

Draft CVPIA Fiscal Year 2010 Annual Work Plan

October 1, 2009

Program Title

Red Bluff Fish Passage- CVPIA Section 3406(b)(10).

Responsible Entities

Staff Name	Agency	Role
Paul Freeman	USBR	Lead
Jim Smith	USFWS	Co-Lead

Program Goals and Objectives for FY 2010

Goal A - Substantially improve the long-term ability of fish to pass upstream and downstream.

Objective: Begin construction on a new pumping plant and ancillary facilities to divert water from the Sacramento River to the Tehama-Colusa Canal (TCC) and allow unimpeded fish passage through permanent elevation of the gates at the Red Bluff Diversion Dam (RBDD), while continuing water deliveries and fulfilling requirements of the National Marine Fisheries Service's (NMFS) 2009 Operations Criteria and Plan (OCAP) Biological Opinion (BO).

Task 1.3.1. Genetic Composition of Adult Chinook Salmon During Gates-In Operations -

Continue the ongoing collaborative project between the Red Bluff Fish and Wildlife Office (RBFWO) and the Service's Abernathy Fish Technology Center (ATFC). The RBFWO will collect tissues samples at the RBDD fish trap for genetic tissue analyses by the ATFC during Calendar Year (CY) 2010 in support of the monitoring requirements for Spring-run Chinook under the NMFS 2009 OCAP BO.

Task 1.3.2. Fish Passage Improvement Planning Project at Red Bluff Diversion Dam –

The RBFWO and Sacramento FWO (SFWO) will provide biological information as needed to guide the engineering work and monitor construction and assist in the design process to the extent that unanticipated issues arise. The time requirements for this project are mutually derived estimates between RBFWO, SFWO and USBR personnel since its inception and will continue to be so. They probably will be adjusted as work proceeds, as the needs of this project are difficult to predict in detail in advance.

Task 1.3.3. Green Sturgeon Population Assessment –

Continue the cooperative radio tagging study of the movements of green sturgeon in the upper Sacramento River involving the USFWS, the USBR, and U.C. Davis and initiate further studies with U.C. Davis in response to the mandates of the 2009 NMFS BO.

Task 1.3.4. Green Sturgeon Egg and Larval surveys, Interim Pumping Plant Evaluations

This task has two significant subtasks.

Subtask 1.3.4.a, green sturgeon egg and larval surveys. Fish and Wildlife Service Red Bluff FWO will continue working on this subtask in support of the directives of the 2009 NMFS OCAP BO (Appendix 2-B, task 1a, page 8). Also see enclosed Table 4, FY 2010 CVPIA Monitoring Projects.

Subtask 1.3.4.b, interim pumping plant evaluations. This subtask is required under the BO for the Interim Pumping Plant which was necessitated by the NMFS 2009 OCAP BO's requirement for gates out operation for an additional six weeks per year.

Task 1.3.5. FWS Sacramento Office

The Sacramento office will continue to provide support by attending Technical Advisory Group (TAG) meetings and responding to construction related issues as they arise.

Task 1.6 Land, Water and Conveyance Acquisitions-

Complete the acquisition of land for the construction of the new pumping plant and allied facilities.

Task 1.7 Outreach and Public Involvement

Coordinate with local government and conduct public informational meetings as needed to address the concerns of local residents.

Task 1.9 Environmental Compliance

Provide the National Historic Preservation Act requirements, National Environmental Policy Act (NEPA), and Endangered Species Act (ESA) support as necessary to accommodate evolutionary changes in the pumping plant design and ensure continued water deliveries.

Task 1.11 Construction

Complete construction of the facilities linking the pumping plant and TCC, and begin construction of the new pumping plant. This is being managed as a separate project under the oversight of the Mid-Pacific Construction Office, and is mentioned here simply for the purposes of comprehensive coverage.

Goal B - Maintain reliable water deliveries to existing users while improving fish passage.

Objective: Maintain water deliveries while constructing the new pumping plant despite the shortened gates-in period under the 2009 NMFS OCAP BO.

Program guidance includes: 1) CVPIA Section 3406 (b)(10); 2) Record of Decision, Central Valley Project Improvement Act; 3) CALFED Bay-Delta Programmatic Record of Decision, proposed Ecosystem Restoration Program stage 1 actions; 4) CALFED Ecosystem Restoration Program Strategic Plan For Ecosystem Restoration; and 5) the FWS and NMFS Biological Opinions on the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan, released in October 2004 and July 2008 respectively.

Status of the Program

The program goals include both outcome and output measures. The outcome goal is passage of 80-100% of adult spring-run Chinook and passage of 50-100% of adult green sturgeon. The output goal is to complete infrastructure improvements for fish passage and supply 115,000 AF of refuge water to the Sacramento National Wildlife Refuge.

Additionally, the program goals include compliance with the mandates of the 2009 NMFS OCAP BO, by replacing dam-based gravity diversions with a screened pumping plant, while continuing to delivery water to the Tehama Colusa Canal Authority's customers.

Passage

Fish passage at Red Bluff was substantially improved in the mid-1990's in response to the operational requirements imposed by the 1992 Biological Opinion for the winter run Chinook salmon. Efforts to further improve passage with existing facilities, while maintaining the water diversions, were helpful but not wholly successful. The helical and Archimedes screw pumps installed in the mid-1990's, and evaluated since, demonstrated an ability to move water without substantial harm to the fisheries, but the water users' deem those research pumps to be economically inefficient. Moreover, the 2009 NMFS BO in effect required the immediate replacement of the dam with a large pumping plant, the preferred alternative of the Environmental Impact Statement for the Red Bluff Fish Passage Program. The BO also mandated further studies of the green sturgeon population. Those studies and studies of adult spring run Chinook will be undertaken also as part of the requirements for continued operation of the diversion dam until the pumping plant is completed.

Maintenance of Water Deliveries

Water deliveries have barely been able to meet springtime demand in most years and have only done so with the aid of temporary gate closures in some years. This has required the use of water stored in Black Butte Reservoir which might otherwise be used to enhance the non-natal rearing habitat of listed salmonids in the mouth and lowermost reaches of Stony Creek, the last such tributary habitat for 100 miles along the Sacramento River. Moreover, the requirements of the

NMFS BO required a crash effort to increase the interim pumping capacity at Red Bluff and the entire complex of research and interim pumps and rediversions from Black Butte will be used during the construction period to ensure continuity of water deliveries.

The Program and a new siphon on the GCID Canal have allowed for unimpeded water deliveries to the three CVPIA identified refuges of the Sacramento National Wildlife Refuge Complex (NWRC) located on the west side of the Sacramento River. These are the Sacramento, Colusa, and Delevan National Wildlife Refuges (Refuges). Annually, the Sacramento NWRC manager develops a water delivery schedule based on full Level 2 water supplies and those Incremental Level 4 water supplies acquired and made available by the Refuge Water Supply Program. Reclamation has continued to satisfy the annual water schedule and monthly water orders submitted by the refuge manager, and timing needs to meet the management plan objectives for the Refuges. Reclamation has a long-term water conveyance agreement with Glenn-Colusa Irrigation District (GCID) for conveyance of water supplies to the Refuges. GCID diverts these water supplies at Hamilton, conveying through GCID's system to specific points of deliveries (POD) on the Refuges.

Consistency with North-of-Delta Off stream Storage Investigation (NODOS)

The current proposals are expected to be fully consistent with operation of a reservoir at Sites, extensions of the Tehama Colusa Canal to service the Interstate-80 urban corridor between Vallejo and Sacramento, and water management in portions of Suisan Bay should any of those be desired.

FY 2009 Accomplishments

Fish Passage

The pumping capacity at Red Bluff was roughly doubled in five months with the design and construction a new 500 cfs, interim pumping plant just below the Red Bluff Diversion Dam. That installation was completed and contributed significantly to the continuity of water supplies for the TCC service area. Concurrently, the dam gates were maintained in a raised position for an additional month in the spring to accommodate the upstream migration of the federally listed green sturgeon and spring run Chinook. The changed minimum gate opening operations begun in 2007, in which the gates are kept open at least one foot or wholly closed, continued to be effective. During 2009, RBDD instituted gate operations of a minimum gate opening of 1.5' (18 inches).

Green Sturgeon Egg and Larval Monitoring

Sampling of green sturgeon spawning habitat using artificial substrate mats to acquire eggs continued for the second of three seasons. Preliminary 2009 data indicates green sturgeon eggs were sampled from three sites previously sampled in 2008, plus one newly sampled site upstream of RBDD. Eggs were sampled above, at, and below RBDD. Preliminary results indicate that green sturgeon spawning occurred from late-March to early July.

Larval sampling of migrating young of the year green sturgeon using a benthic D-net proved more successful per unit effort in 2009 than 2008. Equipment failures in high velocity sample areas resulted in an overall reduction in sampling effort for 2009. Preliminary data suggests that the abundance of green sturgeon adults above RBDD was greater in 2009 than 2008 as evidenced by greater total capture of green sturgeon larvae using the D-net. Moreover, larvae and juveniles were sampled from the RBDD rotary traps in 2009 compared to zero green sturgeon sampled in 2008.

Video Evaluation and Velocity Monitoring at the Interim Pump Screens

The FWS Red Bluff Office used underwater video cameras to test the suitability of available technology for monitoring and surveillance of the interim pump screens. Specifically, the surveillance was to document whether fish are being impacted by the pumps (i.e. impingement, impaired swimming/avoidance ability, impact with the screen, etc). The results from 2009 are still under analysis. This project is expected to continue in CY 2010.

The FWS Sacramento Office conducted velocity measurements (approach and sweeping velocities) at the interim pump fish screens to determine whether the pumps/screens are operating within specified parameters (e.g. CA State standards for juvenile salmonids, etc). A draft preliminary report of the CY 2009 findings is currently under BOR review. This monitoring is expected to continue during CY 2010.

Chinook salmon genetics assessments at the Red Bluff Diversion Dam

The FWS Red Bluff and Abernathy Fish Technology Center (AFTC) have been collaborating on an on-going study of Chinook salmon genetics at the RBDD, since 2007. Chinook salmon tissue samples are collected at the fish trapping facility of the RBDD. The fish trap is operated by the CA. Dept. of Fish and Game (CDFG). However, due to the severe State of California fiscal crisis, elevated water temperatures, and the limited utility of the trapping information, the CDFG did not operate the fish trap during CY 2009, and therefore, FWS could not collect tissue samples.

During CY 2009, the final report for the CY 2007 study was completed, and both electronic and printed copies of the report were made available to interested parties.

Water deliveries

Contracted water deliveries were made without interruption. However, the one month delay in closing the gates, as required by the Federal Court, necessitated the investment of approximately \$8,000,000 for an interim pumping plant and a very tight, five month construction schedule, from concept to operation, to provide up to 500 cfs of additional pumping capacity and a monitoring program. Even so, the much reduced water allocations caused by drought also contributed to the ability to deliver all water allocated for the 2009 water year.

Consistency with NODOS

Coordination with the NODOS effort continued via Reclamation's representative in the NODOS planning effort.

Table 1. FY 2010 Task, Costs, Schedules and Deliverables

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Restoration Fund Anticipated	Water and Related Resources Anticipated	State or Other Sources Anticipated	Total All Sources Anticipated
1.1	Program Management							
			There are three Program Management funding requirements. USBR, as the lead Federal agency; the USFWS, as a co-lead Federal agency; the Tehama-Colusa Canal authority (TCCA), as lead state agency.	9/30/2010				
1.1.1		0.25	USBR	9/30/2010		\$50,000	\$0	\$50,000
1.1.2		0.25	USBR	9/30/2010		\$50,000	\$0	\$50,000
	<u>Subtotal Costs</u>	0.5				\$100,000	\$0	\$100,000
1.2	Program Support							
1.2.1			TCCA Red Bluff Pumping Plant (separate funding source)			\$0	\$0	\$0
	<u>Subtotal Costs</u>					\$0	\$0	\$0
1.3	Technical Support							
1.3.1		0.4	Genetic Composition of Adult Chinook Salmon During Gates-In-Operation- FWS Abernathy Fish Tech. Center (Implicit in the monitoring requirements of the 2009 NMFS OCAP Section 11.2.1.3)	9/30/2010		\$60,000	\$0	\$60,000
1.3.2		0.9	Fish Passage Improvement Planning Project at Red Bluff Diversion Dam <u>2009 NMFS OCAP Action I.3.1, page 604</u>	9/30/2010		\$100,000	\$0	\$100,000
1.3.3		1.7	Green Sturgeon Population Assessment <u>2009 NMFS OCAP Section 11.2.1.3, pages 585 and 586</u>	9/30/2010		\$270,000		\$270,000
1.3.4		0.9	Green Sturgeon Egg and Larval Surveys, Interim Pumping Plant Evaluations-FWS Red Bluff FWO. (Essential for genetic studies required by 2000 NMFS OCAP BO, Appendix 2-B, task 1a, page 8)	9/30/2010		\$150,000		\$150,000
1.3.5		0.1	FWS - Sacramento response to correspondence	9/30/2010		\$20,000		\$20,000
	<u>Subtotal Costs</u>	4.0				\$600,000	\$0	\$600,000
1.4	Restoration Actions							
1.4.1		0.1	Improve fish passage at Red Bluff diversion dam.	9/30/2010		\$10,000	\$0	\$10,000
1.4.2		0.05	Improve fish passage of juveniles migrating down stream, particularly Chinook salmon - (fall, late fall, winter and spring runs). (Source document, CVPIA)	9/30/2010		\$5,000	\$0	\$5,000

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Restoration Fund Anticipated	Water and Related Resources Anticipated	State or Other Sources Anticipated	Total All Sources Anticipated
1.4.3		0.05	Improve upstream passage of adults. (Particularly Chinook Salmon - fall, late fall, winter and spring runs, and Steelhead). (Source document, CVPIA)	9/30/2010		\$5,000	\$0	\$5,000
1.4.4		0.05	Provide water to users (farmers, and wildlife refuges) served by the Tehama-Colusa and Corning Canals. (Source document, CALFED)	9/30/2010		\$5,000	\$0	\$5,000
1.4.5		0.05	Continue to allow Lake Red Bluff to exist if possible, by leaving the gates in during the summer months, while meeting Objectives 1.4.2, 1.4.3, 1.4.4, 1.4.6.	9/30/2010		\$5,000	\$0	\$5,000
1.4.6		0.05	Select and implement further actions to minimize fish passage problems at Red Bluff Diversion Dam (RBDD). (Source document, CVPIA).	9/30/2010		\$5,000	\$0	\$5,000
1.4.7		0.05	Revise if needed EIS/EIR	9/30/2010		\$5,000	\$0	\$5,000
	<u>Subtotal Costs</u>	0.4				\$40,000	\$0	\$40,000
1.6	Land - Water - and - Conveyance - Acquisitions							
1.6.1		0.6	Complete Land Acquisition for fish passage solution. <u>NMFS OCAP Action I.3.1, page 604</u>	9/30/2010		\$1,000,000	\$0	\$1,000,000
	<u>Subtotal Costs</u>	0.6				\$1,000,000	\$0	\$1,000,000
1.7	Outreach and Public Involvement							
1.7.1		0.1	Public Information Meetings to Address Concerns <u>2009 NMFS OCAP Action I.3.1, page 604</u>	9/30/2010		\$10,000		\$10,000
	<u>Subtotal Costs</u>	0.1				\$10,000	\$0	\$10,000
1.9	Environmental Compliance							
1.9.1		0.3	Construction support as required. <u>2009 NMFS OCAP Action I.3.1, page 604</u>	9/30/2010		\$100,000	\$0	\$100,000
	<u>Subtotal Costs</u>	0.3				\$100,000	\$0	\$100,000
1.11	Design & Construction							

Task or Subtask Number	Name of Activity	FTE's	Description of Activity	Completion Date	Restoration Fund Anticipated	Water and Related Resources Anticipated	State or Other Sources Anticipated	Total All Sources Anticipated
1.11.1		0.1	Complete construction specification drawings. <u>2009 NMFS OCAP Action I.3.1, page 604</u>	11/1/2009		\$50,000		\$50,000
1.11.2		10.0	Construction of facilities pumping plant. <u>2009 NMFS OCAP Action I.3.1, page 604</u>	5/15/2012		\$11,850,000	\$0	\$11,850,000
	<u>Subtotal Costs</u>	10.1				\$11,900,000	\$0	\$11,900,000
1.12	Monitoring							
1.12.1			Not at this time - Upon completion of construction	9/30/2010		\$0	\$0	\$0
	<u>Subtotal Costs</u>					\$0	\$0	\$0
	Reclamation total cost	14.6				\$13,520,000	\$0	\$13,520,000
	Service total cost	1.4				\$230,000		\$230,000
	Total cost	16				\$13,750,000	\$0	\$13,750,000

Table 2. Budget Breakdown

Task	Agency	FTE	LABOR		CONTRACTS		USBR Only Misc. Costs	Total Costs
			Direct Salary and Benefits Costs ^{1/}	FWS Only Overhead Assess: 22% of Direct Salary and Benefits Costs ^{2/}	Contract, Grant, and Agreement Costs	FWS Only Overhead Assess: 6% Contract Costs ^{2/}		
1.1 Program Management	FWS		\$0	\$0	\$0	\$0		\$0
	USBR	0.5	\$95,000		\$0		\$5,000	\$100,000
1.3 Technical Support	FWS	1.4	\$188,600	\$41,400	\$0	\$0		\$230,000
	USBR	2.6	\$360,000		\$0		\$10,000	\$370,000
1.4 Restoration Actions	FWS		\$0	\$0	\$0	\$0		\$0
	USBR	0.4	\$40,000		\$0		\$0	\$40,000
1.6 Land, Water and Conveyance Acquisitions	FWS		\$0	\$0	\$0	\$0		\$0
	USBR	0.6	\$100,000		\$900,000		\$0	\$1,000,000
1.7 Outreach and Public Involvement	FWS		\$0	\$0	\$0	\$0		\$0
	USBR	0.1	\$10,000		\$0		\$0	\$10,000
1.9 Environmental Compliance	FWS		\$0	\$0	\$0	\$0		\$0
	USBR	0.3	\$25,000		\$75,000		\$0	\$100,000
1.11 Construction	FWS		\$0	\$0	\$0	\$0		\$0
	USBR	10.1	\$1,294,800		\$10,605,200		\$0	\$11,900,000
Administrative Total - FWS			\$188,600	\$41,400		\$0		\$230,000
Contracts, Grants and Agreements Total - FWS					\$0			\$0
FWS Total Costs			1.4	\$188,600	\$41,400	\$0		\$230,000
Administrative Total - USBR			\$1,924,800				\$15,000	\$1,939,800
Contracts, Grants and Agreements Total - USBR					\$11,580,200			\$11,580,200
USBR Total Costs			14.6	\$1,924,800	\$11,580,200		\$15,000	\$13,520,000
TOTAL ALL			16	\$2,113,400	\$41,400	\$11,580,200	\$15,000	\$13,750,000

^{1/} For FWS only: The FWS develops a bio-rate which is the combination of both the salary/benefit and related administrative costs. The FWS simple definition reads, "It is an average \$\$ rate that is developed and used for estimating project costs. It incorporates a biologists' salary and benefits, supervisory, clerical and biologist support costs and all other office operating costs related to completing project tasks.

^{2/} FWS assesses an O/H Burden charge of 6% on all contracts/agreements related to budget object codes starting with 25, 41, and 32, and a charge of 22% on costs under all other budget object codes.

Table 3. Three Year Budget Plan 2011-2013

(\$ amounts in thousands)

Year	Description of Activities	Requested RF Funding	Total Requested W&RR Funding
2011	Manage, support, restoration and compliance		
	Tasks # 1.1 – 1.9 \$ 890		
	Pumping plant Construction Tasks # 1.11 \$ 50,000	\$0	\$50,890
2012	Manage, support, restoration and compliance		
	Tasks # 1.1 – 1.9 \$ 916		
	Pumping plant Construction Tasks # 1.11 \$ 76,125	\$0	\$77,041
2013	Manage, support, restoration and compliance		
	Tasks # 1.1 – 1.9 + 1.12 \$ 942		
	Pumping plant Construction Finish Tasks # 1.11 \$ 9,137	\$0	\$10,0790

Note: The FY 2011 – 2013 Budget Plan provides estimates of capability only. The amounts are displayed are those that might be reasonably appropriated each year. These figures do not reflect the future Congressional Appropriations process. All of these estimates will be adjusted annually as RF collections are realized.

Table 4. FY 2010 CVPIA Monitoring Projects

Project Description:	Identify temporal and spatial distribution patterns of green sturgeon spawning activity above, at, and below Red Bluff Diversion Dam by conducting egg deposition and larval drift surveys.
FY 2010 Project Complete?	No.
CVPIA annual work plan subtask number:	Red Bluff Fish Passage – CVPIA Section 3406(b)(10) Task 1.3.2
Scope of the monitoring effort:	Sacramento River centered on RBDD (between rm 354 and rm 430; RBDD = rm 391)
Product/deliverable:	Final Report of 2008-2010 survey results.
Cost:	The total cost for conducting this project in CY 2010 is approximately \$100,000. This project is part of a collaborative project between USFWS, USBR, and UC Davis.
Questions posed:	When and where do green sturgeon spawn in the Sacramento River? What are the distribution patterns of emerging sturgeon larvae? What effects, if any, do the operations of the RBDD have on green sturgeon spawning, eggs, and larvae.

Objectives:	Identify green sturgeon spawning habitat use in the Sacramento River and determine drift characteristics of emerging larvae.
Results – expected or actual:	The activity will produce digital files with raw spawning habitat characteristics data (in database) and a final report documenting the results of the 3 year monitoring activity.
Data collection methods:	Artificial substrate mats will be placed in multiple locations in the Sacramento river to sample newly deposited green sturgeon eggs at known and presumed spawning sites based on telemetry data. A benthic D net will be deployed at multiple sites to detect downstream migrating larvae leaving the spawning grounds to determine spatial and temporal drift patterns (e.g., nocturnal distribution patterns).
Data management:	Digital files with raw data will be archived by the USFWS in an Access database. A final report documenting the results of the project will be available on the USFWS Red Bluff office website.
Assessment:	The timing, location, and duration of spawning adult green sturgeon in the vicinity of the RBDD on the Sacramento River will be evaluated. The environmental characteristics of sturgeon spawning habitat and larval migration habitat will be described.
Use of information in future decision making:	Adult spawner distribution, timing, and habitat use data coupled with larval drift characteristics and habitat use data will assist various fishery and water management operators with identifying future river management actions (i.e., temperature and flow operations) and future restoration actions for this species in the Sacramento River. Green sturgeon is listed as threatened under the ESA and these data will assist USFWS and NMFS with recovery planning and implementation efforts.
NMFS OCAP BO RPA	Yes. RPA Action I.3.4: Measures to Compensate for Adverse Effects of Interim Operations on Green Sturgeon (p. 605).

Project Description:	Green Sturgeon Population Assessment Determine spatial and temporal movements of acoustically-tagged green sturgeon. Identify adult green sturgeon holding and spawning habitats upstream and downstream of Red Bluff Diversion Dam (RBDD). Evaluate potential impacts of the RBDD on upstream and downstream migration of adult green sturgeon.
FY 2009 Project Complete?	No, will continue to track and monitor acoustically-tagged green sturgeon that remain in the study area.
CVPIA annual work plan subtask number:	1.3.3
Scope of the monitoring effort:	Sacramento River: Upstream and Downstream of the RBDD between Keswick Dam and Hamilton City.
Product/deliverable:	Receiver data will be stored in a database maintained by the Central Valley Fish Tracking Consortium and National Marine Fisheries Service. Mobile tracking and temperature data will be maintained in Excel files by Reclamation and will be available on request. Data will be analyzed and documented in final report.
Cost:	The total cost of this project in FY 2010 will be approximately \$270,000.
Questions posed:	What are the potential impacts of the RBDD on green sturgeon migration, spawning, and behavior? What is the behavior of post-spawning adult green sturgeon? Do they hold over or do they make rapid downstream migrations once spawning is completed and what are the cues (e.g. temperature, flows, photoperiod, etc.) for downstream migration. Where are the holding and spawning habitats within the Sacramento River?
Objectives:	Monitor and evaluate habitat utilization, spawning behavior, and migration of acoustically-tagged adult green sturgeon downstream and upstream of the Red Bluff Diversion Dam (RBDD) Monitor and evaluate the potential impacts of RBDD on adult green sturgeon migration, spawning, and behavior. Identify potential holding and spawning habitats that could be utilized by green sturgeon.
Results – expected or actual:	Monitoring and tracking acoustically-tagged green sturgeon will be continued in 2010 with expected results to be similar to 2009. Determine spatial and temporal movements of acoustically-tagged green sturgeon. Monitor downstream passage under the gates of the RBDD. Identify and characterize new spawning and holding habitat.

Data collection methods:	A mobile tracking receiver (Vemco VR-100) and directional hydrophone was utilized to track acoustically-tagged adult green sturgeon movements in real-time and locate their holding and spawning habitats. Submersible stationary receivers (Vemco VR2W), capable of identifying adult green sturgeon implanted with acoustic transmitters, were strategically located upstream and downstream of the RBDD and recorded the date and time that the acoustically-tagged adult green sturgeon was in the vicinity of the receiver. Also, a temperature datalogger was deployed at each stationary receiver location to record water temperature hourly.
Data management:	Receiver data will be stored in a database maintained by the Central Valley Fish Tracking Consortium and National Marine Fisheries Service. Mobile tracking and receiver data will be maintained in Excel files by Reclamation and will be available on request. Data will be analyzed and documented in final report authored by UC-Davis, USFWS, and Reclamation personnel.
Assessment:	Spatial and temporal movements of adult green sturgeon during their pre-spawning and post-spawning migration and their spawning behavior within the Sacramento River will be evaluated. Adult green sturgeon holding and spawning habitat will be identified and evaluated for physical and environmental characteristics.
Use of information in future decision making:	Spatial and temporal movements, habitat use, and green sturgeon behavior data will assist NMFS and AFRP in the recovery of this threatened species listed under the ESA. The data will also assist Reclamation in the operation of the RBDD.
NMFS OCAP BO RPA	<p>YES</p> <p>Appendix 2-B “Summary of Proposed Conservation Measures to Offset Operations of the Red Bluff Diversion Dam”</p> <p>Table 3: Recommended Conservation Measures for Green Sturgeon.</p> <ol style="list-style-type: none"> 1. Genetic evaluation of green sturgeon effective spawning population. 2. Telemetric studies of movements of adult green sturgeon including the effects of RBDD. 3. Characterization of green sturgeon spawning grounds. 4. Juvenile green sturgeon movements and identification of critical rearing habitat.

	<p>5. Spawning of wild caught green sturgeon and rearing of juveniles for use in telemetric studies.</p> <p>6. Develop screen criteria.</p> <p>7. RBDD gate configuration management team.</p>
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