary screw trap is operated just above the Shelton Road Bridge at river mile 28.

FIELD SAMPLING

Sampling Frequency: 4-7 days per week

Sampling Period: December through May

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Water temperature (F), turbidity (NTU), water velocity (ft/s), time elapsed per revolution of cone, total revolutions of cone.

Biological:

1. Count and identify all fish to species.
2. Measure (forklength) up to 50 salmonids and 20 non-salmonids per trap check.
3. Weigh 50 *O.mykiss* and 50 Chinook each sampling week.
4. Rate degree of smolting based on 1-6 smolt index scale.

DATA ANALYSIS

Methods: Expansion of *O. mykiss* using percent of water sampled and flow.

Results: See "Reporting" Section

DATA MANAGEMENT/STORAGE

Location: FISHBIO Environmental

Data Retrieval Contact: Chrissy Sonke
670 Hi-Tech Parkway, Suite A
Oakdale, CA 95361
(209) 614-0813
sonke@comcast.net

Electronic Storage Format (Software): Access/Quattro Pro

REPORTING

Escapement Estimate: N/A

Annual Report: Annual Report; Calaveras River Data Report

Other Reporting: Website and bi-weekly e-mail updates

REFERENCES

Simpson, M.L. and D.B Demko. 2004. Migration characteristics of juvenile salmonids in the Calaveras River: 2002-2004. Prepared for Stockton East Water District, Stockton, CA by S.P. Cramer & Associates, Chico, CA.

SAN JOAQUIN RIVER
JUVENILE CHINOOK SALMON AND STEELHEAD
KODIAK TRAWL AT MOSSDALE

SUMMARY

Stream: San Joaquin River River

Target Species/run: Fall-run Chinook Salmon, steelhead

Monitoring Method: Kodiak Trawl

Variable Measured: Juvenile Outmigrant Abundance

Program Objectives:

- To estimate the number of juvenile (smolt) fall-run Chinook outmigrating from the San Joaquin River each spring;
- To evaluate temporal and spatial distribution, and relationships to environmental conditions fall-run Chinook salmon smolts

Lead Agency: California Department of Fish and Game

Contact: Tim Heyne
California Department of Fish and Game
San Joaquin River River Restoration Center
737 N. Old La Grange Road
La Grange, CA
(209) 853-2533
theyne@dfg.ca.gov

Program Duration: 1988 – present

Previous Methods Used: None.

COST

Funding Source: SFRA

Total Cost (Personnel, operating, equipment):

$ 82,000 (including overhead)

Staffing:

Field: 1 PY (Scientific Aide—4 @ 3 months each)
0.6 PY (Fishery Biologist)

Funding End Date: June 30, 2009

GEOGRAPHIC AREA

Reach Covered: Head of Old River to a point two miles upstream

FIELD SAMPLING

Sampling Frequency: Daily

Sampling Period: April 1 to mid-June (10 weeks)

Survey Transport: Kodiak Trawl

Sampling Parameters and Methods:

Physical: Temperature (thermograph)
Water clarity (secchi disk)
Water Velocity

Biological:
Count all juvenile chinook salmon captured

DATA ANALYSIS

Methods: The actual number of non-marked Chinook smolt caught per tow adjusted by the mean vulnerability "index" calculated from marked release groups. This number is then extrapolated out to a 5-hour index and a 24-hour seasonal estimate.

Results:

1) Smolt production estimate for the San Joaquin River Drainage
2) Definition of outmigrant window
3) Fraction of outmigrant population afforded protection by VAMP (e.g., Vernalis Adaptive Mangement Program)

DATA MANAGEMENT/STORAGE

Location: California Department of Fish and Game
La Grange

Data Retrieval Contact: Tim Heyne (contact information above)

Electronic Storage Format (Software): Data maintained in Access Data Base

REPORTING

Annual Report: October 1 Annually

Other Reporting: N/A

REFERENCES

Johnson, Ken. Annual Report, Fiscal Year 2003-2004. San Joaquin Drainage Chinook Salmon and Steelhead Habitat Restoration Program: Index and Estimate San Joaquin Drainage Salmon Smolt Production. Sport Fish Restoration Act, Project F-51-R-6 Project No. 26, Job 4.

STANISLAUS RIVER
JUVENILE FALL-RUN CHINOOK AND *O. MYKISS*
ROTARY SCREW TRAP AT OAKDALE

SUMMARY

Stream: Stanislaus River

Target Species/run: Fall-run Chinook salmon and *O. mykiss*

Monitoring Method: Rotary screw trap

Variable Measured: Annual production of juvenile Chinook salmon outmigrants and timing of *O. mykiss*

Program Objectives:

- To estimate the production of juvenile Chinook salmon each year in the lower Stanislaus River, evaluate patterns and magnitude of juvenile Chinook outmigration, examine the relationship of flow and other environmental variables to time, size, and abundance of Chinook outmigrants.
- Compare production estimates at Oakdale (RM 40.1) to outmigration abundance estimates at Caswell (RM 8.6) to obtain an index of survival through the lower river.
- Monitor timing and abundance of *O. mykiss*

Lead Agency: FISHBIO Environmental

Contact: Andrea Fuller
P.O. Box 342
Mi Wuk Village, CA 95346
(209) 596-4509

Program Duration: 1993-present (except 1994 and 1997)

Previous Methods Used: None.

COST

Funding Source(s): Tri-dam Project, Oakdale Irrigation District and South San Joaquin Irrigation District

Total Annual Cost: $121,468

Staffing:

Field:

2 PY - Fisheries Technician
0.5 PY - Fisheries Biologist

Funding End Date: On-going.

GEOGRAPHIC AREA

Reach Covered: Below Goodwin Dam to Oakdale Recreation Area (RM 40.1).

Sampling Reaches: Sampling is conducted at river mile 40.1 on the Stanislaus River near Oakdale Recreation Area.

FIELD SAMPLING

Sampling Frequency: 4-7 days per week

Sampling Period: mid-December through early to mid-June

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Water temperature (F), turbidity (NTU), water velocity (ft/s), time elapsed per revolution of cone, total revolutions of cone.

Biological:

1) Count and identify all fish to species.
2) Measure (forklength) up to 50 salmonids and 20 non-salmonids.
3) Weigh 50 Chinook and all *O.mykiss* each sampling week.
4) Collect scale samples from 50 parr/smolt each week.
5) Rate degree of smolting based on 1-5 smolt index scale.
6) Conduct trap efficiency tests (mark-recapture) on a weekly basis.

DATA ANALYSIS

Methods: Expand daily catch numbers based on trap efficiency evaluation results.

Results: See "Reporting" section

DATA MANAGEMENT/STORAGE

Location: Oakdale, CA

Data Retrieval Contact:

Chrissy Sonke
670 Hi-Tech Parkway, Suite A
Oakdale, CA 95361
(209) 614-0813
sonke@comcast.net

Electronic Storage Format (Software): Access, Quattro Pro

REPORTING

Escapement Estimate: N/A

Annual Report: Annual Stanislaus River Data Report.

Other Reporting: Website and bi-weekly e-mail updates.

REFERENCES

Cramer, S. P., D. B. Demko. 1993. Effects of Pulse Flows on Juvenile Chinook Migration in the Stanislaus River.

Demko, D.B., S.P. Cramer. 2000. Effects of Pulse Flows on Juvenile Chinook Migration in the Stanislaus River. 2000 Annual Report. Report prepared Tri-dam Project by S.P. Cramer & Associates, Gresham, OR.

Demko, D.B., A. Phillips, and S.P. Cramer. 1999. Juvenile Chinook Migration Characteristics in the Stanislaus River 1999 Annual Report. Report prepared Tri-dam Project by S.P. Cramer & Associates, Gresham, OR.

Demko, D.B., Steven P. Cramer. 1995. Effects of Pulse Flow on Juvenile Chinook Migration in the Stanislaus River, 1995 Annual Report.

S.P. Cramer and Associates, Inc. 2004. 2004 Stanislaus River Data Report Supplement. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

S.P. Cramer and Associates, Inc. 2003. 2003 Stanislaus River Data Report Supplement. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

S.P. Cramer and Associates, Inc. 2002. 2002 Stanislaus River Data Report Supplement. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

S.P. Cramer and Associates, Inc. 2001. 1996-2001 Stanislaus River Data Report. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

STANISLAUS RIVER
JUVENILE FALL-RUN CHINOOK AND *O. MYKISS*
ROTARY SCREW TRAP AT CASWELL STATE PARK

SUMMARY

Stream: Stanislaus River

Target Species/run: Fall-run Chinook salmon and *O. mykiss*

Monitoring Method: Rotary screw trap

Variable Measured: Annual outmigration estimates of juvenile Chinook salmon outmigrants and timing of *O. mykiss*

Program Objectives:

- To estimate the juvenile Chinook salmon outmigrants each year in the lower Stanislaus River, evaluate patterns and magnitude of juvenile Chinook outmigration, examine the relationship of flow and other environmental variables to time, size, and abundance of Chinook outmigrants.
- Compare production estimates at Oakdale (RM 40.1) to outmigration abundance estimates at Caswell (RM 8.6) to obtain an index of survival through the lower river.
- Monitor timing and abundance of *O. mykiss.*

Lead Agency: Cramer Fish Sciences

Contact: Ryan Cuthbert
Fisheries Biologist
Cramer Fish Sciences
636 Hedburg Way, #22
Oakdale, CA 95361
(209)847-7786
cuthbert@fishsciences.net

Program Duration: 1996-present (USFWS/CDFG operated traps in 1994-95)

Previous Methods Used: None.

COST

Funding Source(s): USFWS

Total Annual Cost: $125,000

Staffing:

Field:

2 PY - Fisheries technician
0.5 PY - Fisheries biologist

Funding End Date: On-going.

GEOGRAPHIC AREA

Reach Covered: Below Goodwin Dam to Caswell State Park (RM 8.6).

Sampling Reaches: Sampling is conducted at river mile 8.6 on the Stanislaus River near Caswell State Park.

FIELD SAMPLING

Sampling Frequency: 4-7 days per week

Sampling Period: mid-January through early to mid-June

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Water temperature (F), turbidity (NTU), water velocity (ft/s), time elapsed per revolution of cone, total revolutions of cone.

Biological:

1) Count and identify all fish to species.
2) Measure (forklength) up to 50 salmonids and 20 non-salmonids.
3) Weigh 50 Chinook and all *O.mykiss* each sampling week.
4) Collect scale samples from 50 parr/smolt each week.
5) Rate degree of smolting based on 1-5 smolt index scale.
6) Conduct trap efficiency tests (mark-recapture) on a weekly basis (if catch allows).

DATA ANALYSIS

Methods: Expand daily catch numbers based on trap efficiency evaluation results.

Results: See "Reporting" section

DATA MANAGEMENT/STORAGE

Location: Cramer Fish Sciences
Oakdale, CA

Data Retrieval Contact:

Ryan Cuthbert
Fisheries Biologist
Cramer Fish Sciences
636 Hedburg Way, #22
Oakdale, CA 95361
(209)847-7786
cuthbert@fishsciences.net

Electronic Storage Format (Software): Access, Quattro Pro

REPORTING

Escapement Estimate: N/A

Annual Report: Annual Stanislaus River Data Report.

Other Reporting: Website and bi-weekly e-mail updates.

REFERENCES

Demko, D.B., C. Gemperle, A. Phillips, and S.P. Cramer. 2000. Outmigrant trapping of juvenile salmonids in the lower Stanislaus River Caswell State Park Site, 1999. Report prepared for the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program by S.P. Cramer & Associates under contract with CH2M Hill, Sacramento, California.

Demko D.B., C. Gemperle, S.P. Cramer, and A. Phillips. 1999. Outmigrant trapping of juvenile salmonids in the lower Stanislaus River Caswell State Park site, 1998. Report prepared for the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program by S.P. Cramer & Associates under contract with CH2M Hill, Sacramento, California.

Demko D.B. and S.P. Cramer. 1997. Outmigrant trapping of juvenile salmonids in the lower Stanislaus River Caswell State Park site, 1996. Report prepared for the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program by S.P. Cramer & Associates under contract with CH2M Hill, Sacramento, CA.

S.P. Cramer and Associates, Inc. 2004. 2004 Stanislaus River Data Report Supplement. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

S.P. Cramer and Associates, Inc. 2003. 2003 Stanislaus River Data Report Supplement. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

S.P. Cramer and Associates, Inc. 2002. 2002 Stanislaus River Data Report Supplement. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

S.P. Cramer and Associates, Inc. 2001. 1996-2001 Stanislaus River Data Report. Final Data Report, S.P. Cramer & Associates, Gresham, Oregon.

STANISLAUS RIVER
JUVENILE FALL-RUN CHINOOK AND STEELHEAD
SNORKEL SURVEY

SUMMARY

Stream: Stanislaus River

Target Species/run: Fall-run Chinook and Steelhead Trout

Monitoring Method: Snorkel Survey

Variable Measured: Salmonid density

Program Objectives:

- Determine spatial and temporal distribution of juvenile salmonids within the Stanislaus River,
- Evaluate salmonid response to instream flow management actions such as VAMP,
- Evaluate juvenile salmonid use of gravel restoration projects.

Lead Agency: USBR

Contact:

John Hannon
U.S. Bureau of Reclamation
2800 Cottage Way, MP-150
Sacramento, CA 95825
(916) 978-5524
jhannon@mp.usbr.gov

Program Duration: 5 Years

Previous Methods Used: Seine Surveys

COST

Funding Source(s): USBR

Total Annual Cost: $ 50,000
(Permanent and temporary personnel, operating, equipment)

Staffing: Project manager (0.1 time)
Field: Field tech (0.1 time)

Funding End Date: On-going

GEOGRAPHIC AREA

Reach Covered: Goodwin Dam to Oakdale Recreation Area

Sampling Reaches:
Goodwin Canyon, Two Mile Bar, Knights Ferry, Lovers Leap, Honolulu Bar, Orange Blossom Bridge, Valley Oak Rec. Area, Oakdale Rec. Area.

FIELD SAMPLING

Sampling Frequency: Bi-monthly
Sampling Period: Year-round

Survey Transport: Truck

Sampling Parameters and Methods:

Physical:

Temperature (thermograph)
Water clarity (turbidity meter)
Flow (California Data Exchange Center)

Biological:

1) Estimate relative density of salmonids within and between sample sites.
2) Estimate temporal distribution and residence time of salmonids within the Stanislaus River.
3) Evaluate salmonid response to VAMP and other water management activities.

DATA ANALYSIS

Methods: Observed numbers converted into densities by reach and sites within reaches.

Results: Spatial and temporal densities of salmonids and non-salmonid fish

DATA MANAGEMENT/STORAGE

Location: Stockton, CA (hard and electronic), Elk Grove, CA (Electronic)

Data Retrieval Contact: Trevor Kennedy (209) 649-8914

Electronic Storage Format (Software): MS Excel

REPORTING

Annual Report: March annually

Other Reporting: Monthly data reports

TUOLUMNE RIVER
JUVENILE FALL-RUN CHINOOK AND *O. MYKISS*
ROTARY SCREW TRAP

SUMMARY

Stream: Tuolumne River

Target Species/run: Fall-run Chinook salmon and *O. mykiss*

Monitoring Method: Rotary screw traps

Variable Measured: Juvenile salmonids and all fish species

Program Objectives: Monitor relative abundance, distribution, emigration timing, and size of naturally produced juvenile Chinook salmon and *O. mykiss*.

Lead Agency: Turlock Irrigation District and Modesto Irrigation District
Contract to FISHBIO Environmental

Contact: Tim Ford – Aquatic Biologist
Turlock Irrigation District
P.O. Box 949
Turlock, CA 95381
(209) 883-8275

Program Duration:
Rotary Screw Traps: 2004-present (similar or longer sampling from 1995-2003, primarily by CDFG). Waterford site has been sampled since 2006.

Previous Methods Used: Fyke nets were used by CDFG/USFWS in 1973 – 1986 period; upstream RST sampling also done in 1998-2000; some electrofishing done in 1988-93.

COST

Funding Source(s): Turlock Irrigation District/Modesto Irrigation District, City and County of San Francisco

Total Annual Cost: $350,000 (Jan-Jun at Waterford and Grayson)

Staffing: 2 biologists or field technicians per daily field activity

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: La Grange Dam to the mouth of the San Joaquin River

Sampling Reaches:

Rotary screw traps: Grayson Ranch at River Mile 5
Waterford at River Mile 30

FIELD SAMPLING

Sampling Frequency: Continuous (daily checks)

Sampling Period: Jan-Jun (Waterford); varies, dependent on funding source; minimum Apr-May (Grayson)

Survey Transport: Pick-up truck

Sampling Parameters and Methods:

Physical: Flow, water temperature, turbidity, velocity

Biological: Count and measure (forklength, total length and weight) all fish species captured or observed; smolt index for salmonids

DATA ANALYSIS

Methods: Data summary and statistical analyses of data collected

Results: Annual reports, including historical summaries

DATA MANAGEMENT/STORAGE

Location: Oakdale, CA

Data Retrieval Contact: Chrissy Sonke
FISHBIO Environmental
670 Hi-Tech Pkwy, Suite A
Oakdale, CA 95361
(209) 614-0813
sonke@comcast.net

Electronic Storage Format (Software): Access database, Excel spreadsheets and Word documents, PDF report files

REPORTING

Annual Report: March report to FERC

REFERENCES

Brown, L. and T. Ford. 2002. Effects of flow on the fish communities of a regulated California river: implications for managing native fishes. River Research and Applications 18: 331-342

Ford, T. and L. Brown. 2001. Distribution and abundance of Chinook salmon and resident fishes of the Lower Tuolumne River, California *in* Contributions to the biology of Central Valley salmonids, R. Brown (ed.) Fish Bulletin 179, California Dept of Fish and Game

TID/MID 2005. 2005 Ten Year Summary Report pursuant to Paragraph (G) of the 1996 FERC Order issued July 31, 1996. Don Pedro Project, No. 2299.

TUOLUMNE RIVER
JUVENILE FALL-RUN CHINOOK AND *O. MYKISS*
BEACH SEINE, SNORKEL SURVEY

SUMMARY

Stream: Tuolumne River

Target Species/run: Fall-run Chinook salmon and *O. mykiss*

Monitoring Method: Beach seine and snorkel surveys

Variable Measured: Juvenile salmonids and all fish species

Program Objectives: Monitor juvenile salmonid abundance, distribution, timing, and size of naturally produced Chinook salmon and *O. mykiss*.

Lead Agency: Turlock Irrigation District and Modesto Irrigation District

Contact: Tim Ford – Aquatic Biologist
Turlock Irrigation District
P.O. Box 949
Turlock, CA 95381
(209) 883-8275

Program Duration:
Seine surveys: 1997-present (similar surveys in 1986-1996)
Snorkel surveys: 2001- present (various surveys in most years of 1982-2000)

Previous Methods Used: Fyke nets were used by CDFG/USFWS in 1973 – 1986 period; upstream RST sampling also done in 1998-2000; some electrofishing done in 1988-93.

COST

Funding Source(s): TID/MID, City and County of San Francisco; pending application to CALFED

Total Annual Cost: Seine surveys $25,000
Snorkel surveys $10,000

Staffing: 2 biologists or field technicians per daily field activity

Funding End Date: Unknown.

GEOGRAPHIC AREA

Reach Covered: La Grange Dam to the mouth of the San Joaquin River

Sampling Reaches: Seining: La Grange to the San Joaquin River (50 river miles); includes two sites in the San Joaquin River
Snorkel surveys: La Grange to Waterford (20 river miles)

FIELD SAMPLING

Sampling Frequency: Seining: every 2 weeks
Snorkel survey: early and late summer

Sampling Period: Seining: January to May
Snorkel survey: June and September

Survey Transport: Pick-up truck

Sampling Parameters and Methods:

Physical: Flow, water temperature, turbidity, conductivity, dissolved oxygen

Biological: Count and measure (estimate for snorkeling) all fish species captured or observed; smolt index for salmonids

DATA ANALYSIS

Methods: Data summary and statistical analyses of data collected

Results: Annual reports, including historical summaries

DATA MANAGEMENT/STORAGE

Location: Turlock Irrigation District
333 E. Canal Dr.
Turlock, CA 95381

Data Retrieval Contact: Tim Ford

Electronic Storage Format (Software): Excel spreadsheets and Word documents, PDF report files

REPORTING

Annual Report: March report to FERC

REFERENCES

Brown, L. and T. Ford. 2002. Effects of flow on the fish communities of a regulated California river: implications for managing native fishes. River Research and Applications 18: 331-342

Ford, T. and L. Brown. 2001. Distribution and abundance of Chinook salmon and resident fishes of the Lower Tuolumne River, California *in* Contributions to the biology of Central Valley salmonids, R. Brown (ed.) Fish Bulletin 179, California Dept of Fish and Game

TID/MID 2005. 2005 Ten Year Summary Report pursuant to Paragraph (G) of the 1996 FERC Order issued July 31, 1996. Don Pedro Project, No. 2299.

MERCED RIVER
JUVENILE FALL-RUN CHINOOK
ROTARY SCREW TRAP AT HOPETON

SUMMARY

Stream: Merced River

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Rotary screw trap (two 8-ft. diameter)

Variable Measured: Relative abundance and timing of juvenile Chinook salmon emigration

Program Objectives: Develop early life history information on fall-run Chinook salmon in the Merced River; to quantify and evaluate the numbers of outmigrant Chinook salmon; transport timing of downstream migrant salmon during pulse flow events; to estimate the survival of outmigrant Chinook salmon.

Lead Agency: Natural Resource Scientists, Inc.

Contact: Dave Vogel
Natural Resource Scientists, Inc.
P.O. Box 1210
Red Bluff, CA 96080
(530) 527-9587
dvogel@resourcescientists.com

Program Duration: 1999 - present

Previous Methods Used: None.

COST

Funding Source(s): Merced Irrigation District

Total Annual Cost: $120,000
(Permanent and temporary personnel, operating, equipment)

Staffing:
Field: 0.1 PY Fisheries Biologist
1.5 PY Fisheries Technician

Funding End Date: Est. 2012

GEOGRAPHIC AREA

Reach Covered: Crocker-Huffman Dam to Hopeton

Sampling Reaches: Sampling is conducted downstream of the principal salmon spawning reach (approx. 15 river miles)

FIELD SAMPLING

Sampling Frequency: 7 days/week

Sampling Period: January to June

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Water temperature, turbidity, water velocity, time elapsed per revolution of cone, total revolutions of cone, river stage with calibrated flow gauge

Biological: Enumerate and identify all species, measure fork length of up to 50 salmonids, conduct periodic trap efficiency tests, fish marks used in fish survival tests.

DATA ANALYSIS

Methods: Basic data compilations and summaries in relation to environmental variables.

Results: See reporting section

DATA MANAGEMENT/STORAGE

Location: Natural Resource Scientists, Inc.
Red Bluff, CA 96080

Data Retrieval Contact: Dave Vogel
Natural Resource Scientists, Inc.
P.O. Box 1210
Red Bluff, CA 96080
(530) 527-9587
dvogel@resourcescientists.com

Electronic Storage Format (Software): Excel

REPORTING

Escapement Estimate: N/A

Annual Report: Annual data submissions to DFG

Other Reporting: Monthly reporting on website, Merced Technical Advisory Committee, and joint DFG/Merced ID MOU studies program.

MERCED RIVER
JUVENILE FALL-RUN CHINOOK
ROTARY SCREW TRAP AT HATFIELD STATE PARK

SUMMARY

Stream: Merced River

Target Species/run: Fall-run Chinook salmon

Monitoring Method: Rotary screw trap (two 8-ft. diameter)

Variable Measured: Relative abundance and timing of juvenile Chinook salmon emigration

Program Objectives:

1) Provide an estimate of the abundance of juvenile salmonids that move through the lower Merced River toward the San Joaquin River;
2) Determine and evaluate patterns of timing, size, and abundance of juvenile salmonids relative to flow and other environmental conditions; and
3) Obtain indices of survival rates through reaches of the lower Merced River.

Lead Agency: Cramer Fish Sciences

Contact:

Ryan Cuthbert
Fisheries Biologist
Cramer Fish Sciences
636 Hedburg Way, #22
Oakdale, Ca. 95361
(209)847-7786
cuthbert@fishsciences.net

Program Duration: 2006 - present

Previous Methods Used: Rotary screw trap.

COST

Funding Source(s): USFWS - Comprehensive Assessment and Monitoring Program (CAMP) and Anadromous Fish Restoration Program (AFRP)

Total Annual Cost: $160,060

Staffing:

Field: 0.5 PY Biologist
2.0 PY Technician

Funding End Date: 2007

GEOGRAPHIC AREA

Reach Covered: Crocker-Huffman Dam to Hatfield State Park

Sampling Reaches: Hatfield State Park (River Mile 2)

FIELD SAMPLING

Sampling Frequency: 7 days/week

Sampling Period: January to June

Survey Transport: N/A

Sampling Parameters and Methods:

Physical: Water temperature, turbidity, water velocity, flow.

Biological: Enumerate and identify all species, measure fork length of up to 50 salmonids, conduct periodic trap efficiency tests, fish marks used in fish survival tests.

DATA ANALYSIS

Methods: Basic data compilations and summaries in relation to environmental variables.

Results: See reporting section

DATA MANAGEMENT/STORAGE

Location: Oakdale, CA

Data Retrieval Contact: Ryan Cuthbert (see contact information above)

Electronic Storage Format (Software): Excel

REPORTING

Escapement Estimate: N/A

Annual Report: Annual data submissions to DFG

Other Reporting: Project website:
http://www.fishsciences.net/projects/merced/hatcard/hatfieldpostcard3.htm

SACRAMENTO-SAN JOAQUIN DELTA
JUVENILE CHINOOK SALMON
BEACH SEINE SURVEYS

SUMMARY

Stream: Lower Sac River, San Joaquin River, North Delta, Central Delta, Southern Delta, and San Francisco/San Pablo Bay

Target Species/run: Spring-, Fall-, late Fall-, and winter-run Chinook salmon

Monitoring Method: Beach Seine

Variable Measured: Abundance and fork length of juvenile Chinook salmon, and other fish species encountered

Program Objectives:

1) To monitor long-term abundance and distribution of all races of juvenile Chinook salmon entering the Delta from upstream.
2) To create an index of relative abundance of all races of juvenile Chinook salmon entering the Delta from upstream.
3) To monitor the abundance of juvenile Chinook salmon for use in decisions regarding operations of the Delta Cross Channel (DCC) gates and water export levels
4) To monitor long-term abundance and distribution of special status species, sport fish species, and other native and non-native fish species.

Lead Agency: U.S. Fish and Wildlife Service

Contact: Paul Cadrett
Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205
(209) 946-6400 x312

Program Duration: 1976-present

Previous Methods Used: None

COST

Funding Source(s): Interagency Ecological Program (IEP)

Total Annual Cost: $460,000

Staffing:

0.3 PY, Supervisory Fishery Biologist – $27,176
1 PY, Fishery Biologist – $49,822 + $78,438
6 PY, Permanent Field Technician – $173,429 (combines perm, term, and temp)

Funding End Date: On-going

GEOGRAPHIC AREA

Reach Covered and Sampling Reaches:

1. Lower Sacramento River (Sampled between Colusa and Elkhorn)
2. Sacramento River at Sacramento (Sampled between Verona and Clarksburg)
3. North Delta (Sampled between Discovery Park to Antioch on Sacramento River)
4. Central Delta (Sampled between San Joaquin and Sacramento Rivers)
5. South Delta (Sampled adjacent to and south of San Joaquin River)
6. San Joaquin River (Sampled between Mossdale and Tuolumne River)
7. San Francisco/San Pablo Bay (Sampled downstream of Pittsburg to Tiburon in San Francisco Bay)

FIELD SAMPLING

Sampling Frequency and Period:

1. Lower Sacramento River – Once a week, year round
2. Sacramento River at Sacramento – 3-7 times per week, October through February
3. North Delta – Once a week, year round
4. Central Delta – 1-2 times per month, year round
5. South Delta – 1-2 times per month, year round
6. San Joaquin – Once per week, January through June
7. San Francisco/San Pablo Bay – Once a week, November through July

Survey Transport: Pick-up truck; or pick-up truck and boat

Sampling Parameters and Methods:

Physical: Water temperature, conductivity

Biological:

1) Count juvenile salmonids by species and race and other species encountered using beach seining methods
2) Measure and record fork length (to nearest mm) of 50 juvenile salmonids of each race and 50 individuals of all other species

DATA ANALYSIS

Methods: Convert catch data to catch per unit effort (CPUE) index based on volume of water sampled

Results:

1) Mean CPUE by week, month, and year
2) Length-frequency of juvenile salmonid and other fish populations by species and/or run

DATA MANAGEMENT/STORAGE

Location: Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205

Data Retrieval Contact:

Paul Cadrett
Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205
(209) 946-6400 x312

Electronic Storage Format (Software): Access database

REPORTING

Count Estimate: Real-time, on-going

Annual Report: Early the following year

Other Reporting: Data posted on BDAT website**,** IEP Newsletter articles, poster/oral presentations, technical reports, journal articles

REFERENCES

Brandes, P.L. 1996. Results of 1996 coded-wire tag smolt survival experiments in the San Joaquin River Delta. Interagency Ecological Program Newsletter. 9(4):13-16

Brandes, P.L., and Pierce, M.M. 1998. 1997 salmon smolt survival studies in the South Delta. Interagency Ecological Program Newsletter. 11(1):29-38.

Brandes P.L., McLain J.S. 2001. Juvenile chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary. In: Brown RL, editor. Contributions to the Biology of Central Valley Salmonids. Fish Bulletin 179. Volume 2. Sacramento (CA): California Department of Fish and Game. p 39-136.

Brandes, P., Perry, K., Chappell, E., McLain, J., Greene, S., Sitts, R., McEwan, D., and Chotkowski, M., Interagency Ecological Program. 2000. Delta Salmon Project Work Team Delta Juvenile Salmon Monitoring Program Review. Stockton, CA

Kjelson, M.A., Brandes, P.L. 1989. The use of smolt survival estimates to quantify the effects of habitat changes on salmonid stocks in the Sacramento-San Joaquin River, California, p. 100-115. In C.D. Levings, L.B. Holtby, and M.A. Henderson [ed.] Proceedings of the National Workshop on the effects of habitat alteration on salmonid stocks. Can. Spec. Publ. Fish. Aquatic. Sci. 105.

Kjelson, M., Greene, S., and Brandes, P.L. 1989. A model for estimating mortality and survival of fall-run chinook salmon smolts in the Sacramento River Delta between Sacramento and Chipps Island. U.S. Fish and Wildlife Service, Stockton, CA. 50pp.

Kjelson, M.A., Raquel, P.F., and Fisher, F.W. 1981. Influences of freshwater inflow on chinook salmon (Oncorhynchus tshawystcha) in the Sacramento-San Joaquin Estuary. pp. 88-108. In (R.D. Cross and D.L. Williams, eds.) Proceedings of the National Symposium on Freshwater Inflow to Estuaries. U.S. Fish and Wildlife Service, FWS/OBS-81-04.

Kjelson, M.A., Raquel, P.F., and Fisher, F.W. 1982. Life history of fall-run juvenile chinook salmon, Oncorhynchus tshawyscha, in the Sacramento-San Joaquin Estuary, California, p. 393-411. In V.S. Kennedy [ed.] Estuarine Comparisons. Academic Press, New York, NY.

McLain, J.S. 1998. Relative efficiency of the midwater and Kodiak trawl at capturing juvenile chinook salmon in the Sacramento River. Interagency Ecological Program Newsletter. 11(4): 26-29.

McLain, J.S., and Burmester, R. 1999. Juvenile fall-run and winter-run chinook salmon abundance. Interagency Ecological Program Newsletter. 12(2) 35-38.

U.S. Fish and Wildlife Service. 1987. Exhibit 31: The needs of chinook salmon, Oncorhynchus tshawystcha in the Sacramento-San Joaquin Estuary. Presented to the State Water Resources Control Board for the 1987 Water Quality/Water Rights Proceedings on the San Francisco Bay/Sacramento-San Joaquin Delta.

U.S. Fish and Wildlife Service. 1994. 1993 annual progress report: “Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary.” Stockton, CA

U.S. Fish and Wildlife Service. 1995. 1994 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1997. 1995 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1999. 1996 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 2000. 1997/98 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 2000. 1999 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

SACRAMENTO-SAN JOAQUIN DELTA
JUVENILE CHINOOK SALMON
MID-WATER TRAWL AT CHIPPS ISLAND

SUMMARY

Stream: Sacramento-San Joaquin Delta

Target Species/run: Spring-, Fall-, late Fall-, and winter-run Chinook salmon

Monitoring Method: Mid-water trawl at Chipps Island

Variable Measured: Counts and fork lengths of juvenile chinook salmon, counts and fork lengths of coded wire tagged juvenile chinook salmon, counts and fork lengths of other juvenile and adult fish captured

Program Objectives:

1. To monitor long-term abundance and distribution of all races of juvenile chinook salmon, special status species, sport fish, other native and non-native fish species
2. To create an index of relative abundance of all races of juvenile chinook salmon
3. To enumerate juvenile salmon emigrating from the Delta to Suisun Bay
4. To determine survival estimates of juvenile chinook salmon from hatcheries

Lead Agency: U.S. Fish and Wildlife Service

Contact: Paul Cadrett
Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205
(209) 946-6400 x312

Program Duration: 1976 to present

Previous Methods Used: None.

COST

Funding Source(s): Interagency Ecological Program (IEP)

Total Annual Cost: $448,456
(Permanent and temporary personnel, operating, equipment)

Staffing:

0.3 PY, Supervisory Fishery Biologist – $21,740
1 PY, Fishery Biologist - $49,822 + $72,733
4 PY, Permanent Field Technician – $121,466 (perm, temp, term)
0.5 PY, Temporary Field Technician

Funding End Date: On-going

GEOGRAPHIC AREA

Reach Covered: Sacramento-San Joaquin Delta

Sampling Reaches: Chipps Island

FIELD SAMPLING

Sampling Frequency: 3-7 days/week, doubling effort to twice a day 7 days a week to coincide with Vernalis Adaptive Management Plan (VAMP) program salmon releases (e.g., April 24 through May 22 for 2004).

Sampling Period: Year-round

Survey Transport: By pick-up truck to Pittsburg Marina, then by boat to sampling area.

Sampling Parameters and Methods:

Physical: Secchi depth, water temperature

Biological:

1) Count juvenile salmonids (by species and race using) and other species encountered in mid-water trawls
2) Measure and record fork length (to nearest mm) of juvenile salmonids (50 of each race), 50 of all other species

DATA ANALYSIS

Methods:

1. Survival estimates, based on # fish released, # fish recovered, proportion of channel width sampled, and proportion of time sampled (from 1st recovery to last recovery)
2. Conversion of count data to catch per unit effort (CPUE) based on volume of water sampled per trawl

Results:

1. Survival of juvenile chinook salmon from hatcheries by race
2. Estimates of emigration from the Delta to Suisun Bay of juvenile chinook salmon
3. Length-frequency of juvenile chinook salmon

DATA MANAGEMENT/STORAGE

Location: Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205

Data Retrieval Contact:
Paul Cadrett
Stockton Fish and Wildlife Service
4001 N. Wilson Way
Stockton, CA 95205
(209) 946-6400 x312

Electronic Storage Format (Software): Access database

REPORTING

Count Estimate: Real-time, on-going

Annual Report: Early the following year

Other Reporting: Data posted on BDAT website**,** IEP Newsletter articles, poster/oral presentations, technical reports, journal articles

REFERENCES

Brandes, P.L. 1996. Results of 1996 coded-wire tag smolt survival experiments in the San Joaquin River Delta. Interagency Ecological Program Newsletter. 9(4):13-16

Brandes, P.L., and Pierce, M.M. 1998. 1997 salmon smolt survival studies in the South Delta. Interagency Ecological Program Newsletter. 11(1):29-38.

Brandes P.L., McLain J.S. 2001. Juvenile chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary. In: Brown RL, editor. Contributions to the Biology of Central Valley Salmonids. Fish Bulletin 179. Volume 2. Sacramento (CA): California Department of Fish and Game. p 39-136.

Brandes, P., Perry, K., Chappell, E., McLain, J., Greene, S., Sitts, R., McEwan, D., and Chotkowski, M., Interagency Ecological Program. 2000. Delta Salmon Project Work Team Delta Juvenile Salmon Monitoring Program Review. Stockton, CA

Kjelson, M.A., Brandes, P.L. 1989. The use of smolt survival estimates to quantify the effects of habitat changes on salmonid stocks in the Sacramento-San Joaquin River, California, p. 100-115. In C.D. Levings, L.B. Holtby, and M.A. Henderson [ed.] Proceedings of the National Workshop on the effects of habitat alteration on salmonid stocks. Can. Spec. Publ. Fish. Aquatic. Sci. 105.

Kjelson, M., Greene, S., and Brandes, P.L. 1989. A model for estimating mortality and survival of fall-run chinook salmon smolts in the Sacramento River Delta between Sacramento and Chipps Island. U.S. Fish and Wildlife Service, Stockton, CA. 50pp.

Kjelson, M.A., Raquel, P.F., and Fisher, F.W. 1981. Influences of freshwater inflow on chinook salmon (*Oncorhynchus tshawystcha*) in the Sacramento-San Joaquin Estuary. pp. 88-108. In (R.D. Cross and D.L. Williams, eds.) Proceedings of the National Symposium on Freshwater Inflow to Estuaries. U.S. Fish and Wildlife Service, FWS/OBS-81-04.

Kjelson, M.A., Raquel, P.F., and Fisher, F.W. 1982. Life history of fall-run juvenile chinook salmon, *Oncorhynchus tshawyscha*, in the Sacramento-San Joaquin Estuary, California, p. 393-411. In V.S. Kennedy [ed.] Estuarine Comparisons. Academic Press, New York, NY.

McLain, J.S. 1998. Relative efficiency of the midwater and Kodiak trawl at capturing juvenile chinook salmon in the Sacramento River. Interagency Ecological Program Newsletter. 11(4): 26-29.

McLain, J.S., and Burmester, R. 1999. Juvenile fall-run and winter-run chinook salmon abundance. Interagency Ecological Program Newsletter. 12(2) 35-38.

U.S. Fish and Wildlife Service. 1987. Exhibit 31: The needs of chinook salmon, *Oncorhynchus tshawystcha* in the Sacramento-San Joaquin Estuary. Presented to the State Water Resources Control Board for the 1987 Water Quality/Water Rights Proceedings on the San Francisco Bay/Sacramento-San Joaquin Delta.

U.S. Fish and Wildlife Service. 1994. 1993 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1995. 1994 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1997. 1995 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 1999. 1996 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 2000. 1997/98 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

U.S. Fish and Wildlife Service. 2000. 1999 annual progress report: "Abundance and survival of juvenile chinook salmon in the Sacramento-San Joaquin Estuary." Stockton, CA

TABLE 1. SUMMARY OF EXISTING ADULT CHINOOK SALMON AND STEELHEAD MONITORING PROGRAMS IN THE CENTRAL VALLEY

Stream	Target Species/Run	Monitoring Method	Variable Measured	Agency	Personnel	Personnel	Total Cost (Personnel/Equip/ Operating)
					Permanent Biologist(PY)	Technician (PY)	
CENTRAL VALLEY-WIDE	Chinook (fall and late fall-run), Steelhead	Angler survey	Angler effort and harvest	CDFG	3.0	13.0	$701,000
UPPER SACRAMENTO RIVER BASIN							
Mainstem Sacramento River	Chinook (fall, late-fall, winter, and spring-run)	Aerial redd survey	Spawning distribution	CDFG	0.1	0.1	$30,000
	Chinook (fall, winter, and spring-run), steelhead	Ladder counts at RBDD	Dam passage (May 15 - Sept. 15)	CDFG/USFWS	0.4	1.1	$107,400
	Chinook (fall, late fall-run)	Carcass survey	Annual escapement	CDFG	0.3	2.9	$200,000
	Chinook (winter-run)	Carcass survey	Annual escapement	CDFG/USFWS	0.9	2.4	$345,000
Clear Creek	Chinook (Fall-run)	Carcass survey	Annual escapement	CDFG	0.1	0.2	$32,000
	Chinook (Spring-run)	Snorkel survey	Annual escapement	USFWS	1.5	0.0	$133,000
	Chinook (late-fall), Steelhead	Redd counts	Annual escapement	USFWS	0.4	0.0	$53,000
	Chinook (Fall-run)	Redd mapping	Digitized spawning areas	USFWS	0.1	0.0	$10,000
Cow Creek	Chinook (Fall-run)	Video monitoring	Annual escapement	DFG/USFWS	0.2	0.5	$20,000
Battle Creek	Chinook (fall-run)	Video monitoring	Annual escapement	CDFG/USFWS	0.2	0.5	$33,000
	Chinook (Spring-run), Steelhead	Barrier weir monitoring	Annual escapement	USFWS	2.0	0.0	$115,000
	Chinook (Spring-run), Steelhead	Snorkel survey	Annual escapement	USFWS	3.2	0.0	$200,383
	Steelhead	Redd survey	Annual escapement	USFWS	0.8	0.0	$53,000
Antelope Creek	Chinook (spring-run)	Snorkel survey	Annual escapement	CDFG	0.2	0.2	$52,000
Beegum Creek	Chinook (Spring-run)	Snorkel survey	Annual escapement	CDFG	0.1	0.1	$5,000
Deer Creek	Chinook (Spring-run)	Snorkel survey	Annual escapement	CDFG	0.2	0.2	$48,000
	Chinook (Fall-run)	Carcass survey	Annual escapement	CDFG	0.1	0.2	$36,000
Mill Creek	Chinook (Spring-run)	Redd counts	Annual escapement	CDFG	0.2	0.2	$52,000
	Chinook (Spring-run)	Hydroacoustics	Annual escapement	USFWS	0.5	0.2	$160,000
	Chinook (Fall-run)	Carcass survey	Annual escapement	CDFG	0.1	0.2	$36,000
Butte Creek	Chinook (Fall and spring-run)	Carcass survey	Annual escapement	CDFG	0.8	0.9	$80,000
Butte and Big Chico Creeks	Chinook (Spring-run), Steelhead	Snorkel survey	Annual escapement	CDFG	0.1	0.1	$10,000
LOWER SACRAMENTO R BASIN							
Yuba River	Chinook (fall-run)	Carcass survey	Annual escapement	CDFG	0.3	0.8	$50,000
	Fall, late-fall, spring-run Chinook, steelhead	Infrared (Vaki) monitoring at Daguerre Point Dam	Annual escapement	CDFG/AFRP Program	0.3	0.6	$54,000
Feather River	Chinook (Fall/spring-run)	Carcass survey	Annual escapement	DWR	0.8	3.5	$300,000
American River	Chinook (Fall-run)	Carcass survey	Annual escapement	CDFG	0.3	5.1	$100,000
	Steelhead	Redd survey	Annual escapement/spawning distribution	USBR	0.3	0.2	$35,000
DELTA TRIBUTARIES							
Mokelumne River	Chinook (fall-run), steelhead	Video monitoring/live trapping	Annual escapement	EBMUD	1.0	4.0	$266,000
	Chinook (fall-run), steelhead	Redd survey	Annual escapement/spawning distribution	EBMUD	1.0	2.0	$40,000
SAN JOAQUIN RIVER BASIN							
Stanislaus River	Chinook (fall-run), steelhead	Weir counts	Annual escapement	USFWS/Cramer Fish Sciences	1.6	4.0	$150,000
	Chinook (fall-run)	Carcass survey	Annual escapement	CDFG	0.6	0.6	$70,000
Tuolumne River	Chinook (fall-run)	Carcass survey	Annual escapement	CDFG	0.6	0.6	$70,000
Merced River	Chinook (fall-run)	Carcass survey	Annual escapement	CDFG	0.6	0.6	$70,000
				TOTAL =	**22.8**	**45.0**	**$3,716,783**

TABLE 2. SUMMARY OF EXISTING JUVENILE CHINOOK SALMON AND STEELHEAD MONITORING PROGRAMS IN THE CENTRAL VALLEY

Stream	Target Species	Monitoring Method	Variable Measured	Agency	Personnel	Personnel	Total Cost (Personnel/Equip/Operating)
UPPER SACRAMENTO RIVER BASIN					Permanent Biologist (PY)	Technician (PY)	
Mainstem Sacramento River	All Chinook races, steelhead	Rotary Screw Trap @ Red Bluff Diversion Dam	Abundance/Outmigrant Timing	USFWS	7.0	3.0	$750,000
	All Chinook races, steelhead	Rotary Screw Trap @ GCID	Abundance/Outmigrant Timing	CDFG	1.0	0.8	$102,400
Clear Creek	All Chinook races, Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	USFWS	6.5	0.0	$356,736
	Chinook	Snorkel survey	Habitat Use	USFWS	2.0	0.0	$80,000
Battle Creek	All Chinook races, Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	USFWS	4.0	0.0	$134,903
Deer/Mill Creeks	Spring and Fall-run Chinook, Steelhead	Rotary Screw Trap	Relative Abundance/Outmigrant Timing	CDFG	0.4	1.3	$100,000
Stony Creek	All Chinook races, Steelhead	Beach seine, fyke net	Presence/Absence of Anadromous Fish	USBR	1.0	1.0	$150,000
Butte Creek	Spring-run Chinook, Steelhead	Rotary Screw Trap, CWT	Abundance/Outmigrant Timing	CDFG	2.3	2.0	$315,387
LOWER SACRAMENTO RIVER BASIN							
Lower Sacramento River	All Chinook races, steelhead	Rotary Screw Trap @ Knights Landing	Abundance/Outmigrant Timing	CDFG	0.8	2.5	$110,000
	All Chinook runs, Steelhead	Kodiak/midwater trawl @ Sacramento	Spatial/temporal Distribution, Outmigration Timing	USFWS	1.3	4.5	$482,714
Feather River	Fall and Spring-run Chinook, Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	DWR	0.0	2.0	$250,000
	Fall and Spring-run Chinook	Beach Seine, snorkel, electrofish	Relative abundance of stranded Chinook, number of dewatered redds	DWR	0.3	1.0	$75,000
	Steelhead	Snorkel, electrofish, enclosures	Distribution, relative abundance, habitat use, growth	DWR	0.5	1.0	$150,000
Yuba River	Fall-run, spring-run Chinook,Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	CDFG	0.3	1.5	$200,000
American River	Fall-run Chinook, Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	CDFG	0.3	1.0	$125,000
DELTA TRIBUTARIES							
Mokelumne River	Fall-run Chinook, Steelhead	Rotary screw traps / incline plane trap	Abundance/Outmigrant Timing	EBMUD	1.0	4.0	$132,000
	Fall-run Chinook, Steelhead	Seine and electrofish	Distribution and Abundance	EBMUD	0.2	0.1	$144,000
Calaveras River	Fall-run Chinook, Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	SEWD/FISHBIO	0.6	2.0	$65,000

TABLE 2. SUMMARY OF EXISTING JUVENILE CHINOOK SALMON AND STEELHEAD MONITORING PROGRAMS IN THE CENTRAL VALLEY

Stream	Target Species	Monitoring Method	Variable Measured	Agency	Personnel	Personnel	Total Cost (Personnel/Equip/Operating)
SAN JOAQUIN RIVER BASIN							
San Joaquin River	Fall-run Chinook, Steelhead	Kodiak trawl at Mossdale	Abundance/Outmigration Timing	CDFG	0.6	1.0	$82,000
Stanislaus River	Fall-run Chinook, Steelhead	Rotary Screw Trap (Oakdale)	Abundance/Outmigrant Timing	Tri-Dam, OID, SSJID/FISHBIO	0.5	2.0	$121,468
	Fall-run Chinook, Steelhead	Rotary Screw Trap (Caswell)	Abundance/Outmigrant Timing	USFWS/Cramer Fish Sciences	0.5	2.0	$125,000
	Fall-run Chinook, Steelhead	Snorkel survey	Spatial/temporal Distribution, Densities	USBR/Fishery Foundation	0.1	0.1	$50,000
Tuolumne River	Fall-run Chinook, Steelhead	Beach Seine, Snorkel	Abundance/Outmigrant Timing, Distribution	Turlock Irrigation District	0.1	0.1	$35,000
	Fall-run Chinook, Steelhead	Rotary Screw Trap	Abundance/Outmigrant Timing	TID/MID/FISHBIO	1.0	1.0	$350,000
Merced River	Fall-run Chinook	Rotary Screw Trap (Hopeton)	Abundance/Outmigrant Timing	Merced ID/Natural Resource Scientists	0.1	1.5	$120,000
	Fall-run Chinook	Rotary Screw Trap (Hatfield St. Park)	Abundance/Outmigrant Timing	USFWS/Cramer Fish Sciences	0.5	2.0	$160,000
SACRAMENTO-SAN JOAQUIN DELTA							
Lower Sacramento River, Lower San Joaquin River, North Delta, Central Delta, South Delta (throughout), SF/San Pablo Bays	All Chinook Runs	Beach Seine	Abundance/Outmigrant Timing, Recovery of marked smolts	USFWS	1.3	6.0	$460,000
Suisun Bay	All Chinook runs	Mid Water Trawl at Chipps Island	Abundance/Outmigrant Timing, Recovery of marked smolts	USFWS	1.3	4.5	$448,456
				TOTAL =	**35.4**	**47.9**	**$5,675,064**