STAFF SUMMARY FOR APRIL 15-16, 2020

14. GENERAL PUBLIC COMMENT

Today's Item **Information ☒** **Action ☐**

Receive public comments, petitions for regulation change, and requests for non-regulatory actions for items not on the agenda.

Summary of Previous/Future Actions

- **Today receive requests and comments** **Apr 15-16, 2020; Teleconference**
- Consider granting, denying or referring Jun 24-25, 2020; Santa Ana

Background

This agenda item is primarily to provide the public an opportunity to address FGC on topics not on the agenda. Staff also includes written materials and comments received prior to the meeting as exhibits in the meeting binder (if received by written comment deadline), or as supplemental comments at the meeting (if received by supplemental comment deadline), for official FGC "receipt."

Public comments are generally categorized into three types under general public comment: (1) petitions for regulation change; (2) requests for non-regulatory action; and (3) informational-only comments. Under the Bagley-Keene Open Meeting Act, FGC cannot discuss or take action on any matter not included on the agenda, other than to schedule issues raised by the public for consideration at future meetings. Thus, petitions for regulation change and non-regulatory requests generally follow a two-meeting cycle (receipt and direction); FGC will determine the outcome of the petitions for regulation change and non-regulatory requests received at today's meeting at the next regular FGC meeting following staff evaluation (currently Jun 24-25, 2020).

As required by the Administrative Procedure Act, petitions for regulation change will be either denied or granted and notice made of that determination. Action on petitions received at previous meetings is scheduled under a separate agenda item titled "Petitions for regulation change." Action on non-regulatory requests received at previous meetings is scheduled under a separate agenda item titled "Non-regulatory requests."

Significant Public Comments

1. New petitions for regulation change are summarized in Exhibit 1, and the original petitions are provided as exhibits 3-4. A comment from one of the petitioners is included in Exhibit 5.
2. Requests for non-regulatory action are summarized in Exhibit 2, and the original requests are provided as exhibits 6-8.
3. Informational comments are provided as exhibits 9-12.

Recommendation

FGC staff: Consider whether any new future agenda items are needed to address issues that are raised during public comment.

Exhibits

1. Summary of new petitions for regulation change received by April 2, 2020 at 5:00 p.m.
2. Summary of requests for non-regulatory action received by April 2, 2020 at 5:00 p.m.
3. Petition #2020-003: *Public uses of Ballona Wetlands Ecological Reserve*
4. Petition #2020-004: *Trinity steelhead season expansion and access restriction*
5. Email from Walter Lamb regarding Petition #2020-003 (Ballona), received Mar 30, 2020
6. Email from Ken Loomis with continued concerns about condition of kelp forests, received Feb 22, 2020
7. Email from Chris Markoff requesting to postpone meetings due to COVID-19, received Mar 28, 2020
8. Letter from David T. Willett regarding Santa Barbara Sea Ranch's application for a state water bottom lease, received Mar 25, 2020
9. Eleven emails from Eric Mills regarding live food markets, bullfrogs, and various diseases (see exhibit for a sample received Feb 25, 2020)
10. Email from Jerry Hong supporting former Petition #2019-12 (Clams), received Feb 28, 2020
11. Three email transmissions from Kathy Lynch with letter from Randall S. Walker, President, Outdoor Sportsmen's Coalition of California regarding DFW Service Based Budgeting, received Mar 26, 2020
12. Email from Marina Sebastiano regarding Petition #2019-009 (Ballona), received Apr 1, 2020

Motion/Direction (N/A)

CALIFORNIA FISH AND GAME COMMISSION
RECEIPT LIST FOR PETITIONS FOR REGULATION CHANGE: RECEIVED BY 5:00 PM ON APRIL 2, 2020
Revised 04/06/2020

Tracking No.	Date Received	Name of Petitioner	Subject of Request	Short Description	FGC Receipt Scheduled	FGC Action Scheduled
2020-003	2/6/2020	Walter Lamb	Public uses of Ballona Wetlands Ecological Reserve	Eliminate authorized recreational uses in Area C and currently allowed parking in existing designated areas.	4/15-16/2020	6/24-25/2020
2020-004	3/10/2020	Kyle De Julio	Trinity steelhead	Change the season opening for steelhead from April 1 to January 1 on the Trinity River mainstem from 250 feet downstream of Lewiston Dam to the Old Lewiston Bridge, and restrict boat access, except for those with disabilities.	*Note: this petition is currently under review by FGC staff, and has not been formally accepted.*	

CALIFORNIA FISH AND GAME COMMISSION - NONREGULATORY REQUESTS - RECEIPT

Revised 4/13/2020

FGC: California Fish and Game Commission | DFW: California Department of Fish and Wildlife | WRC: Wildlife Resources Committee | MRC: Marine Resources Committee

Date Received	Subject	Short Description	Name/ Organization of Requestor	Category
2/22/2020	Kelp forests	Allow divers to help prevent kelp forest loss.	Ken Loomis	Marine
3/28/2020	Postpone meeting	Postpone meetings due to COVID-19.	Chris Markoff	Marine
3/25/2020	Concern over DFW/FGC inactivity on application for state water bottom lease	After 2 years, DFW and FGC staff have hindered progress on consideration of lease application and have requests that are unreasonable. Provided 28 pages of documentation of efforts to coordinate with FGC and DFW staff on its application process and environmental review. Gave 6 key comments (p. 27) and asks: What can be done to remedy this and encourage consideration of this aquaculture operation?	David Willett Santa Barbara Sea Ranch	Marine

Tracking Number: (2020-003)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, 1416 Ninth Street, Suite 1320, Sacramento, CA 95814 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. Person or organization requesting the change (Required)
Name of primary contact person: Walter Lamb, Ballona Wetlands Land Trust
Address:
Telephone number:
Email address: landtrust@ballona.org

2. Rulemaking Authority (Required) - Reference to the statutory or constitutional authority of the Commission to take the action requested: Fish and Game Code Section 1580 ["The commission may adopt regulations for the occupation, utilization, operation, protection, enhancement, maintenance, and administration of ecological reserves."]

3. Overview (Required) - Summarize the proposed changes to regulations: This petition proposes to amend Section 630 of the Code of California Regulations, Title 14 to strike the second sentence from paragraph (h)(3) so that it reads "Pets, including dogs and cats, are prohibited." The purpose of this proposed change is to maximize the native habitat potential for the ecological reserve by terminating incompatible uses. The Fish and Game Commission should evaluate each affected use independently, and make factual findings based on substantial evidence for each use in order to determine if some uses should continue.,

4. Rationale (Required) - Describe the problem and the reason for the proposed change: California taxpayers spent $139 million 16 years ago to acquire the land which now makes up the Ballona Wetlands Ecological Reserve. This included approximately $129 million of Proposition O public bond funds and $10 million of Proposition 12 public bonds funds. Neither of these public bond fund measures was approved by the voters to provide parking space for non-ecological reserve use or to maintain baseball fields.

Section 630 currently provides the Department with discretion as to whether a more appropriate use of affected areas should take precedence over the existing uses. There is no question that these areas can and would be more appropriately used if the Department exercised that discretion, but the Department

has not done so. Instead, the Department has allowed these uses to continue without conducting any analysis to determine whether other uses of the affected land would be more appropriate, despite assuring this Commission in 2005 that it would undertake such an analysis. Therefore the only available remedy available to stakeholders of the ecological reserve is to request this regulatory change.

The Land Trust recognizes that each specific use potentially impacted by this petition has a different set of circumstances. The Commission should adopt separate factual findings, based on substantial evidence, to determine whether each of the following uses furthers the conservation goals of the state:

- Los Angeles County Department of Beaches and Harbors Parking

- Los Angeles Sheriff's Department Parking

- Commercial Parking (currently prohibited, with potential to return)

- Little League Baseball Fields

Los Angeles County currently pays the Department of Fish and Wildlife $1,608 per year to lease approximately 254 parking spaces, the same amount it has paid since approximately 1995

Existing parking uses violate the public bond fund measures used to acquire the land, violate the temporary Coastal Development Permits issued in or around 1988, and violates the prohibition in the California Constitution against gifts of public funds, given the discrepancy between the fair market value of the parking spaces and what the County actually pays the Department pursuant to the lease agreement.

New Information:

Since the Commission last denied a similar petition at its June 2019 meeting, substantial new information has surfaced. Most notably, the Department's Director assured the Commission in April 2019 that the Department would not include a parking structure in its final environmental impact analysis. However, the final EIR released in December 2019 did, in fact include a parking structure.

At the Commission's December 2017 meeting, multiple Commissioners urged the Department's Regional Manager for Region 5 to include analysis in the final EIR of an alternative that removed some or all of the existing paved parking areas in the ecological reserve. However, the final EIR included no such analysis and instead cited the regulation which the Commission has so far declined to amend as justification for the existing parking areas.

Multiple entities, including the California Coastal Commission, suggested the need for a parking analysis to justify the high number of parking spaces being included in the draft EIR. However the final EIR included no such analysis.

This new information warrants a reconsideration of this issue by the Commission..

SECTION II: Optional Information

5. Date of Petition: February 06, 2020

6. Category of Proposed Change

☐ Sport Fishing
☐ Commercial Fishing
☐ Hunting
☒ Other, please specify: Ecological Reserves

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)

☒ Amend Title 14 Section(s):630
☐ Add New Title 14 Section(s): Click here to enter text.
☐ Repeal Title 14 Section(s): Click here to enter text.

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition 2017-002 and 2019-001
Or ☐ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: As soon as practically possible, but not an emergency

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents: The Land Trust has previously provided a substantial record showing that the parking areas in question were created and maintained to further the interests of the County of Los Angeles, not to further the purposes of the ecological reserve. Those records should be incorporated into this petition by reference. We will provide additional documentation upon request.

The Ballona Wetlands Final EIR and Draft EIR are available on the CDFW site: https://www.wildlife.ca.gov/Regions/5/Ballona-EIR

The archived audio of the 2005 Fish and Game Commission hearing is at http://cal-span.org/media/audio_files/cfg/cfg_05-08-19/cfg_05-08-19.mp3 and the discussion of the parking lots occurs at 223 minutes and 25 seconds (3:43.25).

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: Eliminating the existing parking lease with Beaches and Harbors and the Sheriff's Department would result in the loss of $1,608 in annual lease payments for each lot, which is substantially below market value. The land Trust hat offered to more than offset that amount if the paved lots can be converted to more appropriate use.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

SECTION 3: FGC Staff Only

Date received: 2/6/2020

FGC staff action:

- ☐ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: _____

Meeting date for FGC consideration: _____

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____

Tracking Number

- ☐ Granted for consideration of regulation change

Tracking Number: (2020-004)

To request a change to regulations under the authority of the California Fish and Game Commission (Commission), you are required to submit this completed form to: California Fish and Game Commission, (physical address) 1416 Ninth Street, Suite 1320, Sacramento, CA 95814, (mailing address) P.O. Box 944209, Sacramento, CA 94244-2090 or via email to FGC@fgc.ca.gov. Note: This form is not intended for listing petitions for threatened or endangered species (see Section 670.1 of Title 14).

Incomplete forms will not be accepted. A petition is incomplete if it is not submitted on this form or fails to contain necessary information in each of the required categories listed on this form (Section I). A petition will be rejected if it does not pertain to issues under the Commission's authority. A petition may be denied if any petition requesting a functionally equivalent regulation change was considered within the previous 12 months and no information or data is being submitted beyond what was previously submitted. If you need help with this form, please contact Commission staff at (916) 653-4899 or FGC@fgc.ca.gov.

SECTION I: Required Information.

Please be succinct. Responses for Section I should not exceed five pages

1. Person or organization requesting the change (Required)
Name of primary contact person: Kyle De Juilio
Address:
Telephone number:
Email address:

2. Rulemaking Authority (Required) - Reference to the statutory or constitutional authority of the Commission to take the action requested: State Special Regulation (14CCR 7.50)

3. Overview (Required) - Summarize the proposed changes to regulations: Change from existing regulation provided below to open dates of January 1 through September 15. Only artificial flies. Restrict boat access limited to those with disability.

Trinity River mainstem from 250 feet downstream of Lewiston Dam to the Old Lewiston Bridge.	April 1 through September15. Only artificial flies	2 hatchery trout or Hatchery Steelhead

The Commission should consider the recommendation for changing the opening date from April 1 to January 1, independently of the restriction to boat access, excluding those with disability.

4. Rationale (Required) - Describe the problem and the reason for the proposed change: This fishery has been extended in the past related to flow management on the Trinity River, to provide for consistent or increased opportunity. Current flow management considerations merit another review of fishing opportunity in this reach. Additionally, research has shown that the hatchery impacts in this reach of river are high (Quinn and De Juilio 2012). The genetic impacts of straying salmon from the hatchery reduce the fitness of the naturally produced population. Redd superimposition is a concern in this reach of river as it exhibits the highest concentration of spawning for Chinook Salmon in the Trinity River (Gough et al. 2019). Hatchery steelhead spawn after salmon runs and cause impacts to salmon

eggs incubating in the gravels when they spawn in the same locations. Other concerns also include genetic, competition, and predation impacts to naturally produced stocks. There is reason to believe that juvenile salmon and salmon eggs are preyed upon by hatchery steelhead in freshwater environments (Naman 2008). These impacts of the hatchery steelhead program are affecting the most abundant runs of SONCC Coho Salmon, listed as threatened under the federal ESA, and Upper Klamath-Trinity River Spring-run Chinook Salmon, petitioned for listing under CESA and ESA, in California waters, and could be partially mitigated by the propose changes to State Special Regulation 14 CCR 7.50. Hatchery steelhead are released to the Trinity River to increase harvest opportunity, any fish in excess of those required for broodstock at the Trinity River Hatchery should be harvested to reduce their impacts to natural production.

A restriction to boat access, excluding those with disability, in this reach is recommended. This is due to the opinion from several local guides and anglers that those who are fishing from boats in this reach are often targeting holding spring Chinook Salmon during the summer months prior to spawning. These fish are currently petitioned for listing under the Federal ESA and CESA. The life history of these fish makes them vulnerable to fishing for an extended period of time in a limited reach below Lewiston Dam. However, we recognize that restricting boat access to anadromous waters would be a departure from current regulation and ask that you consider this suggestion independently from the change in opening date.

SECTION II: Optional Information

5. Date of Petition: 12/24/2019

6. Category of Proposed Change

- ☒ Sport Fishing
- ☐ Commercial Fishing
- ☐ Hunting
- ☐ Other, please specify:

7. The proposal is to: (*To determine section number(s), see current year regulation booklet or https://govt.westlaw.com/calregs*)

- ☐ Amend Title 14 Section(s): 7.50
- ☐ Add New Title 14 Section(s):
- ☐ Repeal Title 14 Section(s):

8. If the proposal is related to a previously submitted petition that was rejected, specify the tracking number of the previously submitted petition #2019-009
Or ☐ Not applicable.

9. Effective date: If applicable, identify the desired effective date of the regulation.
If the proposed change requires immediate implementation, explain the nature of the emergency: January 1, 2021

10. Supporting documentation: Identify and attach to the petition any information supporting the proposal including data, reports and other documents:

Naman, S. 2008. Predation By Hatchery Steelhead On Natural Salmon Fry In The Upper-Trinity River, California. A Thesis Presented to the Faculty of Humboldt State University.

Quinn, S. and K. De Juilio. 2012. An Assesment of Adult Hatchery Steelhead Straying Behavior Following Release into the Trinity River from 2009-2011. Yurok Tribal Fisheries Program – Trinity Division.

Gough, S. A., N. A. Som, S. Quinn, W. C. Matilton, A. M. Hill, and W. Brock. 2019. Mainstem Trinity River Chinook Salmon Spawning Survey, 2017. USFWS, Arcata California. https://www.fws.gov/arcata/fisheries/reports/dataSeries/2017%20SpawningSurveyReport_FINAL.pdf

11. Economic or Fiscal Impacts: Identify any known impacts of the proposed regulation change on revenues to the California Department of Fish and Wildlife, individuals, businesses, jobs, other state agencies, local agencies, schools, or housing: This would likely increase contributions to the local economy of Trinity County by anglers during the months of January, February, and March annually by paying for services including: food services, lodging, guides, tackle, fuel, and others.

12. Forms: If applicable, list any forms to be created, amended or repealed:

Click here to enter text.

SECTION 3: FGC Staff Only

Date received: 3/10/2020

FGC staff action:

- ☐ Accept - complete
- ☐ Reject - incomplete
- ☐ Reject - outside scope of FGC authority

Tracking Number

Date petitioner was notified of receipt of petition and pending action: _____

Meeting date for FGC consideration: _____

FGC action:

- ☐ Denied by FGC
- ☐ Denied - same as petition _____

Tracking Number

- ☐ Granted for consideration of regulation change

An Assessment of Adult Hatchery Steelhead Straying Behavior Following Release into the Trinity River from 2009-2011

Shane Quinn & Kyle De Juilio

Yurok Tribal Fisheries Program – Trinity Division

Abstract. - Current spawning protocols at Trinity River Hatchery (TRH) require that spawned and unspawned adult hatchery-produced steelhead are released back to the Trinity River after weekly egg-take quotas are met. To investigate the effects of this practice, we implanted TRH steelhead with PIT and radio-telemetry tags prior to being released from the hatchery to monitor movement and behavior during the 2009-2011 spawning seasons. During the three year study, tagged TRH steelhead strayed into monitored tributaries at an average rate of 9.9%, for a total of 216 straying incidents. The majority of tributary straying (67.1%) occurred in Deadwood Creek, which is the most proximal tributary to TRH. We observed that 53.5% of tagged TRH steelhead return to the hatchery after release, which corresponds with 874 tagged TRH steelhead that never returned. Of the 874 non-returns, 212 were observed to spend an average of 17.1 days in the uppermost 2 kilometers of the main stem Trinity River near TRH. The tagged steelhead that did return to TRH spent an average of 16.8 days in the river system before returning to the hatchery. We found that the current protocols at Trinity River Hatchery increase the potential for hatchery and natural populations to interact, both in the main stem Trinity River and its tributaries.

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Introduction:

Hatcheries were established throughout the Western United States to mitigate for declining salmon and steelhead populations (Hilborn 1992). Recent studies report that mixing hatchery and natural populations have a negative ecological impact on natural populations (McMichael et al. 1999; Kostow and Zhou 2006), and can result in decreased natural production and genetic viability (Reisenbichler and Rubin 1999; Quinn 2001; McLean et al. 2004).

In 1957, the Bureau of Reclamation began construction on the Trinity River Division (TRD) of the Central Valley Project, which transfers water from the Klamath Basin to the Sacramento Basin. The Division consists of a series of dams, lakes, power plants, tunnels, and other related facilities. At times, 90% of the Trinity River's flow was diverted to the Sacramento Basin, contributing to the decline of salmon and steelhead (*Oncorhynchus* spp.*)* populations (Stene 1994). Lewiston Dam, part of the TRD, was constructed in 1963 near Lewiston, California, and is now the uppermost limit of anadromous fish migration on the Trinity River. Trinity River Hatchery (TRH), located at the base of Lewiston Dam, was constructed to mitigate for the loss of 109 miles of anadromous fish habitat upstream of the dam (CDFG 1963).

Current protocols for TRH steelhead broodstock collection are designed to maintain run-timing characteristics of the natural population through weekly egg-take quotas. As a result, all steelhead arriving at the hatchery (regardless of natural/hatchery origin or spawning condition/ripeness) are released back to the Trinity River once the weekly egg-take quota is achieved. In 2007 and 2008, the two years prior to this project, in-river returns of TRH steelhead *Oncorhynchis mykiss* far exceeded the production goal of 22,000 for the Trinity Basin (Table 1). The increased hatchery return estimates caused concern among stakeholders and managers that hatchery practices could be negatively impacting naturally-produced steelhead stocks in the main stem Trinity River and tributaries. Furthermore, recent spawning surveys suggest TRH steelhead stray into tributaries close to the hatchery at an unknown rate (Hill 2008).

Table 1. Run-size estimates from the CDFG Willow Creek weir for the six years prior to project implementation (2003 to 2008). Estimates are partitioned to include the hatchery and natural proportions of the overall in-river run-size estimates.

Year	Hatchery Estimate	Natural Estimate	% TRH Steelhead of Total Run-size Estimate
2003	14,408	4,650	75.6%
2004	19,245	3,947	83.0%
2005	15,038	4,817	75.7%
2006	14,049	5,363	72.4%
2007	32,609	8,781	78.8%
2008	46,379	7,506	86.1%

During the steelhead spawning seasons of 2009-2011, the Yurok Tribal Fisheries Program (YTFP) conducted a monitoring effort to determine whether the current protocols at TRH

increase the potential for hatchery and natural populations to interact, both in the main stem Trinity River and its tributaries. To investigate the potential for interaction, YTFP staff implanted TRH steelhead with PIT and radio-telemetry tags prior to being released from the hatchery to monitor movement and behavior.

The objectives of this project were to:

1) Verify and quantify straying of TRH-produced steelhead released back to the Trinity River after an initial return to TRH;

2) Determine spatial and temporal distribution of hatchery straying after being released back to the Trinity River;

3) Enumerate TRH steelhead returning to TRH multiple times;

4) Evaluate the stray rate of TRH steelhead prior to hatchery entrance.

Methods:

Study Area

The Trinity River is the largest tributary of the Klamath River Basin, the second largest river system in California, which drains approximately 31,000 km^2 in Northern California and Southern Oregon, with the Trinity River draining approximately 7,690 km^2 in California (Figure 1). It once supported large anadromous populations of fall and spring run Chinook salmon *Oncorhynchus tshawytscha* , coho salmon *O. kisutch*, and steelhead, as well as Pacific lamprey (*Lamptera tridentata*) and green sturgeon (*Acipenser medirostris*) that supported commercial and recreational fisheries, as well as cultural, subsistence, and commercial needs of native tribes throughout the region. The Klamath-Trinity River Basin is still an important producer of anadromous salmonids and the number one producer of steelhead in California (Hopelain 1998).

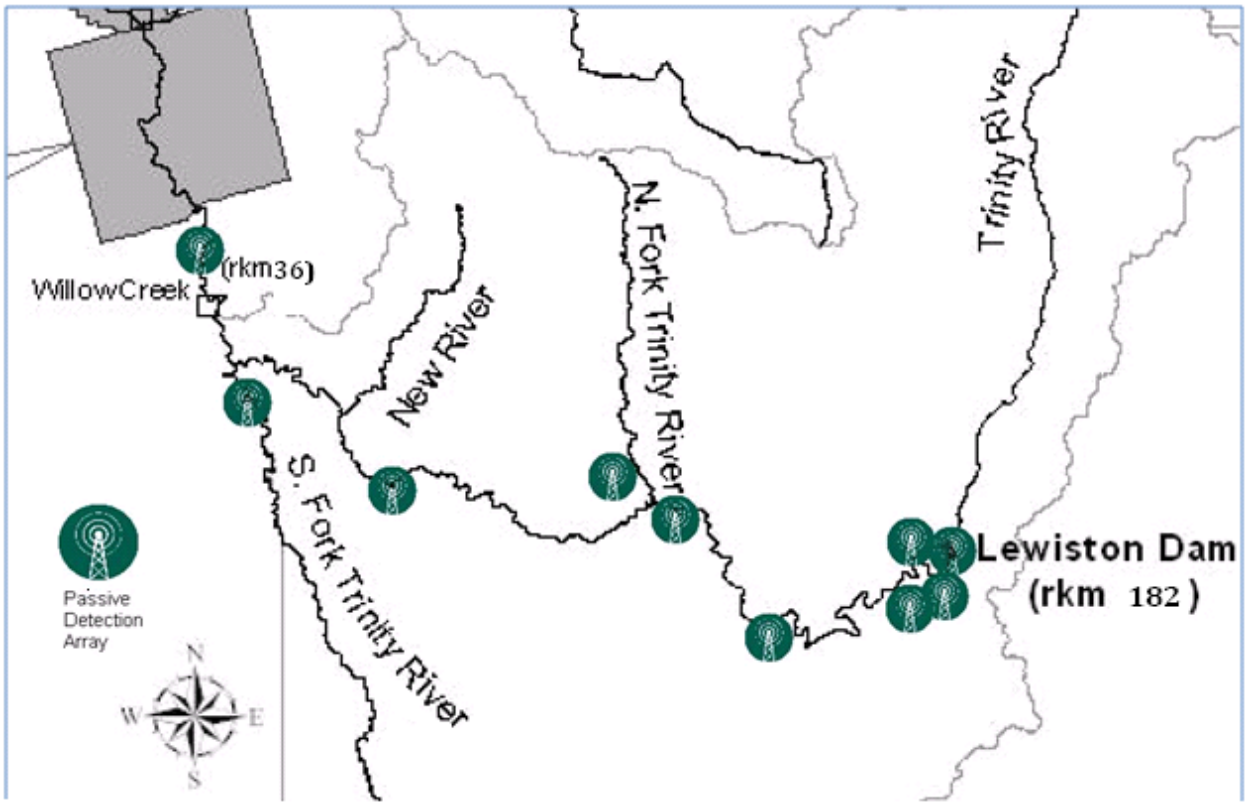

Figure 1. Map of the study site, including radio-telemetry and PIT monitoring sites. The radio-telemetry sites were used during 2010, whereas PIT monitoring sites were used during all three years of study (2009-2011).

The study area extended downstream from river kilometer (rkm) 182 at TRH to below Willow Creek, CA (rkm 36) where the California Department of Fish and Game (CDFG) operate an Alaskan style weir.

This study focused on the upper river and its tributaries found closest to Lewiston Dam, where flow regime is driven by releases from Lewiston Dam and there is very little tributary accretion. During the majority of this study, the water volume released from Lewiston Dam was at base flow, 300

cubic feet per second (cfs), and the end of the study coincided with spring dam releases beginning in late April and range from 2,000-11,000 cfs, depending on the water year type.

The first three streams below Lewiston Dam: Deadwood Creek (DC), Rush Creek (RC), and Grass Valley Creek (GVC), were monitored with Passive Integrated Transponder (PIT) scanning equipment. In addition, the two largest tributaries of the Trinity River, South Fork Trinity River (SFTR) and North Fork Trinity River (NFTR), were monitored using radio-telemetry equipment during 2010. The upper river tributaries (DC, RC, and GVC) were selected due to the increased potential of straying associated with their proximity to TRH, while the lower tributaries (SFTR and NFTR) were chosen because of size and overall importance to the entire Trinity River system.

Figure 2. Photo of the upstream antenna at the Rush Creek tributary PIT monitoring site.

Fish Collection and Tagging

Adult TRH steelhead were tagged with a PIT tag (*Texas Instruments*®: 23mm x 3.85mm, 0.6 g) to monitor their movements after they were released back to the Trinity River. Steelhead were collected during normal CDFG hatchery spawning operations conducted weekly each year beginning the first week of January through the second week of March. Fish entering the spawning facilities are anesthetized using CO_2 and examined to determine species, sex, and reproductive viability,

presence of clips or tags, and forklength. Hatchery personnel select fish for weekly gamete collection and all fish, regardless of whether it was spawned or not, are recycled back to the river by way of an outflow tube that terminates at the bottom of the hatchery fish ladder. To qualify for gamete collection, steelhead must be of hatchery origin, 41 cm in length or larger, and reproductively ripe. Only steelhead that met the hatchery qualifications and were not used during the weekly gamete collection were tagged. All fish were handled and tagged in accordance with industry standard protocols (Columbia Basin Fish and Wildlife Authority 1999). Forklength, sex, ripeness, and PIT tag number were recorded for each steelhead tagged. Tags were injected into the peritoneal cavity of the fish using a surgical grade 8-gauge hypodermic needle. The wound was dressed with *Duro*® quick drying gel adhesive, an effective alternative to applying sutures (Nemetz and Macmillan 1988). All tagged fish were immediately released down the outflow tube, in accordance with normal hatchery protocols.

During the 2009 TRH spawning season, a subsample of PIT-tagged steelhead (see Table 2) were randomly chosen to receive a double-mark, and were implanted with a radio-telemetry tag (*Sigma Eight*® Shark: 45mm x 17mm, 15.7 g). The double-marking technique is essential for evaluating tag retention (Bateman et al 2009). Adult fish could not be sedated using a narcotic agent due to potential human consumption; therefore, gastro-implantation was chosen over the more commonly used surgical implantation method. The gastro-implantation process reduces handling and recovery times in comparison to other surgical techniques (Keefer 2004). Radio-telemetry tags were inserted immediately prior to PIT tag injection. Tags were wrapped with bands of surgical tubing to prevent regurgitation and covered with glycerin to ease insertion into the stomach through the esophagus (Mellas and Haynes 1985).

The 2010 assessment was expanded to include an additional tagging location at the CDFG weir located in Willow Creek, CA. This weir has been operated annually since 1979 to monitor upstream migration timing and provide population estimates of anadromous salmonids for the entire Trinity River Basin. Tagging at the weir was performed during normal CDFG daily weir operations. All fish caught at the weir trap were examined by CDFG personnel to determine species, forklength, and overall health condition. All healthy salmonids were given a spaghetti tag (Floy® Tag FT-4 spaghetti tag) to determine annual run-size estimates for the Trinity River Basin, and a sub-sample of selected steelhead also received PIT and radio-telemetry tags. All tagged fish recovered in a modified fyke net trap in the river current before release above the weir in low flow.

Table 2. Location, date, and number of adult TRH steelhead tagged.

Year/Location	Dates of Tagging	PIT Tags	Radio Telemetry Tags
2009			
TRH	12/11/08 – 2/25/09	473	110
2010			
WC Weir	9/28/09 – 11/20/09	147	132
TRH	12/23/09 – 3/10/10	800	0
2011			
TRH	12/21/10 – 3/8/11	634	0
Total		*2054*	*242*

Data Collection

Adult TRH steelhead implanted with a PIT tag could be detected at any PIT monitoring sites in the upper Trinity River including tributaries, the main stem Trinity River, and TRH facilities (Figure 2). A PIT monitoring site is comprised of three components: a multiplexor unit (MUX), one or more in-stream antenna(e), and a power source. The antenna is a loop of insulated copper wire that emits an energy field and is connected to an *Oregon RFID*® MUX. The MUX controls the amperage and frequency of power transmitted to the antenna, and also receives and stores the PIT tag detections (tag ID code, date and time of detection). Tag detections occur when a tag is activated by coming into contact of the energy field, or "read range", of the antenna and broadcasts its unique ID code. The read range of an antenna is determined by the size and shape of the antenna, the distance between the antenna and the multiplexor, and by localized electrical interference (e.g. nearby power lines, iron ore in streambed, etc.). As a result, the read ranges between antennas varied considerably with a range of 6" to 5'. All sites were installed with two antennae, so that directional movements (i.e. upstream/downstream) could be ascertained. The power source for each site was deep-cycle 12 V batteries connected to a solar panel (50w – 85w), or AC power was used if available. Data (detection histories) would be collected weekly by connecting the MUX to a laptop PC or PDA equipped with *PTLogger* software and performing a download.

The 242 steelhead that were double-tagged in 2009 & 2010 could also be detected by fixed-site and mobile radio tracking, in addition to detection at PIT monitoring sites. Fixed sites were equipped with a 3-element YAGI antenna connected to either a *Lotek*® SRX400 receiver or *Orion*® receiver and powered by deep-cycle 12 V batteries connected to a solar panel (50w – 85w). Antennas were placed two to three meters above the ground to maximize reception at each site (Mech 1983). Radio tags were programmed to broadcast over one frequency (164 MHz) using four separate channels, which reduced the scan time of the receivers. Receivers stored detection events, but had limited memory and were downloaded weekly with WINhost (*Lotek*®) or OrionTool (*Grant Systems Engineering*®) software. Mobile radio tracking was conducted by foot, boat, or car on a semi-weekly basis using a *Lotek*® receiver attached to a collapsible directional antenna. Tag detections were recorded by date and location (rkm), and monitored to determine if it was moving or stationary, potentially indicating regurgitation or mortality.

Analysis

Detection Efficiencies

Detection efficiencies of PIT antenna arrays are essential to determine the correct proportion of fish that exhibit a particular trait (Horton et al. 2007). In this study, low antenna detection efficiencies would potentially result in the underestimation of straying events. The primary method used to determine antenna efficiencies at each monitoring site is called 'in situ efficiency', and is commonly used in PIT studies (Zydlewski et al. 2006). This method provides efficiency estimates using detections at each site to compare antenna efficiencies at each site. Below is the antenna efficiency (E) equation used for either antenna, in this case it is the efficiency for antenna1:

$$E_{antenna1} = (d_{common})/(d_{unique\ antenna2} + d_{common})$$

Where:

d_{common} = the number of tags detected by both antennae

$d_{unique\ antenna2}$ = the number of tags detected only at antenna2

In 2010, a second method to determine efficiencies was conducted with dummy tags by simulating a detection event at each tributary site and the hatchery ladder site. The same tags implanted in TRH steelhead were inserted into a rectangular piece of wood. The float test was performed at least twice at each site tested by releasing ten dummy tags roughly 30 feet upstream of the antennae array. The percentage of successful detections was then determined for both antennae by dividing the number of detections at each antenna by the number of tags that were known to have passed by the antenna.

Tag Retention

In 2010, a study of PIT and radio-telemetry tag retention was conducted. A total of 51 steelhead (26 male, 25 female) were processed, tagged, and released into a hatchery raceway instead of the outflow tube. In addition, 26 of the 51 (13 male, 13 female) were also implanted with radio tags. Tagged fish were held in the raceway and examined weekly to determine retention rates. Retention rate was estimated by dividing the number of tags detected each week by the total number of tags originally implanted.

Hatchery Returns

The number of tagged TRH steelhead that returned to the hatchery was determined by the number of valid tag detections at the final hatchery antenna at the entrance of the hatchery trap. To qualify as a valid hatchery return, the tag must be initially detected by the antenna at the exit of the hatchery outflow tube that recycles fish back to the river, then later detected at the final ladder antenna without any subsequent detections at the antenna placed "down-ladder" below the hatchery trap. This would indicate movement up the hatchery ladder without descending the ladder.

Multiple returns are defined as tagged TRH steelhead that return to the hatchery more than once after tagging. To qualify as a multiple return there needed to be at least two valid hatchery returns that were separated by hatchery spawning dates.

Hatchery return rates were determined by the number of tagged TRH steelhead that returned to the hatchery divided by the total number of TRH steelhead tagged. Return timing was calculated by summing the number of days between the date that the tagged steelhead returned to TRH spawning facilities and the date it was tagged. Since the return couldn't occur until the tagged fish returned to inside the spawning shed, the shortest time it would take to return would be roughly seven days (depending on holidays, scheduling changes, etc.) because the hatchery spawned steelhead only once per week. Differences in return rates and timing for males and females were analyzed using basic two-tailed *t*-tests.

Straying

The number of tagged TRH steelhead that strayed was determined from PIT detections at tributary monitoring sites and also the main stem PIT monitoring site located two kilometers downstream from TRH. A "main stem stray" was any tagged fish that spent at least 14 days above the Old Lewiston Bridge monitoring site and was not detected at TRH facilities or any tributary sites. No assumptions were made of undetected tagged fish. Straying rate was determined by the number of detections at a given PIT monitoring site divided by the total number of tagged steelhead. Duration of tributary straying incidents was determined by the

number of days from the first to the last detection within the tributary, while main stem straying duration was the days between tagging date and the last detection at the main stem antenna.

2010 Radio-telemetry from Willow Creek Weir

In 2010, an additional effort was conducted to assess migrational movements and straying of TRH steelhead prior to entrance into TRH facilities. A total of 132 TRH steelhead were tagged at the Willow Creek weir with radio-telemetry and PIT tags, and released after a brief recovery period. Seven stationary radio-telemetry sites and five passive pit arrays spread throughout 145 km of the main stem Trinity River and five different tributaries tracked migrational movements and potential straying of tagged TRH steelhead through six sections of the main stem Trinity River (Table 3). Additional movement information was gathered from manual radio tracking and information provided from anglers claiming reward tags. Migration rates (rkm/day) were also calculated from time elapsed between different site detections.

Table 3. Radio-telemetry monitoring sites for 2010 by section of main stem, plus length of each section (rkm).

Section	Lower Site	Upper Site	Length (in rkm)
1	WC Weir	Willow Creek	5
2	Willow Creek	Burnt Ranch	35
3	Burnt Ranch	North Fork	41
4	North Fork	Brown's Creek	25
5	Brown's Creek	Old Lewiston Bridge	35
6	Old Lewiston Bridge	Trinity River Hatchery	4

Results:

A total of 2,054 adult TRH steelhead were PIT-tagged over the three-year project. All fish were tagged at either TRH spawning facilities or at the Willow Creek weir (Table 4). Over 65% of tags were detected at least once (Figure 1).

Table 4. Yearly totals of PIT-tagged adult TRH steelhead during the three-year straying assessment.

Year	Tagging Dates	Total Tagged	Females Tagged	Males Tagged	Detection %
2009	12/4/2008 to 2/25/2009	473	231	242	64.7%
2010 Weir	9/28/2009 to 11/20/2009	147	64	83	38.1%
2010 TRH	12/23/2009 to 3/10/2010	800	385	415	75.1%
2011	12/21/2010 to 3/8/2011	634	365	269	61.0%

All tagged steelhead had forklength, sex, and spawning condition recorded. Average forklength remained fairly consistent throughout the three years of study (Table 5). Mean forklength for all steelhead was 62 cm (SD = 6 cm; range = 40-86 cm), with males at 63 cm (SD = 7 cm; range = 40-86 cm), and females at 62 cm (SD = 5 cm; range = 43-81 cm). Differences in average forklength between sexes was not significant ($P > .05$).

Table 5. Forklength data (including mean, range, and standard deviation) of tagged TRH steelhead

Year	Mean FL	Range	Standard Deviation
2009	65 cm	42 - 86 cm	6 cm
2010	62 cm	40 - 80 cm	4 cm
2011	61 cm	40 - 80 cm	7 cm
Total	*62 cm*	*40 – 86 cm*	*6 cm*

Detection Efficiencies

Antenna detection efficiencies using the "in situ" method ranged from 60% for the main stem site to 100% in the tributaries and at the hatchery ladder (Table 6). Due to a change in antenna configurations at the OB Main site in 2011, efficiencies could not be calculated for either antenna. No antenna was installed at GVC in 2009.

Efficiencies using the "dummy tag" method were 100% for all antennas tested. Sites tested consisted of TRH, DC, RC, and GVC. No tests were performed at the main stem site because of logistical constraints.

These antenna efficiencies were well within the typical antenna efficiencies described in the literature (Zydlewski et al. 2001; Connolly et al. 2008). Low detection efficiencies could have resulted in grossly underestimating the total amount of straying or hatchery returns, but with tributary and hatchery antennae efficiencies between 90-100% the straying and return estimates are likely to be close to the true value.

Table 6. Antenna detection efficiencies by year for each PIT monitoring site using the "in situ" method.

Location /Antenna	2009	2010	2011
TRH / A2	98.0%	100.0%	97%
OB Main / A1	86.1%	80.0%	N/A
OB Main / A2	63.6%	60.0%	N/A
DC / A1	100.0%	100.0%	100%
DC / A2	100.0%	100.0%	100%
RC / A1	90.9%	100.0%	90%
RC / A2	87.5%	100.0%	100%
GVC / A1	N/A	86.7%	88%
GVC / A2	N/A	86.7%	100%

Tag Retention

Weekly retention rates for PIT tags dropped from 100% the first week to 98% the second week, and down to 84% the final week. Retention rates for females and males were 84% and 96%, respectively. Radio tag retention rates were similar: 100% the first week, then down to 88% the second week. Male and female retention rates were 92% and 85%, respectively. All radio-tagged fish were released after two weeks due to deteriorating health conditions developed in the hatchery raceways.

Hatchery Returns

During the three-year project, 1,878 adult TRH steelhead were PIT-tagged after an initial return to TRH. An additional 29 tagged fish were not included in the hatchery return analysis because they were released on the last day of hatchery spawning operations and had no chance of returning to TRH. In total, 53.5% (N = 1,004) returned to TRH after being tagged. Returning

fish spent an average of 16.8 days in the river before returning to TRH. Total steelhead tagged, hatchery return rate, and duration spent at large varied between the three years of study (Table 7).

Table 7. Yearly totals of TRH tagged steelhead, returns, and time before return to TRH facilities.

Year	Tagged	Returns	Return Rate	Duration
2009	473	211	44.6%	17.1 days
2010	792	490	61.9%	17.1 days
2011	613	303	49.4%	16.2 days
Total	*1878*	*1004*	*53.5%*	*16.8 days*

In each year male steelhead returned at a significantly higher rate ($P = < .05$) than females (Figure 3). Female return rates ranged from 41.9% to 47.9%, while male return rates ranged from 47.1% to 74.8% (Table 8). Males took longer to return to TRH, with an average at-large duration of 18.4 days compared to14.8 days for females.

Table 8. Male and female hatchery return rates and duration at-large after release, by year.

Year	Female Return Rate	Male Return Rate	Female Duration	Male Duration
2009	41.9%	47.1%	16.6 days	17.5 days
2010	47.9%	74.8%	14.4 days	18.7 days
2011	45.7%	54.3%	14.2 days	18.4 days
Total	*45.7%*	*61.6%*	*14.8 days*	*18.4 days*

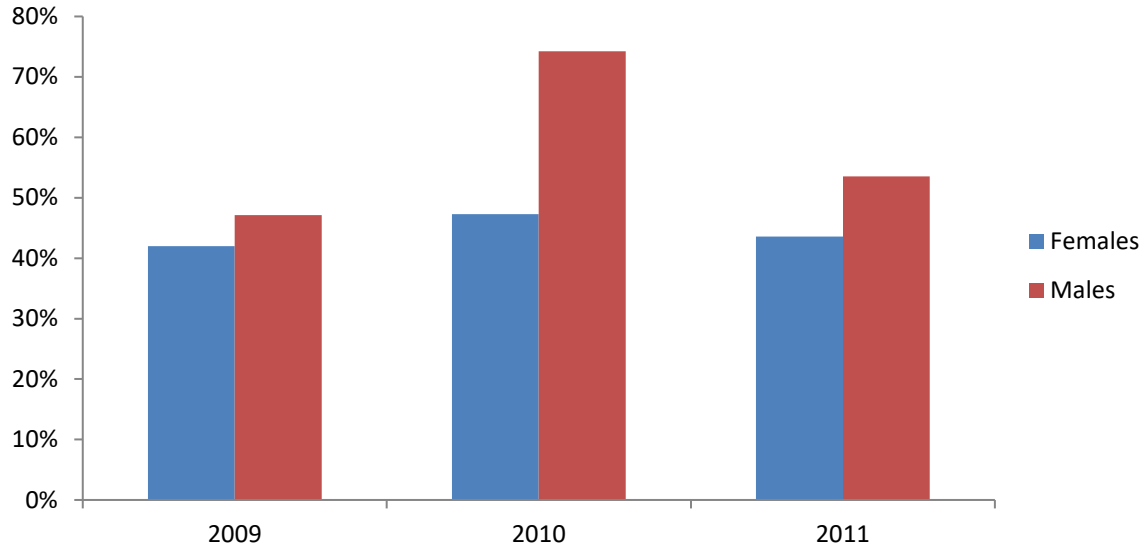

Figure 3. A three year comparison of male and female hatchery return rates for tagged TRH steelhead.

A total of 393 (20.9%) of all tagged steelhead returned multiple times to TRH (Table 9), and 39.1% of fish returning once made multiple returns. Males returned multiple times at a rate of 33.3%, while 9.1% of females returned multiple times.

Table 9. Total number of tagged steelhead returning multiple times to TRH by year and sex. Number of returns is displayed in the top row.

Year	1	2	3	4+
2009	211	61	7	1
2010	490	239	125	63
2011	303	93	36	15
Males	*566*	*306*	*147*	*77*
Females	*438*	*87*	*21*	*2*
Total	*1004*	*393*	*168*	*79*

Tributary Straying

A total of 189 TRH steelhead strayed into the three monitored tributaries (Table 10), for an overall straying rate of 9.9%, with females straying at a rate of 5.4% and males at a rate of 14.7%. Steelhead straying varied annually, but males always strayed at a greater rate than females (Figure 4). In 2009, the total straying rate was 4.4%, with males straying at a rate of 5.8% and females at a rate of 3.0%. In 2010, the total straying rate was 16.3%, with males straying at a rate of 22.6% and females at a rate of 9.2%. In 2011, the total straying rate was 6.6%, with males straying at a rate of 10.7% and females at a rate of 2.7%.

Table 10. Total number of tagged steelhead detected in monitored tributaries by sex and year.

Year	Tagged	Tributary Strays	Male Strays	Female Strays
2009	473	21	14	7
2010	800	129	93	36
2011	634	39	29	10
Total	*1907*	*189*	*136*	*53*

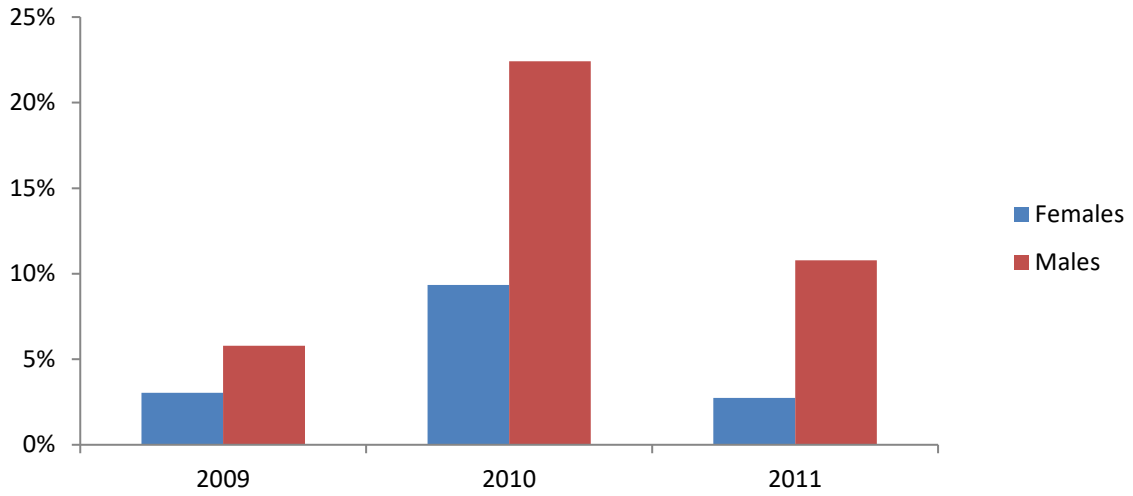

Figure 4. Tributary straying rates of male and female tagged TRH steelhead by year.

Straying incidents occurred each year in all of the tributaries that were monitored during this study (Table 11). Deadwood Creek had the greatest incidence of tributary straying, comprising 67.1% of all tributary straying detections. Rush Creek and Grass Valley Creek experienced similar amounts of straying during the two years that both tributaries were monitored (Table 11).

Main stem straying was defined in this study as any tagged fish that was detected at the Old Lewiston Bridge monitoring site and had spent at least 14 days in the reach directly below the hatchery and was never detected in a tributary. There was a higher occurrence of main stem straying than tributary straying in 2009 and 2011, but not in 2010 (Table 11).

Table 11. Straying incidents detected in main stem and tributaries by year.

Year	Main stem Below TRH	Deadwood Creek	Rush Creek	Grass Valley Creek
2009	88	13	10	n/a
2010	63	107	22	22
2011	61	25	8	9
Total	*212*	*145*	*40*	*31*

The average duration of each straying incident was similar throughout the monitored tributaries (Table 12), with the exception of Rush Creek in 2009 where one female remained upstream of the PIT antennae for 28 days. This female was witnessed building a redd above the monitoring site by the field crew.

Table 12. Average duration of straying incidents by monitoring site and year.

Year	Main Stem Below TRH	Deadwood Creek	Rush Creek	Grass Valley Creek
2009	15.8	5.8	10.2	n/a
2010	16.4	5.9	4.9	4.9
2011	19.4	4.1	4.8	3
Avg.	*17.1*	*5.5*	*6.5*	*4.2*

2010 Radio-telemetry at Willow Creek Weir

Of the 132 radio-tagged fish, a total of 99 (75%) were detected at least once upstream of the weir, four (3%) were found dead on the weir from tagging mortalities, six (4.5%) were detected by manual tracking downstream of the weir but never above the weir, and 23 (17.5%) were never detected by either tag type at the 12 monitoring locations, or by manual tracking.

Three tagged TRH steelhead (2.3%) were detected straying into tributaries prior to entry into TRH, including one female detected straying into NFTR that was never detected again, and two males that strayed into RC and DC for less than two days, then continued upstream to TRH.

Forty-five (35%) of 128 tagged steelhead successfully completed the upstream migration from Willow Creek weir to TRH. Therefore, 83 (65%) didn't fully migrate upstream (i.e. returned to ocean, shed both tags, caught in the sport fishery, strayed, or were mortalities). Reaches 1 and 6 had significantly higher tag disappearances than other reaches combining for 66.2% of all the missing tags (Figure 5, Table 13).

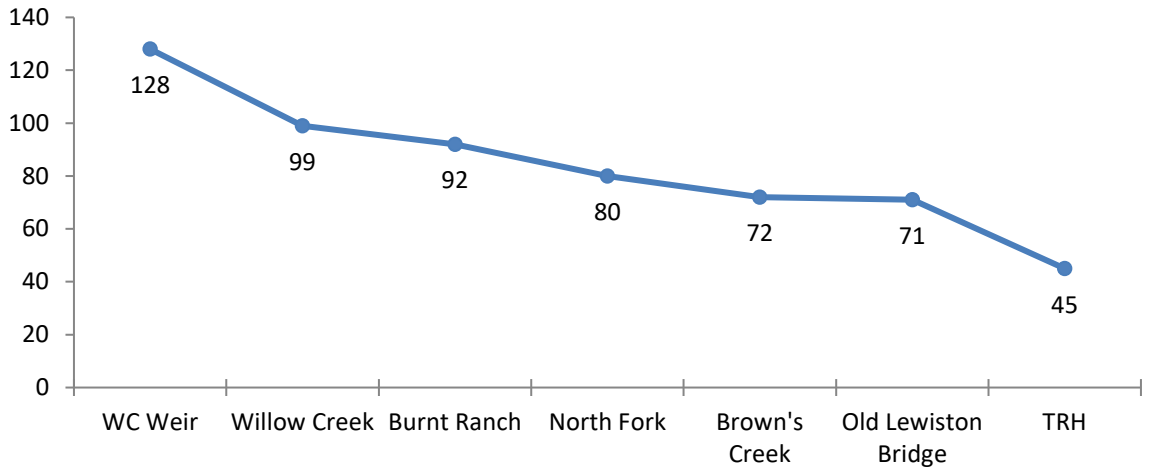

Figure 5. Number of tagged TRH steelhead detected at each of the main stem monitoring reaches.

Table 13. Total number and percentage of radio- tag loss (or final known location) of tagged steelhead migrating upstream.

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6
Tags Disappeared Within Reach	29	7	12	8	1	26
% of Total Disappeared Tags	34.9%	8.4%	14.5%	9.6%	1.2%	31.3%

The tag recovery rate at TRH of 35% of tagged steelhead from the Willow Creek weir is within the 17% to 42% spaghetti tag recovery rate reported by CDFG from 2006 to 2010, although it is on the higher end (Table 14).

Table 14. CDFG spaghetti tag recovery at TRH from 2006-2010. "*" indicates tags recovered by the YTFP Steelhead Straying project in 2010.

Year	2006	2007	2008	2009	2010	2010*
Total Tagged	1975	3404	4216	775	1437	128*
Recovered at TRH	828	949	892	128	332	45*
% Recovered	42%	28%	21%	17%	23%	35%*

Upriver migration rates of steelhead were highly variable between reaches (Table 15), averaging 1.41 km/day from the weir to TRH (102.7 total days). The maximum migration rate was 4.8 km/day between Brown's Creek and the Old Lewiston Bridge main stem monitoring sites. The minimum migration rate was 0.88 km/day in the uppermost reach between Old Lewiston Bridge and TRH.

Table 15. Average cumulative number of days it took for tagged steelhead to pass through each reach on their upward migration to TRH and the average migration rate through each of the main stem Trinity River radio-telemetry reaches.

Reach	1	2	3	4	5	6
Average Day	7.2	22.2	64.2	72.5	89.1	102.7
Average Migration Rate (km/day)	2.4	4.6	4.1	2.9	4.8	.88

Discussion:

We found that the current protocols at Trinity River Hatchery increase the potential for hatchery and natural populations to interact, both in the main stem Trinity River and its tributaries. Our results show that TRH steelhead stray into tributaries after being released back into the Trinity River at a rate of 9.9%, and when main stem strays are included, the straying rate increases to over 21%, and can be directly attributed to the current hatchery practice of releasing TRH-produced steelhead back to the Trinity River because if they were not released to back to the river, there would be no additional opportunity for these fish to stray. In other river systems it has been observed that the straying of hatchery fish pose threats to wild salmon and steelhead populations (Quinn 1993). The majority of detected straying incidents occurred within two kilometers of the TRH ladder, though tributary straying was detected in all monitored tributaries. This practice conflicts with the Steelhead Restoration and Management Plan for California (McEwan 1996) that states, "Existing hatchery and rearing programs will be operated to minimize impacts to natural stocks to the maximum extent possible". There was no documentation found that listed any specific reason why TRH steelhead are released back into the Trinity River.

Radio-telemetry data provided by tagging at the Willow Creek weir suggests there is a low rate (2.3%) of tributary straying by TRH steelhead prior to returning to the hatchery. Compared to the 9.9% straying rate of TRH steelhead released from TRH back to the river, it is clear that the current TRH protocol of releasing adult TRH steelhead back into the Trinity River greatly increases the hatchery impact on the natural salmon and steelhead populations within the Trinity River, especially in the upper river and tributaries. The most significant impact from the current TRH protocol is the addition of more hatchery fish to the natural spawning population, but at a minimum, the current protocol increases the number of hatchery steelhead in the river system and it has been observed that increased numbers of hatchery fish pose conservation risks to wild salmonids (Waples 1991; Currens et al. 1997). These concerns include potential negative competitive interactions (Flagg et al. 2000; Kostow and Zhou 2006; Kostow 2009), disease transfer (Currens et al. 1997; Amos and Thomas 2002), and interbreeding with wild salmonids (Waples 1991; Kostow et al. 2003; Hayes et al. 2004; Araki et al. 2007).

According to the straying data, male TRH steelhead have a greater impact on the natural salmon and steelhead populations within the Trinity River because of the increased straying rate versus female TRH steelhead (14.7% to 5.4%). Also, hatchery return data showed that 33.3% of male TRH steelhead returned to the hatchery multiple times, which provides an opportunity for male TRH steelhead to be used multiple times throughout the season's spawning procedures.

The Willow Creek weir migration data provided hatchery return rates similar to tag recovery data provided by the CDFG spaghetti tagging effort. The 35% hatchery return rate of the radio-telemetry tags fell within the range of spaghetti tag recoveries from the past five year (17% to 42%), and the radio-telemetry data provided insight into where most of these tags are lost. Tag loss can be defined as tags that fail to continue upstream migration, whether this is due to predation, sport fishing, straying, or actual tag loss. Our data showed that there were two areas where the majority of tags were lost: either during the first five kilometers above the Willow Creek weir or during the last five kilometers below Trinity River Hatchery. The 31.3% tag loss observed in the upper reach below the Lewiston Dam is most likely main stem straying of hatchery produced steelhead, which has been the reach documented as having the greatest

occurrence of straying for all salmonid species in the Trinity River (Chamberlain et al. 2012). The 22% loss of radio-telemetry tags below the weir represent an even greater insight into the spaghetti tag estimates provided by CDFG, and the possibility that CDFG is not adequately estimating the number of spaghetti tagged fish that fail to continue their upstream migration after being caught at the weir. The spaghetti tags are used to estimate the total in-river escapement for the Trinity River basin, including the proportions of natural and hatchery produced salmon and steelhead that spawn in natural areas. If the CDFG spaghetti tag data is comparable to our radio telemetry data, and 22% of the spaghetti-tagged fish at the Willow Creek weir turn downstream and never migrate past the weir, then the in-river and natural area spawner estimates of hatchery produced steelhead provided by CDFG may be grossly over-estimated.

We recommend that the managers of TRH change the current hatchery protocol that requires all TRH steelhead to be released back to the Trinity River. The current protocols are negatively influencing the natural salmon and steelhead populations within the Trinity River and its tributaries by providing additional opportunity for interaction. These practices may also be having a deleterious genetic effect on the TRH steelhead population from allowing male TRH steelhead to contribute on multiple spawning occasions: so, male TRH steelhead should be removed from the system once they return to the hatchery, or at least all re-run male steelhead should not be spawned. Also, we recommend that further evaluation is needed on the CDFG weir spaghetti tagging effort, and the possibility of the spaghetti tag data drastically over-estimating the in-river return estimates due to run-back steelhead that return downstream after being caught at the weir.

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Mainstem Trinity River Chinook Salmon Spawning Survey, 2017

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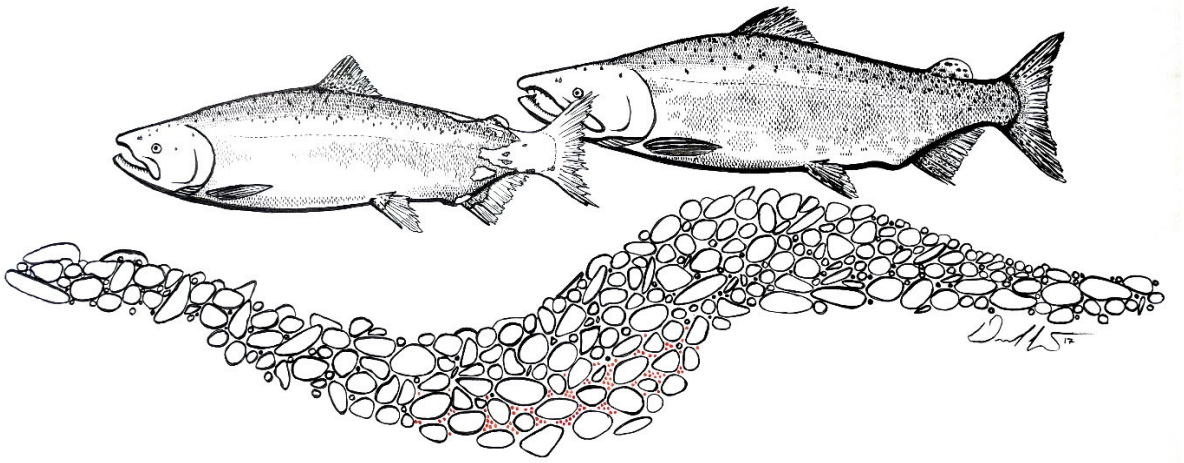

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Mainstem Trinity River Chinook Salmon Spawning Survey, 2017

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Abstract.— Salmon redds and carcasses were surveyed on the mainstem Trinity River, California from Lewiston Dam to the confluence with the Klamath River, during the 2017 spawning season to map spawning abundance and distribution, evaluate pre-spawn mortality, and characterize redds by species and spawner origin. The total redd count in 2017 was 1,982. We applied generalized additive models to the spatiotemporal distribution of unmarked and hatchery-marked spawned female salmon carcasses to apportion redd counts by natural- and hatchery-origin Chinook Salmon *Oncorhynchus tshawytscha* and Coho Salmon *O. kisutch*. This methodology only allows for the partitioning of redds constructed by hatchery- and natural-produced females and does not account for the origin of the male spawners. We estimated that 1,600 (95% c.i.: 1,435–1,762) redds were constructed by natural-origin Chinook Salmon, 348 (95% c.i.: 186–513) by hatchery-origin Chinook Salmon, and the remaining 34 were attributed to Coho Salmon. Natural-origin Chinook Salmon spawned throughout the mainstem river while the distribution of redds constructed by hatchery-origin Chinook Salmon was highly skewed toward Lewiston Dam and the Trinity River Hatchery (about 59% were within 10 km of the

dam). Pre-spawn mortality of female Chinook Salmon was 1.8% for carcasses observed in all reaches and 2.0% within an intensively managed 'restoration reach', which is a focal area for habitat restoration improvements being implemented by the Trinity River Restoration Program (TRRP). Long-term trend analyses from 2002 to 2017 showed no significant change in the abundance of natural-origin Chinook Salmon redds constructed in the mainstem Trinity River, while the number of hatchery-origin Chinook Salmon redds decreased. The proportion of total annual natural-origin Chinook Salmon redds decreased in the reaches nearest to Lewiston Dam and increased in reaches farther downstream from 2002 to 2017, while the annual component of hatchery-origin Chinook Salmon redds remained almost completely within the two reaches nearest to Lewiston Dam.

Introduction

The Trinity River, California, once supported large populations of naturally produced anadromous salmonids, including spring- and fall-run Chinook Salmon *Oncorhynchus tshawytscha* (USFWS and HVT 1999). Prior to the construction of Trinity and Lewiston dams, the spawning of spring- and fall-run Chinook Salmon was separated temporally and spatially due to the timing of adult upstream migration of each race and the hydrology of the river. In 1940s, Moffett and Smith (1950) noted that "almost without exception, Trinity River salmon migrating above the South Fork spawn in the 72 miles of river between the North Fork and Ramshorn Creek."

Following construction of Lewiston Dam [river kilometer (rkm 182.2)], spring- and fall-run Chinook Salmon spawning in the mainstem Trinity River exhibited considerable spatial and temporal overlap due to lack of access to historic spawning areas for the spring-run. High redd densities became frequent within the upper-most portions of the river below the dam, where presumably hatchery-origin salmon and their progeny comingled and spawned with naturally produced fish. Trinity River Hatchery (TRH), located at the base of Lewiston Dam, is operated to mitigate for the loss of Chinook Salmon, Coho Salmon *O. kisutch*, and steelhead *O. mykiss* production upstream of the dam. Rogers (1972) documented that in 1970 more than 50% of Chinook Salmon spawned in the two miles (3.2 km) below Lewiston Dam and 80% spawned above Douglas City (around rkm 150.1). Redd surveys in the 1980s and 1990s between North Fork Trinity River (rkm 118.2) and Cedar Flat (rkm 79.1) documented variable spawning use in these reaches, with redd counts ranging from a low of 187 in 1998 to a high of 928 redds in 1997 (USFWS 1986, 1987; Quihillalt 1999). Chamberlain et al. (2012) noted that the mean distance from Lewiston Dam of natural-origin Chinook Salmon redds upstream of Cedar Flat increased from 2002 to 2011. Rupert et al. (2017a) noted that when the mainstem Trinity River was divided into reach-scale sections, natural-origin Chinook Salmon spawning activity decreased near Lewiston Dam and increased in sections of the river farther downstream.

In an effort to restore the fishery resources of the Trinity River, the Secretary of the Interior signed the Trinity River Mainstem Fishery Restoration Record of Decision (ROD) in 2000 (USDOI 2000) and the Trinity River Restoration Program (TRRP) was established. The goal of the TRRP is to:

> "…restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to pre-dam levels, to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities" (TRRP and ESSA 2009).

To achieve this goal, the TRRP implements a suite of actions (flow management, mechanical channel rehabilitation, coarse sediment augmentation, and watershed restoration) to restore riverine habitats and restore habitat-creating alluvial processes (USFWS and HVT 1999; USDOI 2000). Collectively, these actions are intended to increase and maintain salmonid habitats in the 64-km section of the Trinity River from Lewiston Dam downstream to the North Fork Trinity River (restoration reach), which was severely degraded due the operation of the Trinity River Division (TRD) of the Central Valley Project. Downstream of the North Fork confluence, the Trinity River valley narrows and accretions of flow and sediment from tributaries attenuate many of the morphological impacts that have occurred in the restoration reach (USFWS and HVT 1999).

The Integrated Assessment Plan (IAP; TRRP and ESSA 2009) sets forth a list of objectives to evaluate the effectiveness of TRRP restoration actions. Salmon spawning surveys are preformed to provide data to address Objective 3, specifically sub-objectives 3.1 and 3.3:

> **Objective 3**: Restore and maintain natural production of anadromous fish populations.
>
> > **Sub-objective 3.1**: Increase spawning, incubation, and emergence success of anadromous spawners.
> >
> > **Sub-objective 3.3**: Minimize impacts of predation and genetic interactions between and among hatchery and natural anadromous fish.

The IAP proposes assessing spawning at three spatial scales: system, reach, and site scales. Each of these spatial scales evaluates the effects of restoration efforts on Chinook Salmon spawning at different resolutions. System-scale analysis evaluates the response to all restoration activities combined over time. Reach-scale analysis evaluates the response to management actions within sections of the river that have unique hydrology and sediment supplies. Finally, site-scale analysis provides insight on changes in spawning distribution/abundance within restoration sites and the localized effects of mechanical channel rehabilitation. The IAP also states that "increased spawner success will likely occur within 3–4 brood cycles following completion of channel rehabilitation and subsequent fluvial and geomorphic evolution."

This report details the results from salmon spawning survey data collected in 2017 on the mainstem Trinity River. Surveying salmon carcasses provides pre-spawn mortality data and carcass estimates and reflect the species and origin composition of spawned salmon. Surveying salmon redds provides the location and spawn timing of individual redds. When analyzed together, each year's data produces a spatially and temporally explicit set of observed redd locations with each redd having an associated probability of construction by female natural-origin Chinook Salmon, hatchery-origin Chinook Salmon, natural-origin Coho Salmon, and hatchery-origin Coho Salmon. We define 'hatchery-origin' as fish produced and released from Trinity River Hatchery (TRH), and 'natural-origin' as fish that emerge from a redd, regardless of parental origin. These data sets facilitate an array of

analyses over a range of spatial and temporal scales, which we use to investigate spawning distribution and abundance. Where applicable, we use the performance measures set forth by the IAP to evaluate changes in spawning as responses to the restoration actions of the TRRP.

Methods

Survey Area and Timing

The Trinity River from Lewiston Dam to its confluence with the Klamath River was delineated into 14 survey reaches ranging in length from 3.3 to 21.3 km (Figure 1, Table 1). Reach breaks were based on river access locations and channel distances that could be surveyed in a day. Two whitewater sections were not surveyed: the 9.7-km Pigeon Point run (Reach 8) and the 15.6-km section that includes the Burnt Ranch Gorge (Reach 11). In 2016, the boundary separating Reaches 5 and 6 was moved from Roundhouse (rkm 135.7) to Evan's Bar (rkm 137.4) because of a change in private landowner permission to use their river access.

Reaches 1–7 were surveyed weekly and Reaches 9–14 (excluding Reach 11) were surveyed every other week, as conditions permitted, for salmon carcasses and redds as described in Rupert et al. (2017a). Surveys in 2017 began August 30 and concluded December 20. This period was intended to encompass the majority of Chinook Salmon spawning activity.

Redd Identification

Chinook and Coho salmon spawning periods temporally overlap and natural- and hatchery-origin salmon spawn in the same areas in the mainstem Trinity River. Given that redds are not visually distinguishable by these species and origin types, the estimated proportion and spatial distribution of fresh female carcasses of hatchery- and natural-origin Chinook and Coho salmon were used to infer the probability of redd construction by species and origin. Since only female carcasses are used in the hatchery–natural analysis, the estimates of redds constructed by natural-origin females do not account for hatchery-produced males spawning with naturally produced females. Therefore natural-origin spawning estimates should be considered maximum values given that estimates were not adjusted downward to account for hatchery–natural mating pairs. Generalized Additive Models (GAM) were used with the spatiotemporal distribution of carcasses to estimate the longitudinal gradient in proportional distribution of spawned females by species (Chinook or Coho salmon) and origin (hatchery or natural) along the river channel and over time (Rupert et al. 2017a). Cumulative redd counts were arranged by survey day within reach boundaries and season total estimates of redds by species and origin were calculated by summing predicted probabilities of construction for each species–origin category (Rupert et al. 2017a).

Carcasses Estimation

Carcass abundance estimates for Reaches 1 and 2 were generated via a hierarchical latent variables model as described in Rupert et al. (2017a). This model assumes a latent (unobservable) ecological process interacts with a detection process to produce the observed counts of carcasses (Kery and Schaub 2012). For this survey, the latent process is the true

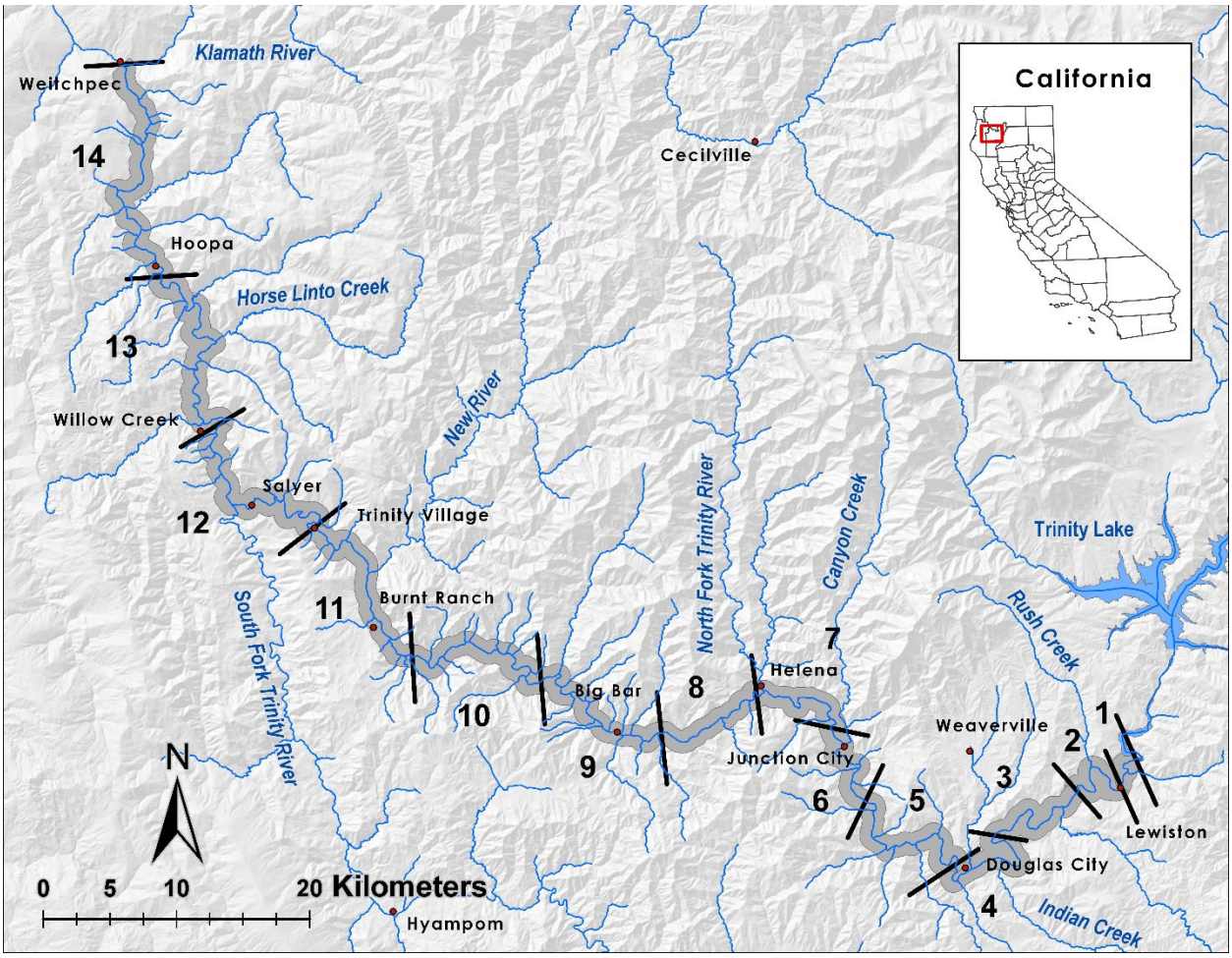

Figure 1. Survey Reaches 1–14 (Lewiston Dam to Weitchpec) on the mainstem Trinity River, California. Dangerous whitewater conditions precluded surveys in Reaches 8 and 11.

abundance of carcasses. As not all carcasses are observed (imperfect detection), a separate observation process links the unobserved latent process to the observed data. In essence, annual carcass estimates were generated by first estimating weekly detection probabilities. Next, weekly counts of fresh carcasses (those arriving since the prior survey) were assumed to arise from a binomial process, which allows the estimation of weekly abundances. Finally, weekly estimates were summed to create an annual abundance estimate as a derived parameter.

Pre-Spawn Mortality

Fresh carcasses were described as spawned (≤1/3 eggs retained), partially spawned (1/3–2/3 eggs retained), or unspawned (≥2/3 eggs retained). These spawning condition data were used to assess levels of pre-spawn mortality. Female carcasses designated as 'spawned' and 'partially spawned' were considered successful spawners. Unspawned carcasses were considered pre-spawn mortalities. Measurement of pre-spawn mortality is limited to occurrence within the time and space of the surveys. Therefore, pre-spawn mortality in the lower Klamath River of Trinity River-bound fish and pre-spawn mortality of spring-run Chinook Salmon prior to the first survey are not reflected in our data and analyses.

Table 1. Reach boundaries [and river kilometer (rkm)] for the mainstem Trinity River, California, salmon spawning surveys. Agencies involved in data collection include California Department of Fish and Wildlife (CDFW), Shasta–Trinity National Forest (USFS), U.S. Fish and Wildlife Service (USFWS), Yurok Tribal Fisheries Program (YTFP), and Hoopa Valley Tribal Fisheries Department (HVT).

Reach	Boundaries		Surveying agency
	Upstream	Downstream (rkm)	
1	Lewiston Dam (rkm 182.2) [a]	Old Lewiston Bridge (178.7)	USFS, YTFP, CDFW
2	Old Lewiston Bridge	Bucktail River Access (171.6)	CDFW, YTFP
3	Bucktail River Access	Steel Bridge River Access (160.7)	CDFW, YTFP
4	Steel Bridge River Access	Douglas City Campground (150.1)	CDFW, YTFP
5	Douglas City Campground	Evan's Bar (137.4) [b]	CDFW, YTFP
6	Evan's Bar [b]	Junction City Campground (127.1)	USFWS, HVT
7	Junction City Campground	Pigeon Point Campground [c] (117.4)	USFWS, HVT
8	Pigeon Point Campground [c]	Big Flat River Access (107.6)	NOT SURVEYED
9	Big Flat River Access	Del Loma River Access (93.8)	USFWS, HVT
10	Del Loma River Access	Cedar Flat River Access (79.1)	USFWS, HVT
11	Cedar Flat River Access	Hawkins Bar (63.4)	NOT SURVEYED
12	Hawkins Bar	Camp Kimtu in Willow Creek (42.6)	USFWS, HVT
13	Camp Kimtu in Willow Creek	Roland's Bar in Hoopa Valley (21.3)	USFWS, HVT
14	Roland's Bar in Hoopa Valley	Weitchpec (Trinity mouth; 0.0)	USFWS, HVT

[a] The spillway and pool directly downstream of Lewiston Dam were not surveyed and presumed to have no redds.

[b] In 2015 and earlier the river access separating Reaches 5 and 6 was at Roundhouse (rkm 135.7).

[c] Pigeon Point Campground access is 0.8 km downstream of the North Fork Trinity River confluence (rkm 118.2). The primary area where Trinity River Restoration Program actively manages to improve channel morphology and salmon habitat is in Reaches 1–7.

Redd–Carcass Relationship

Spawning density was hypothesized to affect the crews' ability to observe redds and carcasses with equal efficiency, especially in the high spawning density areas of Reaches 1 and 2 (Bradford and Hankin 2012). This hypothesis would be supported if the number of redds surveyed in an area was not proportional to the number of spawned female carcasses found in that same area. To determine if this occurred, the estimates of spawned female Chinook Salmon carcasses were compared with corresponding counts of Chinook Salmon redds from Reaches 1 and 2. These values were log-transformed and analyzed using linear regression. These two variables would be considered proportional if the slope of their linear relationship was not significantly different than '1'. A slope that is significantly different than '1' would indicate that these variables are not proportional and some density-dependent observer error could be inferred.

Trends in Redd Abundance and Distribution

Data from 2017 were combined with the preceding fifteen years (2002–2016) of mainstem Trinity River redd data from Chamberlain et al. (2012) and Rupert et al. (2017a, 2017b) for long-term analyses of redd abundance and distribution. Past years' data availability was sometimes limited since not all variables analyzed were previously collected (i.e., spatially explicit redd data are not available for Reaches 12–14 prior to 2007). Redd abundance and distribution were analyzed at three spatial scales: the system (~50–100 km sections), reach (~10–20 km sections), and site (~1–2 km sections) scales. The 2017 data were examined and, when applicable, included with previous years' data for multi-year trend analyses.

For spatial analyses, the river was partitioned into individual segments based on morphology and referred to as 'riffle units' (Rupert et al. 2017b). A riffle unit is defined as a section of river that corresponds to a singular pool–riffle–pool sequence that typically ranges between 0.1 and 0.5 km in length. These units were delineated by this sequence for redd abundance analyses because Chinook Salmon typically build redds in patches proximate to riffle crests. Therefore, riffle units generally contain an undivided group of redds. Riffle unit designations were based on the 'morphological units' delineated by Gaeuman et al. (2016). Where Gaeuman et al. (2016) used hydraulic controls (i.e., riffles) to delineate morphological units, the deepest locations (i.e., pools) between these hydraulic controls were used to split riffle units. As a result, the morphological units from Gaeuman et al. (2016) were shifted slightly upstream. Aerial photography was used to construct riffle units downstream of the restoration reach (excluding Reaches 8 and 11) because the morphological units developed by Gaeuman et al. (2016) were limited to the restoration reach. In total, the mainstem Trinity River was divided into 482 riffle units.

The riffle unit method described in this report refers to the method used for partitioning the river in Rupert et al. (2017b). In Rupert et al. (2017a), the smallest spatial units were based on contiguous 400-m (and occasionally 200-m) sections of the Science Advisory Board dataframe (SAB units; Buffington et al. 2014). This change in methodology is an improvement over that used in Rupert et al. 2017a because redd groupings are no longer split and the three spatial scale sections better reflect local spawning habitat and TRRP channel rehabilitation sites or suites of sites. The upstream and downstream site-, reach-, and system-scale section boundaries changed slightly as a result to reflect the newer riffle

unit divisions. The complete 2002–2017 data set was analyzed using the newer riffle unit-based divisions at each spatial scale.

Contiguous groups of riffle units were combined to create the sections used for the site-scale analysis (Table 2). These site designations were generally based on the TRRP site designations of the Science Advisory Board dataframe (Buffington et al. 2014). However, the total count of site-scale units was reduced from 57 to 44 by merging the smallest site-scale sections of the SAB dataframe into the most appropriate adjacent site-scale sections. This spatial scale was used to evaluate changes in natural- and hatchery-origin Chinook Salmon redd abundance at a scale similar to TRRP restoration sites or suites of sites. Changes in spawning abundance within these sites was analyzed using linear regression of the annual proportion (number of redds in the site / sum of redds in the restoration reach) of redds.

Ten reach-scale sections were also used to evaluate long-term trends in natural- and hatchery-origin Chinook Salmon redd abundance (Figure 2, Table 3). These reaches consisted of groups of sites and were intended to evaluate redd abundance at a spatial scale that was an intermediate between the system and site scales. Our reach-scale designations closely resemble those defined by HVT et al. (2011), who partitioned the restoration reach into five 'rehabilitation reaches' that were delineated by differences in hydrology and sediment supply characteristics. Boundaries of the other five river sections downstream of the restoration reach were set similarly. Changes in spawning abundance within these reaches were analyzed using linear regression analyses of both the annual number and proportion (number of redds in reach / sum of redds in all reaches) of natural- and hatchery-origin Chinook Salmon redds.

Changes in redd abundance and distribution at the system scale were evaluated over the entire mainstem and also separately for the restoration reach (Reaches 1–7) and remaining surveyed river downstream of the restoration reach (Reaches 9–10 and 12–14). Linear models were used to detect trends in redd abundance. Mean distance from Lewiston Dam of natural- and hatchery-origin Chinook Salmon redds built upstream of Cedar Flat were evaluated using linear regression models.

Table 2. The reach- and site-scale sections used for redd abundance and distribution analysis within the restoration reach. Sites are listed with the approximate location of their upstream boundary, shown as distance from the Klamath River confluence (rkm).

Reach	Site (rkm)	TRRP Rehabilitation	Length (km)
Lewiston	Hatchery (182.20)	2006	0.69
	Sven Olbertson (181.51)	2008	1.28
	Old Bridge (180.22)	2008	1.75
	Sawmill (178.47)	2009	1.60
	Upper Rush Creek (176.87)		1.46
Limekiln	Lower Rush Creek (175.41)		1.33
	Dark Gulch (174.08)	2008	2.81
	Lowden Ranch (171.27)	2010	1.73
	Trinity House Gulch (169.54)	2010	0.72
	Tom Lang Gulch (168.82)		1.48
	Poker Bar (167.34)		2.30
	China Gulch (165.05)		1.47
	Limekiln Gulch (163.57)	2015	2.38
	Steel Bridge (161.20)		1.67
	McIntyre Gulch (159.53)		1.53
	Vitzthum Gulch (158.00)	2007	2.02
	Upper Indian Creek (155.98)	2007	0.56
Douglas City	Lower Indian Creek (155.42)	2007	1.52
	Upper Douglas City (153.90)	2007, 2015	0.83
	Douglas City (153.07)	2013	1.30
	Reading Creek (151.77)	2010	1.77
	Upper Steiner Flat (150.00)		1.26
	Lower Steiner Flat (148.74)	2012	1.90
	Lorenz Gulch (146.83)	2013	1.49
	The Canyon (upstream) (145.34)		2.17
Junction City	The Canyon (downstream) (143.18)		2.23
	Dutch Creek (140.95)		2.56
	Evan's Bar (138.38)		1.28
	Soldier Creek (137.11)		0.89
	Chapman Ranch (136.22)		1.10
	Deep Gulch (135.13)		1.11
	Sheridan Creek (134.02)		1.15
	Oregon Gulch (132.87)		0.76
	Sky Ranch (132.12)		1.20
	Upper Junction City (130.91)	2012	0.89
	Lower Junction City (130.01)	2014	0.67
North Fork	Hocker Flat (129.34)	2005	1.88
	Upper Conner Creek (127.46)		1.12
	Conner Creek (126.34)	2006	1.71
	Wheel Gulch (124.63)	2011	1.05
	Valdor Gulch (123.58)	2006	1.84
	Elkhorn (121.74)	2006	1.50
	Pear Tree Gulch (120.24)	2006	1.33
	Bagdad (118.92) [a]		1.52

[a] the downstream boundary of the Bagdad site was at rkm 117.4

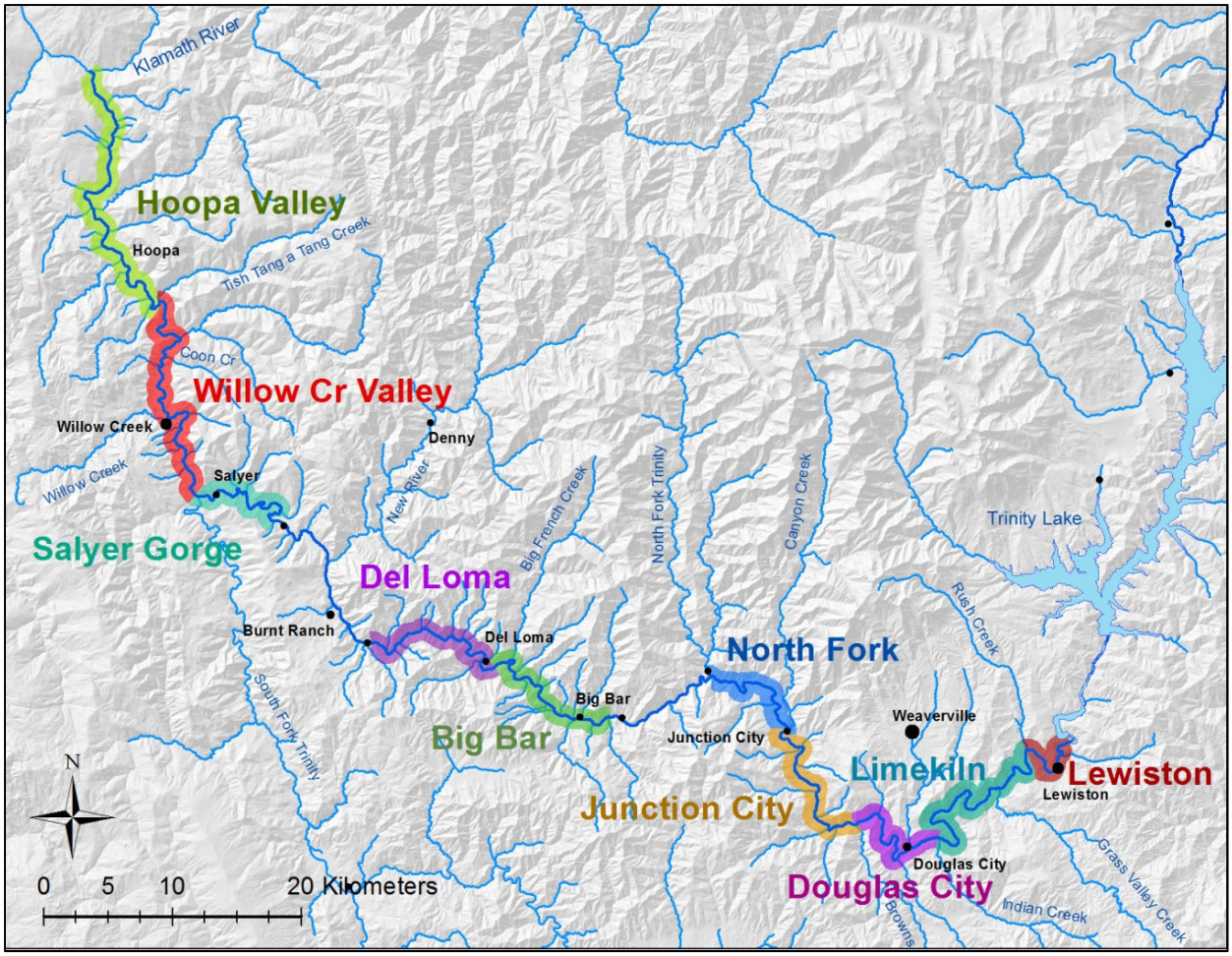

Figure 2. The ten sections of the mainstem Trinity River used for reach-scale analyses of Chinook Salmon redd distribution.

Table 3. River sections [with river kilometer (rkm)] used for the reach-scale analysis of redd abundance.

Section	Boundaries		Length (km)
	Upstream (rkm)	Downstream (rkm)	
Lewiston Rehab	Lewiston Dam (182.20)	Rush Creek (175.41)	6.79
Limekiln Rehab	Rush Creek	Indian Creek (155.42)	19.99
Douglas City Rehab	Indian Creek	Browns Creek (143.18)	12.25
Junction City Rehab	Browns Creek	Canyon Creek (129.34)	13.84
North Fork Rehab	Canyon Creek	North Fork Trinity River (117.40)	11.94
Big Bar	Big Flat access riffle unit (107.82)	Del Loma access riffle unit (94.03)	13.79
Del Loma	Del Loma access riffle unit	Cedar Flat access riffle unit (79.31)	14.72
Salyer Gorge	Hawkins Bar river access (63.76)	South Fork Trinity River (50.33)	13.41
Willow Creek Valley	South Fork Trinity River	Tish Tang a Tang Creek (26.95)	23.40
Hoopa Valley	Tish Tang a Tang Creek	Weitchpec (Trinity River mouth; 0.0)	26.95

Results

Survey Success and Conditions

Crews were able to complete 86% of the originally scheduled surveys in 2017, including missed surveys that were rescheduled for the following week (Appendix A). The first scheduled surveys on Reaches 4–7 were cancelled due to wildfires causing smoky air conditions and road and river access closures. Other missed surveys, which were mostly for Reach 6 and downstream from mid-November to early December, were usually cancelled due to rain events causing increased turbidity and poor visibility. Additionally, surveys on Reaches 1–4 and 13 were completed the week of December 17, which was one week more than initially scheduled.

Trinity River discharge at Lewiston, California, was about 13.1 m^3/s during the first half of the survey season before dropping to about 9.0 m^3/s in mid-October, at which it remained for the remainder of season (Appendix B). At Hoopa, California, mean daily flows on the mainstem Trinity River ranged between 18.2 and 31.4 m^3/s from the start of the survey season to early November before rain events caused flows to increase in mid-November. Mean daily flow peaked at 277.5 m^3/s on November 21 before coming back down to about 36.0 m^3/s by mid-December.

Crews reported water visibility between 1.5 and 3.0 m during most of the surveys in 2017 (Appendix A). Visibility was occasionally higher (>3.0), particularly in the lower reaches. Visibility was lower (0.9–1.5 m) during some early season surveys and less than 0.9 m once in Reach 9 in early September after a project in Sheridan Creek temporarily increased turbidity.

Salmon Carcasses

During the 2017 surveys, 527 fresh (conditions 1 and 2 as described in Rupert at al. 2017a) Chinook Salmon carcasses were examined (Table 4). Of these fresh carcasses, 333 (63.4%) were females, 39 (7.4%) were adipose fin-clipped ('ad-clip'), and 32 (6.1%) had been marked with a spaghetti tag at the Willow Creek or Junction City weir operated by the California Department of Fish and Wildlife. Chinook Salmon released from the TRH are batch-marked with coded-wire tags (CWT) and externally marked using an ad-clip at a constant fractional mark rate of about 25%. From the 39 ad-clipped fresh Chinook Salmon carcasses observed, 31 head samples were collected (Table 5). Data from CWT recoveries yielded an average annual production multiplier (i.e., tagging rate) of 0.240 in 2017.

Of the 333 fresh female Chinook Salmon carcasses recovered, 25 (7.5%) were ad-clipped, and of these, 20 heads were collected. CWTs were recovered and read from all 20 (100%) of these heads. Of the spawned female hatchery-origin Chinook Salmon carcasses (spring and fall broods combined) with associated CWT data, 90% (18 of 20) were recovered within 10 km of Lewiston Dam (Figure 3).

Relatively few (six) Coho Salmon carcasses were recovered during the 2017 surveys (Table 6). Of these, three were fresh and of these, none (0%) were right maxillary-clipped, which would indicate hatchery origin. Only one of the Coho Salmon carcasses was a fresh spawned female. The limited number of spawned female Coho Salmon carcasses recovered inhibited the ability to differentiate Coho Salmon redds by origin in 2017.

Table 4. Summary of fresh (conditions 1 and 2) Chinook Salmon carcass data by survey reach, 2017 Trinity River surveys.

Reach	Total	Males	Females	Female proportion	Ad-clipped	Weir-tagged
1	120[a]	33	85	72.0%	17	9
2	119	43	76	63.9%	13	9
3	76	38	38	50.0%	3	4
4	38	18	20	52.6%	1	1
5	53	24	29	54.7%	4	3
6	62	18	44	71.0%	1	1
7	20	6	14	70.0%	0	0
9	25	9	16	64.0%	0	3
10	13	3	10	76.9%	0	2
12	0	0	0	-	0	0
13	1	0	1	100.0%	0	0
14	0	0	0	-	0	0
Total	527[a]	192	333	63.4%	39[b]	32

[a] includes two carcasses of unknown sex

[b] head samples were collected from 31 of the 39 fresh ad-clipped Chinook Salmon carcasses

Table 5. Coded-wire tag (CWT) information retrieved from fresh adipose fin-clipped Chinook Salmon carcasses, 2017 Trinity River surveys.

Carcasses	CWT	Brood Year	Run type	Release type	Production multiplier	Production multiplier
1	060605	2013	Spring	Advanced fingerling	4.24	0.236
1	060606	2013	Spring	Advanced fingerling	4.15	0.241
1	060609	2013	Fall	Fingerling	4.12	0.243
2	060612	2013	Spring	Yearling	4.22	0.237
1	060615	2014	Fall	Fingerling	4.13	0.242
2	060689	2014	Spring	Advanced fingerling	4.27	0.234
1	060691	2014	Spring	Advanced fingerling	4.14	0.242
6	060692	2014	Fall	Advanced fingerling	4.09	0.244
5	060693	2014	Fall	Advanced fingerling	4.08	0.245
1	060694	2014	Fall	Fingerling	4.28	0.233
1	060696	2014	Spring	Yearling	4.27	0.234
2	060697	2014	Fall	Yearling	4.18	0.239
1	060775	2015	Fall	Fingerling	4.27	0.234
4	060780	2015	Fall	Yearling	4.25	0.236
1	068849	2013	Spring	Fingerling	4.18	0.239
1	-- Missing CWT/head --				NA	NA
					Mean = 4.17	Mean = 0.240

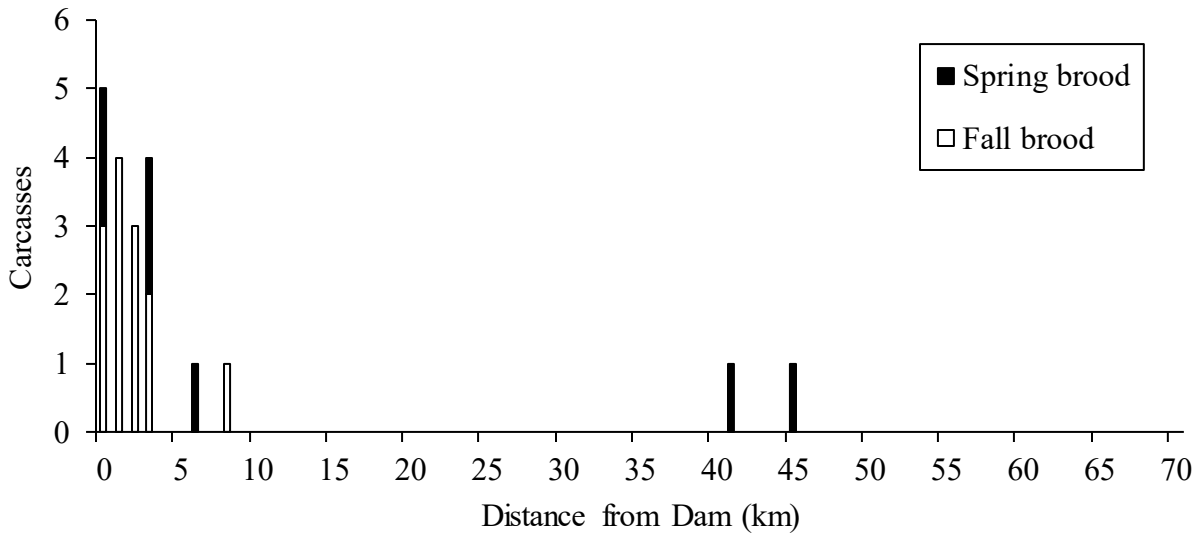

Figure 3. Distribution of coded-wire-tagged (CWT) spawned female Chinook Salmon carcasses by brood type (spring and fall) located in the mainstem Trinity River downstream of Lewiston Dam in 2017.

Table 6. Summary of fresh (conditions 1 and 2) Coho Salmon carcass data by survey reach, 2017 Trinity River surveys.

Reach	Total	Males	Females	Female proportion	Maxillary-clipped	Weir-tagged
1	1	1	0	0.0%	0	0
2	0	0	0	-	0	0
3	2	1	1	50.0%	0	0
4	0	0	0	-	0	0
5	0	0	0	-	0	0
6	0	0	0	-	0	0
7	0	0	0	-	0	0
9	0	0	0	-	0	0
10	0	0	0	-	0	0
12	0	0	0	-	0	0
13	0	0	0	-	0	0
14	0	0	0	-	0	0
Total	3	2	1	33.3%	0	0

Carcass Estimates

The hierarchical latent variables model estimated 366 (95% CI: 277–499) Chinook Salmon carcasses in Reach 1 and 498 (95% CI: 356–735) in Reach 2 in 2017. Estimates of spawned female Chinook Salmon carcasses were 250 (95% CI: 186–353) in Reach 1 and 316 (95% CI: 218–475) in Reach 2.

Pre-spawn Mortality

Six fresh unspawned female Chinook Salmon carcasses were found in 2017, all without a hatchery mark, which yielded a pre-spawn mortality rate among female Chinook Salmon throughout the mainstem Trinity River of 1.8% (Table 7). Weekly pre-spawn mortality rates ranged from 0.0% to 8.0% (the first six survey weeks were combined, as were the final three, due to small sample sizes; Figure 4). Annual pre-spawn mortality of female Chinook Salmon in the Trinity River restoration reach was 2.0% in 2017.

The lone (one) fresh female Coho Salmon carcass encountered in 2017 was of natural-origin and had spawned (Table 8). Note that pre-spawn mortality rates were based on data collected through late December, while Coho Salmon are still spawning.

Table 7. Pre-spawn mortality rates of Chinook Salmon in the Trinity River below Lewiston Dam (Reaches 1–14) and in the restoration reach (Reaches 1–7), 2009–2017 surveys. Pre-spawn mortalities by week and reach for unmarked and ad-clipped Chinook Salmon are presented in Appendix C.

Year	Reaches 1-14 (Lewiston Dam to Klamath River)	Reaches 1-7 (Lewiston Dam to North Fork)
2009	7.9%	6.8%
2010	10.2%	9.5%
2011	4.6%	4.6%
2012	2.4%	2.4%
2013	5.1%	6.1%
2014	11.5%	9.1%
2015	0.8%	0.0%
2016	0.7%	0.8%
2017	1.8%	2.0%

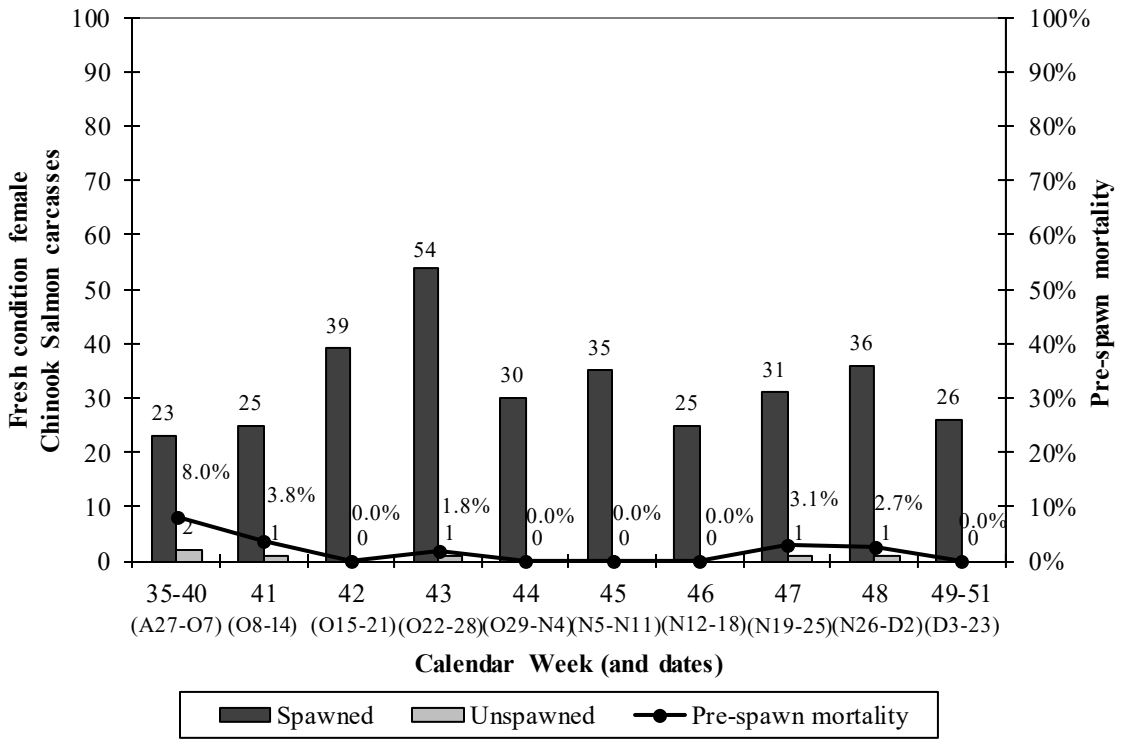

Figure 4. Weekly pre-spawn mortality from fresh (conditions 1 and 2) female Chinook Salmon carcasses, Trinity River surveys 2017. Calendar weeks 36–40 and 48–51 were combined because sample sizes were low in at least one of those weeks.

Table 8. Pre-spawn mortality rates of natural- and hatchery-origin Coho Salmon, Trinity River surveys, 2009–2017. Note that these pre-spawn mortality rates were based on data only collected through late December. Spawning success often varies, typically improving over time, and our surveys did not extend over the entire Coho Salmon spawning period.

Year	Natural-origin	Hatchery-origin	Combined
2009	7.1%	20.3%	16.1%
2010	21.9%	16.2%	17.0%
2011	6.1%	15.1%	11.6%
2012	3.6%	11.8%	10.4%
2013	10.7%	6.1%	6.6%
2014	35.1%	28.5%	29.8%
2015	33.3% [a]	50.0% [a]	40.0% [a]
2016	0.0% [b]	0.0% [b]	0.0% [b]
2017	0.0% [c]	-	0.0% [c]

[a] the sample size for Coho Salmon was only five carcasses in 2015

[b] the sample size for Coho Salmon was only two carcasses in 2016

[c] the sample size for Coho Salmon was only one carcass in 2017

Salmon Redds

During the 2017 surveys, 1,982 salmon redds were identified (Table 9). A majority of the redds (1,600; 80.7%) were estimated to have been constructed by natural-origin female Chinook Salmon, while hatchery-origin female Chinook Salmon accounted for 348 (17.6%) of the total redd count (Table 10). Coho Salmon redds accounted for 34 (1.7%) of the surveyed redds. The low numbers of spawned female Coho Salmon carcasses collected in 2017 precluded the differentiation of hatchery- and natural-origin Coho Salmon redds. Note that Coho Salmon spawning continued beyond our survey season, and our estimates of Coho Salmon redds are included only to differentiate them from Chinook Salmon redds.

Natural-origin Chinook Salmon redds were constructed throughout most of the mainstem Trinity River in 2017, though the lowest numbers were in the downstream-most reaches (Figure 5). Hatchery-origin Chinook and Coho (both origin types) salmon redds were consistently skewed toward Lewiston Dam. Little to no spawning by hatchery-origin Chinook Salmon or Coho Salmon was detected downstream of Reach 7.

Table 9. Redd counts (before species differentiation) by week and reach, Trinity River surveys 2017. NS = No Survey for scheduled surveys that were missed. Dashes (-) represent days when surveys were not scheduled.

Week	Reach												
start	1	2	3	4	5	6	7	9	10	12	13	14	Total
Aug. 27	0	-	-	-	-	-	-	-	-	-	-	-	-
Sep. 3	1	0	0	NS	NS	NS	NS	-	-	-	-	-	1
Sep. 10	6	3	1	1	2	1	0	0	0	-	-	-	14
Sep. 17	13	13	3	10	15	2	1	-	-	-	-	-	57
Sep. 24	8	13	16	34	32	18	NS	3	3	-	-	-	127
Oct. 1	22	52	21	29	24	44	NS	-	-	0	0	0	192
Oct. 8	6	14	26	21	41	53	60	122	3	-	-	-	346
Oct. 15	16	15	21	17	25	37	17	-	-	16	2	NS	166
Oct. 22	8	5	4	17	31	21	54	78	NS	-	-	-	218
Oct. 29	8	6	13	5	43	15	26	-	-	16	32	17	181
Nov. 5	16	8	19	10	15	3	22	111	96	-	-	-	300
Nov. 12	21	25	14	7	8	3	7	-	-	NS	NS	NS	85
Nov. 19	51	18	16	NS	NS	1	NS	NS[a]	NS[a]	-	-	-	86
Nov. 26	21	19	17	10	10	4	2	44	27	NS[a]	NS	NS	154
Dec. 3	8	8	3	0	5	2	0	NS[a]	NS[a]	6	-	-	32
Dec. 10	5	4	0	0	0	NS	NS	1	6	NS[a]	3	2	21
Dec. 17	0	0	1	0	-	-	-	-	-	1	0	-	2
Total	210	203	175	161	251	204	189	359	135	39	37	19	1,982

[a] missed survey rescheduled for the following week

Table 10. Estimated numbers and bootstrap-generated 95% confidence intervals of salmon redds by species and origin observed in the mainstem Trinity River, 2017. Natural- and hatchery-origin estimates are for the maternal first generation only.

Species	Origin	Redd estimate	95% confidence limits	
			Lower	Upper
Chinook Salmon	All	1,948 [b]	-	-
	Natural	1,600	1,435	1,762
	Hatchery	348	186	348
Coho Salmon [a]	All	34 [b]	-	-
	Natural	NA [c]	-	-
	Hatchery	NA [c]	-	-

[a] The survey season only partially covers the Coho Salmon spawning period

[b] Confidence intervals are generated with both Chinook and Coho salmon data. Not enough female Coho Salmon carcasses were found in 2017 to calculate a confidence interval.

[c] Not enough Coho Salmon carcasses were observed in 2017 to calculate separate estimates for natural- and hatchery-origin Coho Salmon redds.

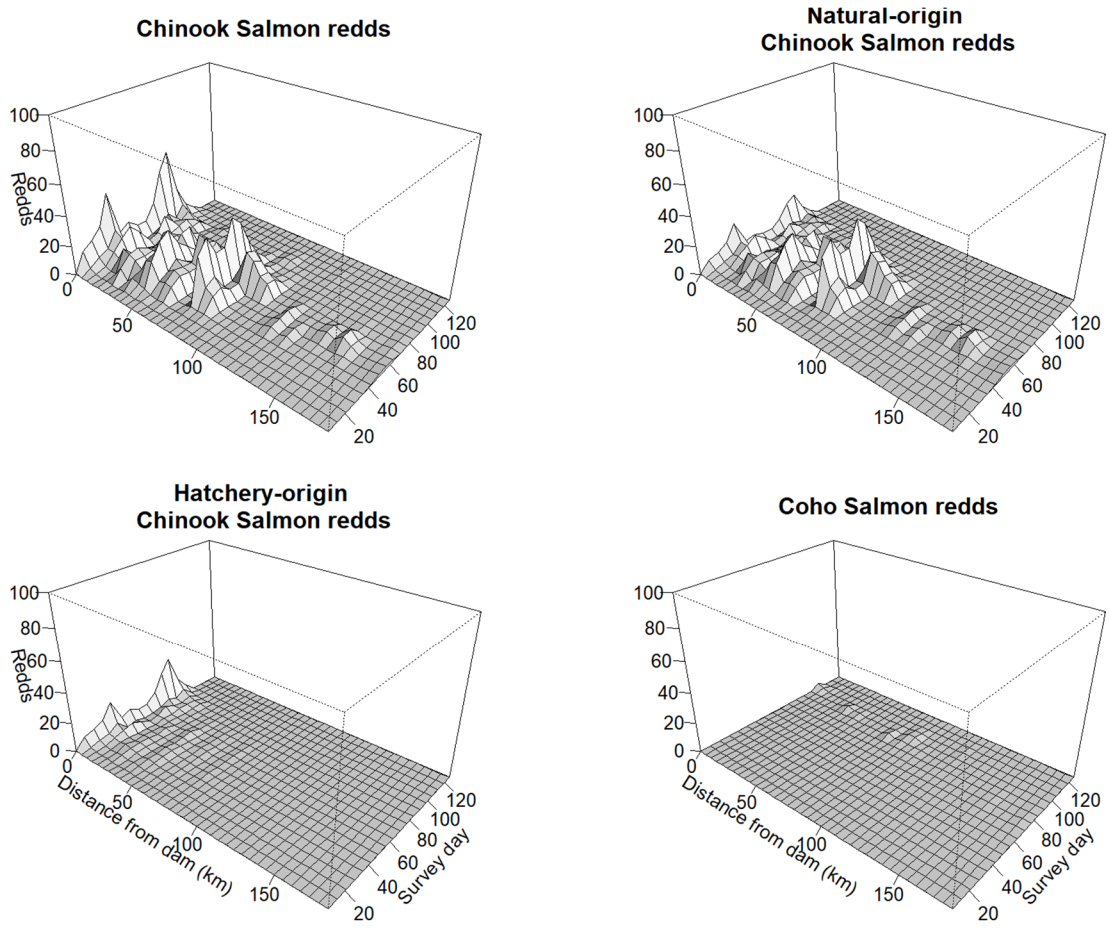

Figure 5. Spatiotemporal distribution of mainstem Trinity River salmon redds from Lewiston Dam to Weitchpec, 2017. Surveys were not conducted in Reaches 8 (rkm 107.6–117.4) and 11 (rkm 63.4–79.1). The Coho Salmon carcass data precluded the differentiation of hatchery- and natural-origin groups. Survey day 1 = September 1.

Redd–Carcass Relationship

Chinook Salmon redds [natural log-(*ln*-) transformed] and fresh spawned female Chinook Salmon carcasses (*ln*-transformed) in Reaches 1 and 2 from 2012 to 2017 had a positive linear correlation ($R^2 = 0.8387$, $p < 0.001$; Figure 6). A significant difference was detected between a slope of '1' and the slope of the linear regression between log-transformed Chinook Salmon redd estimates and Chinook Salmon carcass estimates (slope = 0.637, 95% CI: 0.465–0.809).

Redd Abundance and Distribution: System Scale

From 2002 to 2017, the number of mainstem salmon redds ranged between 1,671 and 7,588 redds and generally decreased over time ($R^2 = 0.2984$, $p = 0.03$; Figure 7). The number of redds constructed by natural-origin Chinook Salmon in the mainstem Trinity River also generally decreased over time, but with no significant trend ($R^2 = 0.0488$, $p = 0.4$), while the number of redds constructed by hatchery-origin Chinook Salmon trended downward ($R^2 = 0.5175$, $p < 0.001$) over this time frame.

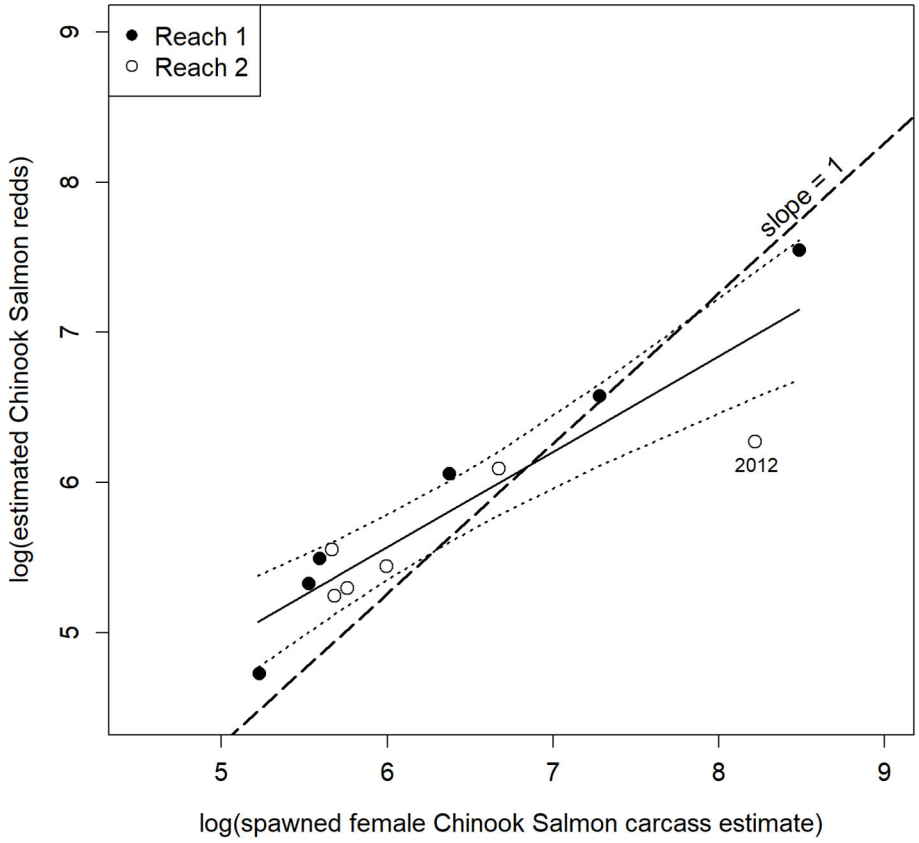

Figure 6. Relationship between counts of *ln*-transformed Chinook Salmon redds and *ln*-transformed estimates of spawned female Chinook Salmon carcasses in Survey Reaches 1 and 2 (solid line), 2012–2017. The dashed line is included to represent a slope of '1', which would be the slope of two perfectly proportional variables. Dotted lines represent 95% confidence limits of the linear model.

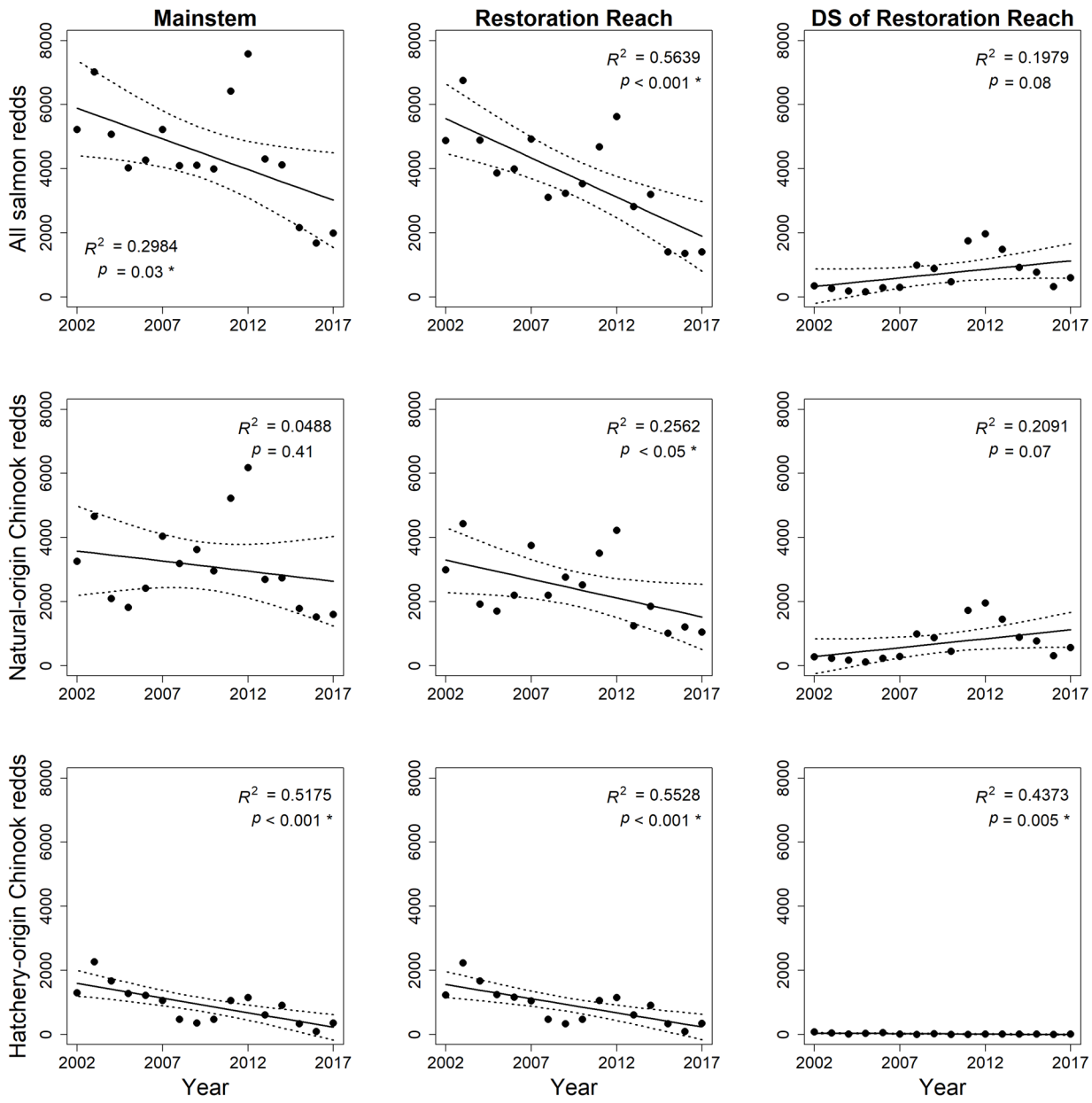

Figure 7. Estimated number of redds constructed in the entire mainstem Trinity River (left), within the restoration reach (center), and downstream (DS) of the restoration reach (right) by all Chinook Salmon (top), natural-origin Chinook Salmon (middle), and hatchery-origin Chinook Salmon (bottom) from 2002 to 2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).

The trends in redd abundance within the restoration reach were similar to the mainstem-wide data (Figure 7). From 2002 to 2017, the number of redds constructed annually by natural- and hatchery-origin Chinook Salmon in the restoration reach were variable but trended downward ($R^2 = 0.2562$, $p < 0.05$ and $R^2 = 0.5528$, $p < 0.001$, respectively).

Downstream of the restoration reach the number of natural-origin Chinook Salmon redds constructed from 2002 to 2017 generally increased but with no significant trend ($R^2 = 0.1979$, $p = 0.07$; Figure 7). A significant decrease in hatchery-origin Chinook Salmon redds was detected downstream of the restoration reach ($R^2 = 0.4773$, $p = 0.005$), but relatively few to no redds were constructed by hatchery-origin Chinook Salmon in this section of river. From 2002 to 2006 between 33 and 72 redds per year were estimated to be constructed by hatchery-origin Chinook Salmon downstream of the restoration reach except for 2004 when none were estimated. From 2007 to 2017 between 0 and 14 redds per year were estimated to be constructed by hatchery-origin Chinook Salmon downstream of the restoration reach and only zero or one redd was estimated in 8 of those 11 years.

In the section of river from Lewiston Dam to Cedar Flat (Reaches 1–10), the mean distance from the dam of redds constructed by natural- (49.2 km) and hatchery-origin (14.2 km) Chinook Salmon were both the highest in the 16-year history of this project. From 2002 to 2016, the mean distance of redds from the dam ranged between 15.3 and 48.9 km for natural-origin and between 2.1 and 7.5 km for hatchery-origin Chinook Salmon. In this section of river, the mean distance from Lewiston Dam of natural-origin Chinook Salmon redds shifted downstream from 2002 to 2017 ($R^2 = 0.7697$, $p < 0.001$; Figure 8). This trend, to a lesser degree, was also evident for redds constructed by hatchery-origin Chinook Salmon ($R^2 = 0.2508$, $p < 0.05$), which also consistently spawned near Lewiston Dam.

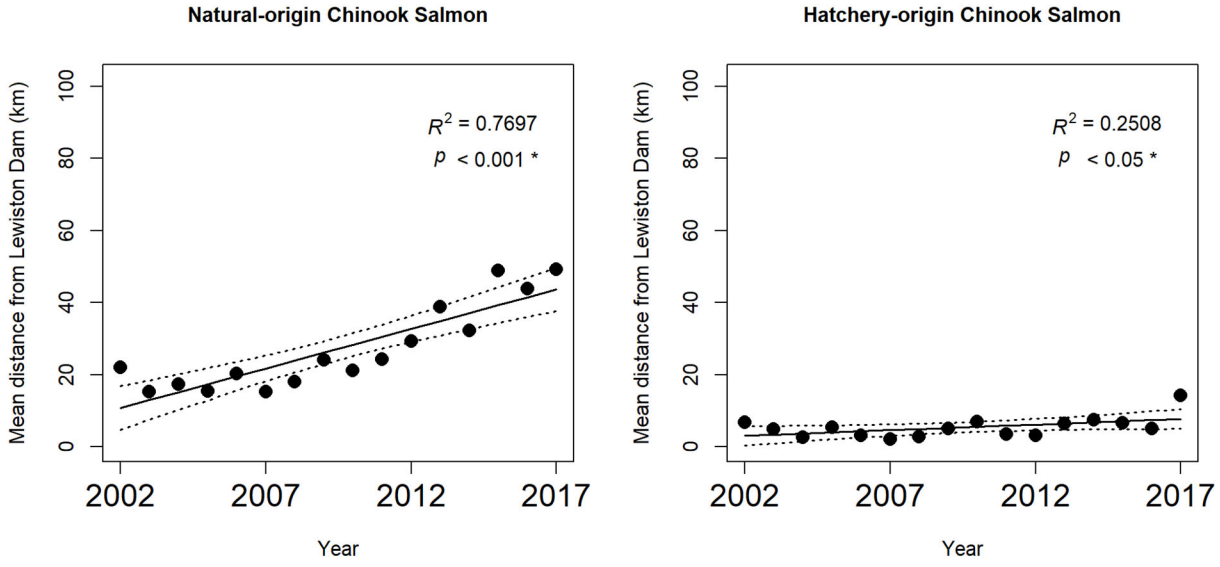

Figure 8. Mean distance from Lewiston Dam of redds constructed by natural- (left) and hatchery-origin (right) Chinook Salmon females between Lewiston Dam and Cedar Flat (0–102.8 km from Lewiston Dam; Reaches 1–10) on the mainstem Trinity River, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).

Redd Abundance and Distribution: Reach Scale

Long-term changes in natural-origin Chinook Salmon redd distribution were detected at the reach scale (~10–20 km). Redds by natural-origin Chinook Salmon most drastically trended downward in the Lewiston ($R^2 = 0.5252$, $p = 0.002$) and Limekiln ($R^2 = 0.3047$, $p = 0.03$) reaches and generally decreased, although not significantly, in the Douglas City reach from 2002 to 2017 (Figure 9). The number of redds between the Junction City and Del Loma reaches generally increased over this time period and generally decreased, although not significantly, in the Salyer Gorge, Willow Creek Valley, and Hoopa Valley reaches over the shorter time period from 2007 to 2017. To account for annual variation in run size, the proportions of natural-origin Chinook Salmon redds within each of the ten reach-scale segments relative to the annual total in the entire mainstem river were compared (Figure 10). This analysis revealed a shift in spawning distribution, where natural-origin Chinook Salmon redds decreased in the two upstream-most reaches [Lewiston ($R^2 = 0.8034$, $p < 0.001$) and Limekiln ($R^2 = 0.4771$, $p = 0.003$)], did not significantly change in the Douglas City reach, and increased in the mid-river reaches [Junction City ($R^2 = 0.5326$, $p = 0.001$), North Fork ($R^2 = 0.5184$, $p = 0.002$), Big Bar ($R^2 = 0.6798$, $p < 0.001$), and Del Loma ($R^2 = 0.7897$, $p < 0.001$) reaches]. The proportion of redds in the downstream-most reaches (Salyer Gorge, Willow Creek Valley, and Hoopa Valley) have not changed significantly.

Most hatchery-origin Chinook Salmon redds were constructed in the Lewiston rehabilitation reach (range = 72–1,888 redds/year, mean = 770 redds/year) and, to a lesser degree, in the Limekiln rehabilitation reach (range = 19–236 redds/year, mean = 84 redds/year) from 2002 to 2017. Over this time frame, the abundance of hatchery-origin Chinook Salmon redds significantly decreased in the Lewiston reach ($R^2 = 0.5648$, $p < 0.001$) and generally decreased in the Limekiln reach (Figure 11). Fewer hatchery-origin Chinook Salmon redds were found downstream of the Limekiln reach to the Del Loma reach where their redd numbers averaged between 7 and 18 per year in each reach and only changed significantly in the Del Loma reach ($R^2 = 0.2753$, $p = 0.04$). No redds were predicted to be associated with hatchery-origin Chinook Salmon downstream of the Del Loma reach.

To account for annual variation in run size, the proportions of hatchery-origin Chinook Salmon redds within each of the reaches were compared to the annual total in the entire mainstem river (Figure 12). The majority of hatchery-origin Chinook Salmon redds were consistently observed in the Lewiston reach (range = 51.7%–95.4%, mean = 82.3%) and, to a smaller degree, in the Limekiln reach (range = 3.5%–30.2%, mean = 11.5%) from 2002 to 2017. The proportion of hatchery-origin Chinook Salmon redds in the Lewiston reach generally decreased while the proportion of redds in the Limekiln reach significantly increased ($R^2 = 0.4229$, $p = 0.006$) over this time period. The mean proportion of hatchery-origin Chinook Salmon redds in each reach downstream of the Limekiln reach ranged between 0.0% and 2.2% and did not change significantly in any of the reaches (Figure 12).

Redd Abundance and Distribution: Site Scale

The proportional abundance of natural-origin Chinook Salmon within the 44 site-scale river sections show a range of long-term (2002–2017) trends. Most sites (21) did not show a significant change, 17 sites showed an increasing trend, and 6 sites showed a decreasing trend (Appendix D). The three upstream-most sites (Lewiston Hatchery, Sven Olbertson, and Old Bridge sites) underwent significant decreases in the proportion of natural-origin

Chinook Salmon redds, followed by a less drastic general decrease at the Sawmill site and significant decrease at the Upper Rush Creek site. Most sections from the Lower Rush Creek site to the Douglas City site did not significantly change. At each site downstream of the Douglas City site, from the Reading Creek site to the Bagdad site, the proportion of natural-origin Chinook Salmon redds either generally or significantly increased.

Of the 22 mechanical channel rehabilitation sites with at least five years of post-construction data, the proportional abundance of natural-origin Chinook Salmon redds trended upward at 7 sites, trended downward at 2 sites, and displayed no significant change at 13 sites (Appendix E). Similar to the long-term trends, the proportional abundance of natural-origin Chinook Salmon redds generally or significantly decreased in the upstream-most sites (Lewiston Hatchery to Sawmill sites), did not change in the middle sites (Dark Gulch to Upper Douglas City sites), and generally or significantly increased in most of the downstream-most sites (Douglas City to Pear Tree Bar sites).

Hatchery-origin Chinook Salmon redds were not distributed throughout the restoration sites and were too few or absent to merit statistical analysis at the site scale. Like at the reach scale, the proportion of hatchery-origin fish were at or close to zero at most sites below the Limekiln reach from 2002 to 2017.

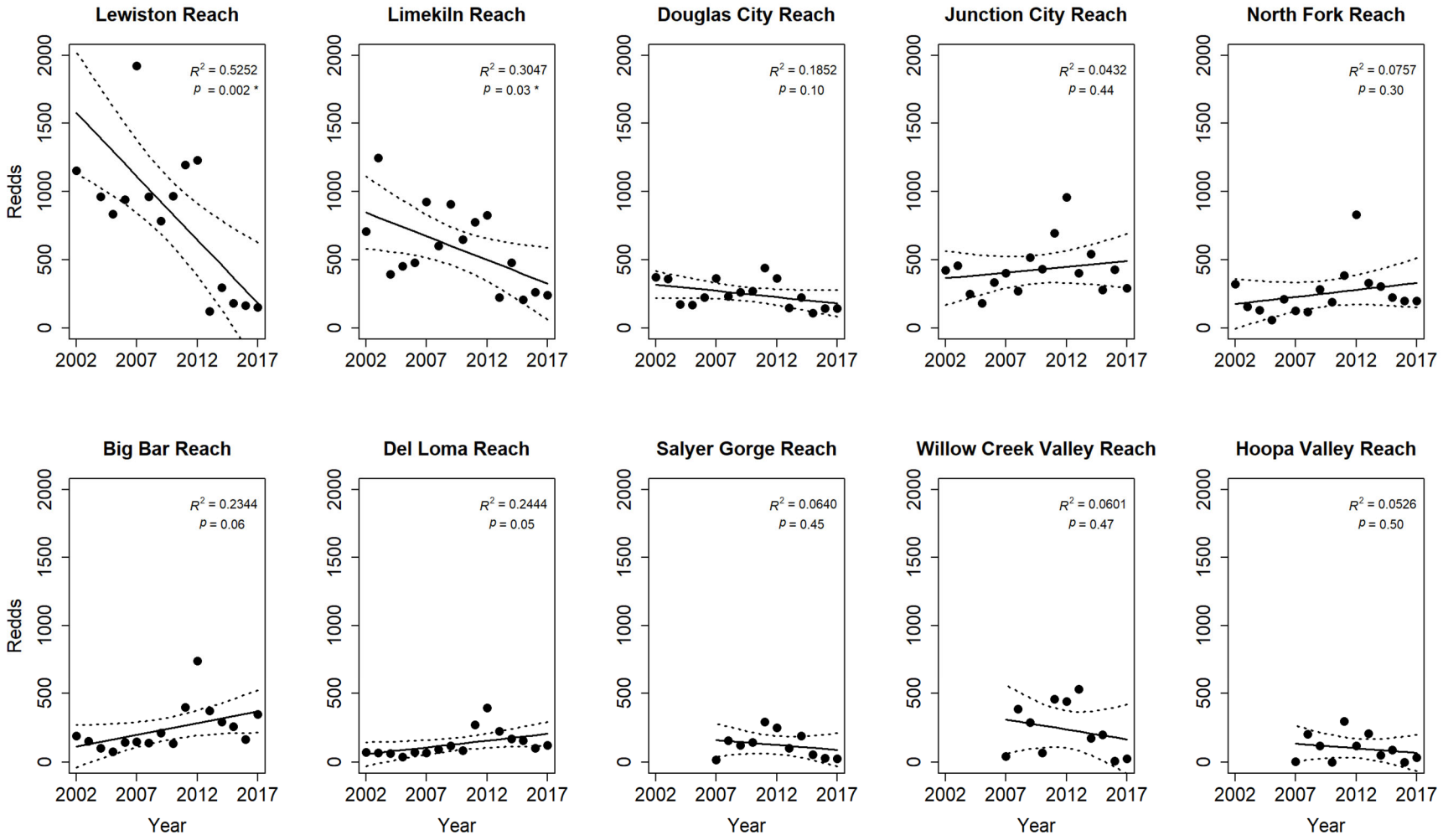

Figure 9. Estimated number of mainstem Trinity River natural-origin Chinook Salmon redds within ten reach-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).

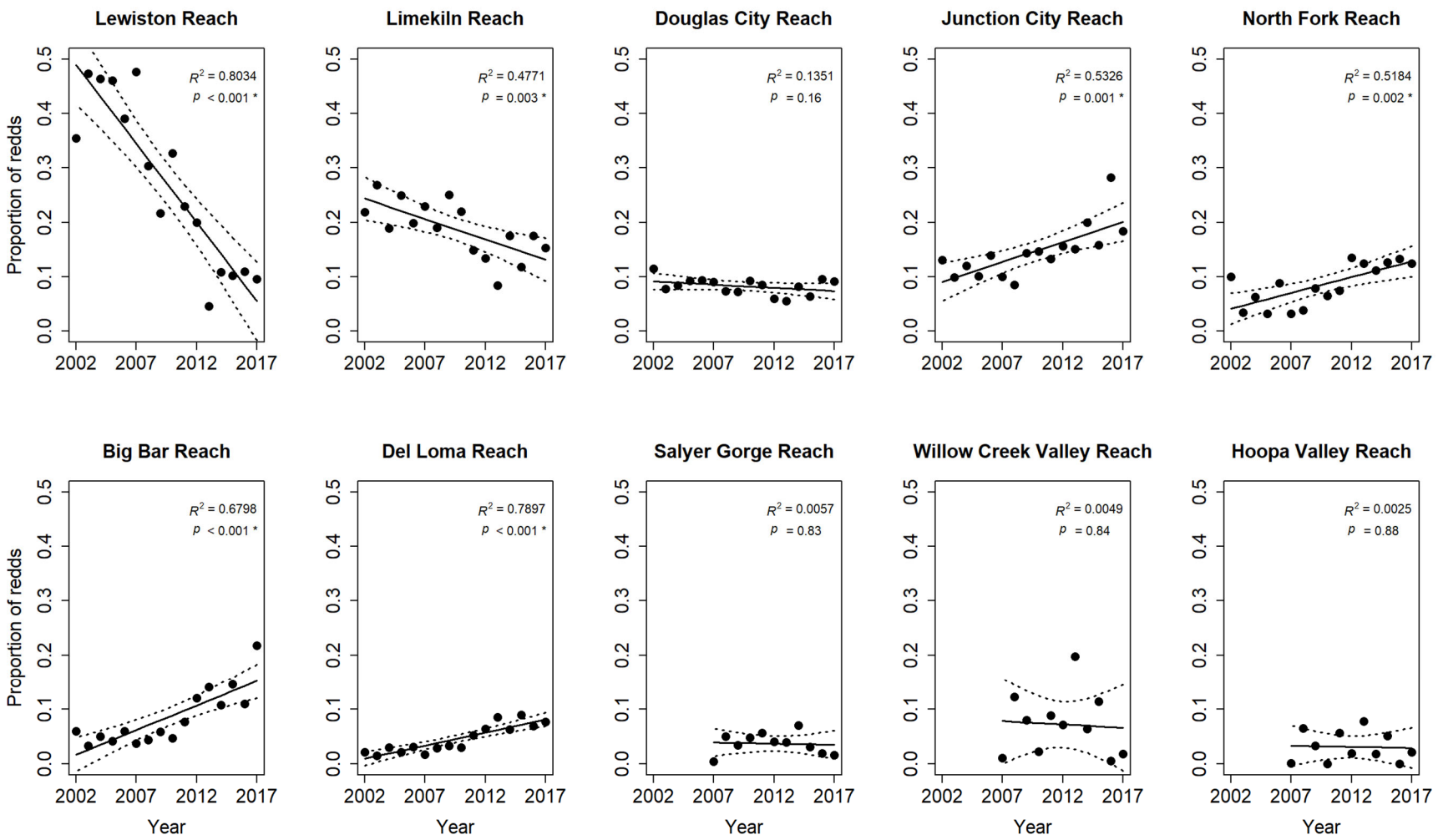

Figure 10. Proportions of mainstem Trinity River natural-origin Chinook Salmon redds relative to the total mainstem count of natural-origin Chinook Salmon redds within ten reach-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, *p*-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).

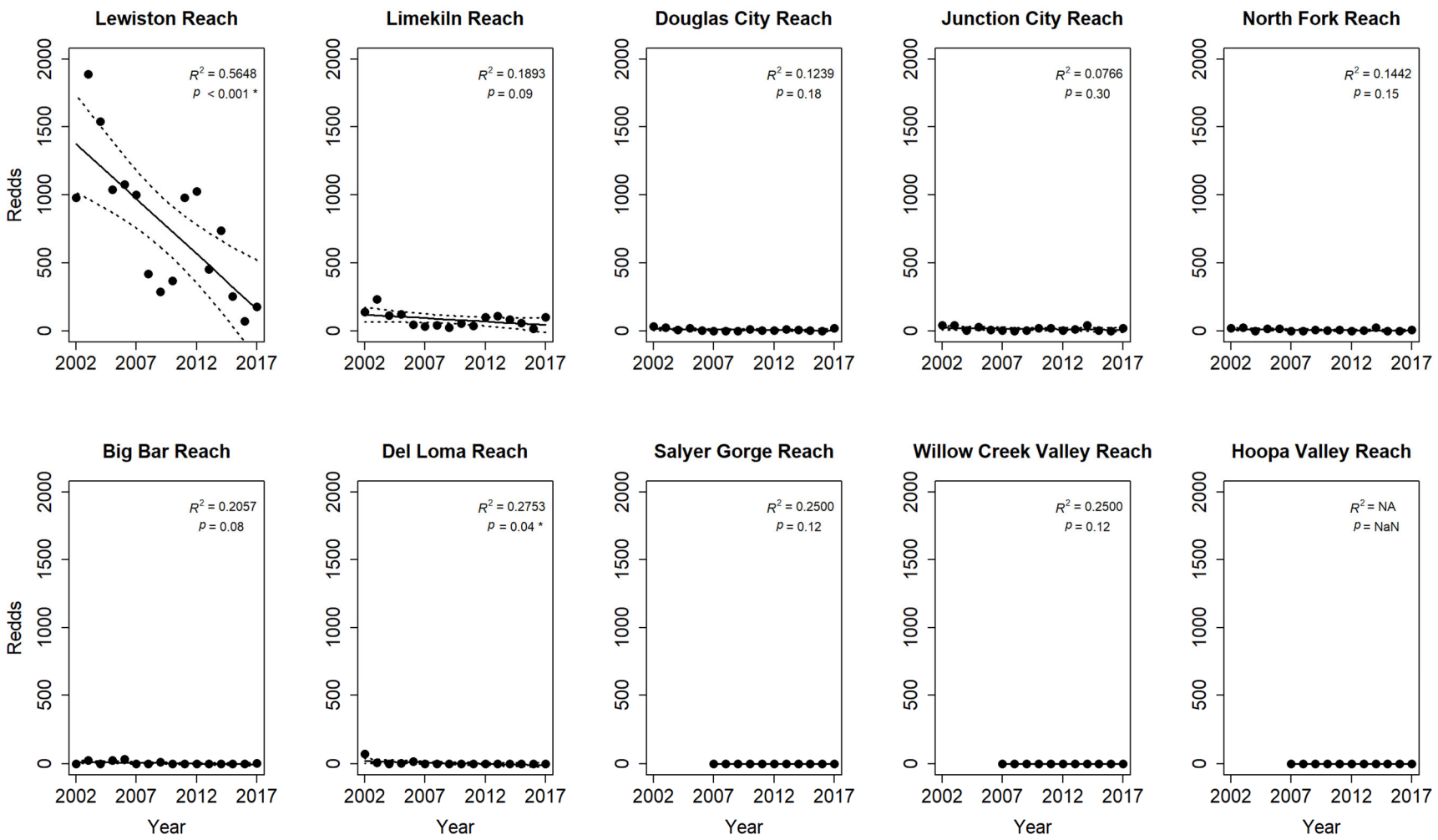

Figure 11. Estimated number of mainstem Trinity River hatchery-origin Chinook Salmon redds within ten reach-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).

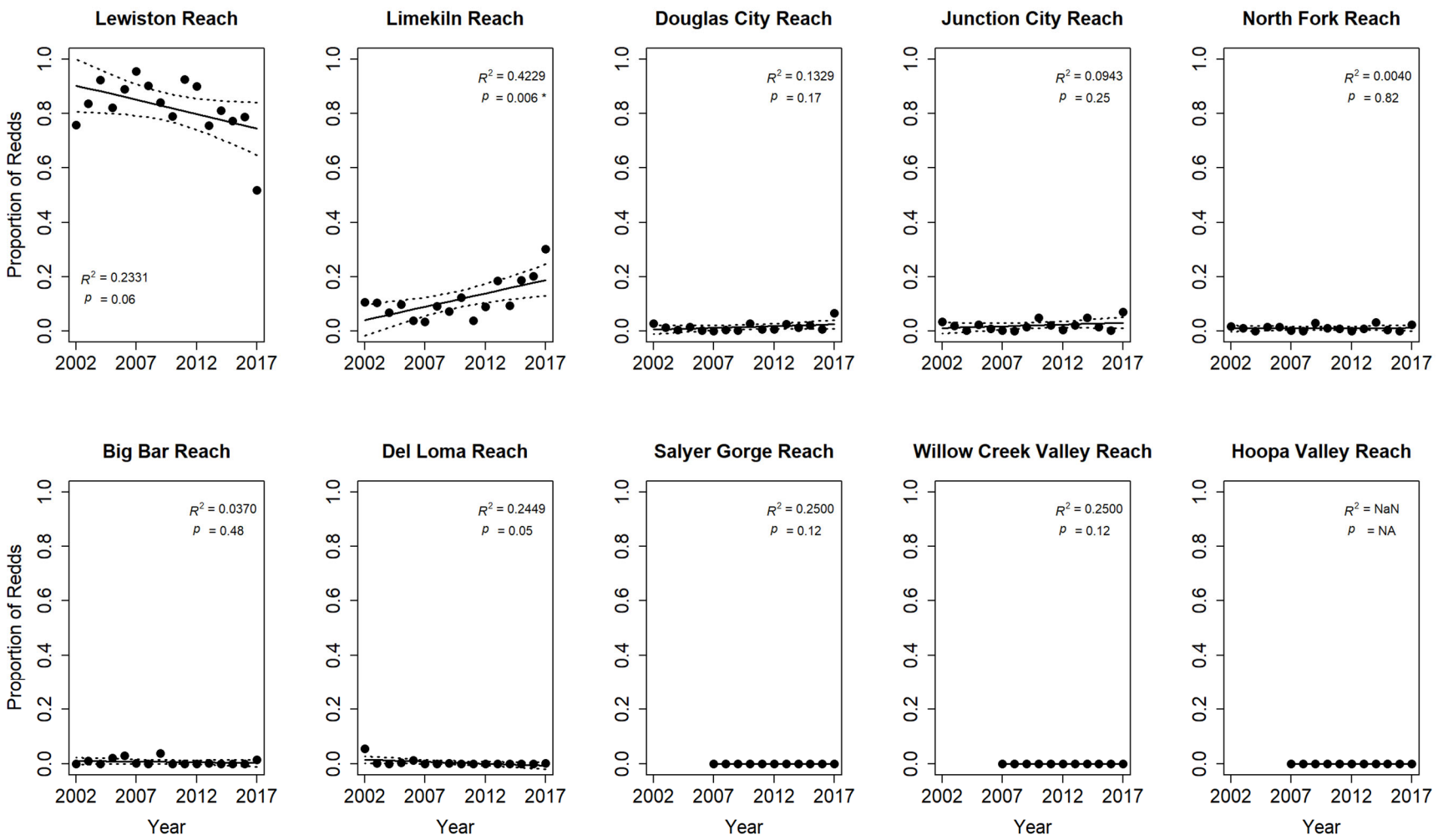

Figure 12. Proportions of mainstem Trinity River hatchery-origin Chinook Salmon redds relative to the total mainstem count of hatchery-origin Chinook Salmon redds within ten reach-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).

Discussion

Redd counts from the 2017 spawning season were the second lowest since this survey's inception in 2002 and salmon carcass estimates were the third lowest. Our 2017 results are consistent with the California Department of Fish and Wildlife Chinook Salmon natural spawner escapement estimates for the Trinity River Basin, which estimated the third lowest numbers of both spring- and fall-run Chinook Salmon since 2002 (CDFW 2018a, 2018b).

Flows were generally stable throughout the survey period in the upper reaches and most of the survey period in the lower reaches. Rain events elevated water turbidity and the reduced visibility impaired the ability to detect redds and carcasses in the lower reaches from mid- to late November. Though scheduled lower river (Reaches 12–14) surveys in mid- to late November were cancelled due to high flow and poor visibility, spawning is typically sparse in these reaches and any missed redds from this section would likely have only been a minor contribution to the total redd count.

The analyses of long-term data from our spawning surveys provide insight into the dynamics of Chinook Salmon spawning activity on the Trinity River. The main themes that emerge are 1) the overall abundance of natural-origin Chinook Salmon redds did not change significantly from 2002 to 2017, 2) straying and spawning of hatchery-origin salmon is generally confined to areas near the hatchery below Lewiston Dam, 3) the spatial distribution of natural-origin Chinook Salmon spawning continues to change, and 4) pre-spawn mortality has been relatively low in recent years.

The annual natural-origin Chinook Salmon redd count from 2002 to 2017 ranged between 1,516 (in 2016) and 6,170 (in 2012). Spawner abundance was hypothesized to increase following restoration actions (TRRP and ESSA 2009), but the abundance of natural-origin Chinook Salmon redds in the mainstem Trinity River from 2002 to 2017 did not significantly change (Figure 7). Other factors (e.g., harvest, ocean conditions, in-river conditions, etc.) that influence in-river escapement may have masked any responses in spawning activity to river restoration. Shifts in abundance are common to Chinook Salmon populations (Mantua et al. 1997; Brown 2002) and are evident in the Klamath Basin (CDFW 2018a, 2018b). The estimates of Trinity River natural-spawner adult escapement (2,532 spring-run and 6,072 fall-run; CDFW 2018a, 2018b) in 2017 were notably below the TRRP annual river escapement goal of 68,000 natural-origin Chinook Salmon spawners (6,000 spring-run adults and 62,000 fall-run adults).

Although the abundance of natural-origin Chinook Salmon redds did not show a significant trend from 2002 to 2017, the spatial distribution of redds shifted downstream. The increase in mean distance from Lewiston Dam of natural-origin Chinook Salmon redds was previously documented (Chamberlain et al. 2012; Rupert et al. 2017a, 2017b) and data collected in 2017 continue to follow this trend. This shift is consistent with the IAP's suggestion that changes in longitudinal redd distribution would happen within three to four brood cycles following restoration activities (TRRP and ESSA 2009).

The abundance of hatchery-origin Chinook Salmon redds (redds constructed by hatchery-produced females regardless of male origin) decreased significantly from 2002 to 2017, as evident in the Lewiston Reach where the majority of hatchery-origin Chinook Salmon

spawn (Figure 11). Also, even though the distribution of hatchery-origin Chinook Salmon redds has remained skewed towards the TRH (Figure 5), the proportion of hatchery-origin Chinook Salmon redds has generally decreased in the Lewiston Reach and increased in the Limekiln Reach (Figure 12). The number and release timing of hatchery-reared juvenile Chinook Salmon has remained relatively constant over these years, so the reason for the decrease in abundance of hatchery-origin Chinook Salmon redds is unclear. While IAP objectives advocate limiting the genetic interaction of hatchery- and natural-origin Chinook Salmon, and having fewer hatchery-origin Chinook Salmon redds on the spawning grounds does support these objectives, further investigations are suggested to examine the causes for this decrease in hatchery-origin Chinook Salmon redds.

Reach-scale analyses revealed the clearest resolution for analyzing spawning distribution shifts of natural-origin Chinook Salmon. The proportion of natural-origin Chinook Salmon that spawned near TRH and Lewiston Dam (Lewiston and Limekiln reaches) decreased from 2002 to 2017 and more spawned in the mid-river sections (Junction City–Del Loma reaches; Figure 10). This shift is contrary to the IAP hypothesis that redd abundance in the reaches below the North Fork Trinity River would not increase until escapement began to approach restoration goals (TRRP and ESSA 2009). TRRP restoration actions may therefore be influencing a larger portion of the Trinity River than expected. Presumably, flow management is the primary factor for the spawning distribution shift of natural-origin Chinook Salmon since the effects of flow extend downstream much further than the generally localized effects of mechanical channel rehabilitation, course sediment augmentation, and watershed (tributaries) restoration.

Changes in redd abundance at the site scale was specifically used to evaluate the effect of TRRP channel rehabilitation activities. Our analysis revealed no clear post-construction response at rehabilitation sites. As reported in Rupert et al. (2017a), despite being the smallest scale used in our analyses, the site scale may still be too spatially broad and too few years have passed since construction to detect responses to restoration. A positive response in the abundance of Chinook Salmon redds to channel rehabilitation may take many generations that encompass several years of geomorphic change and restoration site maturation. TRRP channel rehabilitation sites only secondarily affect spawning habitat since many constructed features are intended to increase and diversify juvenile rearing habitats and/or change the geomorphology of the site. The long-term effects of flow management, however, are intended to increase spawning habitat, though this would presumably affect all sites regardless of channel rehabilitation treatments (TRRP and ESSA 2009).

The relationship between redd counts and the estimated number of spawned female Chinook Salmon in Reaches 1 and 2 using the 2012–2017 data set indicate a density-dependent redd observation bias (Figure 6). This is contrary to the result that Rupert et al. (2017a) found with just the 2012–2014 data set. The Reach 2 data point from 2012, the largest run year, appears to have a negative influence on the slope of the regression line. Large spawning runs in the future may help validate or refute the density-dependent observation bias within this section of the river.

The importance of describing pre-spawn mortality has increased in recent years with ongoing drought conditions and associated higher risks of epizootic events. Aguilar et al. (1996) reported that pre-spawn mortality for Chinook Salmon ranged between 1.1% and 44.9% in the mainstem Trinity River above the North Fork confluence from 1978 to 1982

and 1987 to 1995. In comparison, pre-spawn mortality rates that we measured were relatively low (between 0.0% and 9.5% from 2009 to 2016 and 2.0% in 2017) in this section of the river. Salmon pre-spawn mortality rates are typically highest at the beginning of the spawning season and decrease as the season advances (Aguilar et al. 1996; Gough and Williamson 2012). Too few pre-spawn mortality Chinook Salmon carcasses (six) were observed in 2017 to conduct a temporal analysis. Aguilar et al. (1996) also reported a positive correlation between pre-spawn mortality and run size for Trinity River Chinook Salmon from 1978 to 1995. After adding the data from 2017, which had the second lowest redd count and third lowest pre-spawn mortality rate since 2009, to the data from 2009 to 2016, no correlation was detected between these two parameters in the restoration reach (Appendix F). The lack of correlation suggests that other factors beyond run size (i.e., river conditions, run timing, etc.) may be influencing pre-spawn mortality rates. The 2017 Coho Salmon run size was notably small and the carcasses sample size (n = 1 fresh female) was inadequate to assess pre-spawn mortality for this species. Interpretation of results pertaining to spawning success should take into account that pre-spawn mortality occurs outside of the temporal and spatial extend of the surveys. Pre-spawn mortality fish are available to our carcass survey because they expired prior to spawning. The spatiotemporal location of carcass recovery is unlikely to be an accurate depiction of when and where fish were destined to spawn had they survived. For instance, pre-spawn mortality occurring in the Lower Klamath River for Trinity River-bound fish were not detectable during our Trinity River spawn surveys. Likewise, spring-run Chinook Salmon that expired well before the first surveys in September were also undetectable.

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Appendices

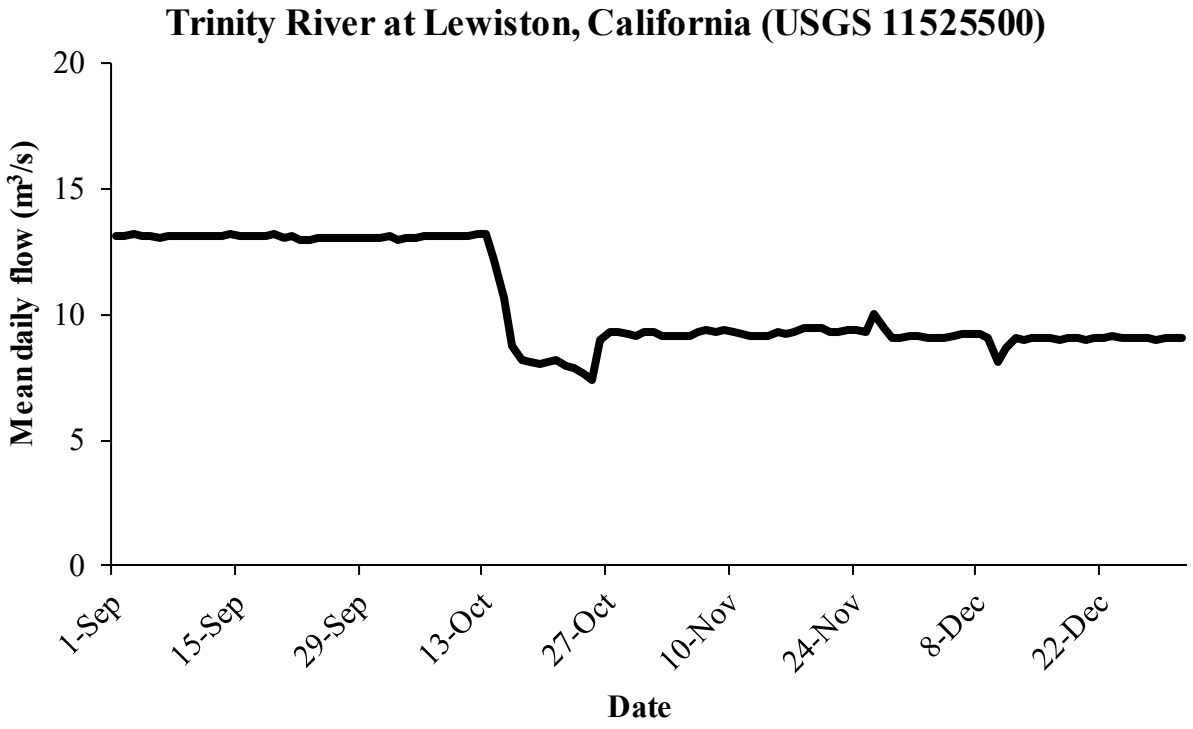
Appendix A. Trinity River water visibility by week and reach throughout the 2017 survey period. Grey boxes represent surveys with sub-optimal visibility. NS = No Survey for scheduled surveys that were missed. Dashes (-) represent days when surveys were not scheduled or performed.

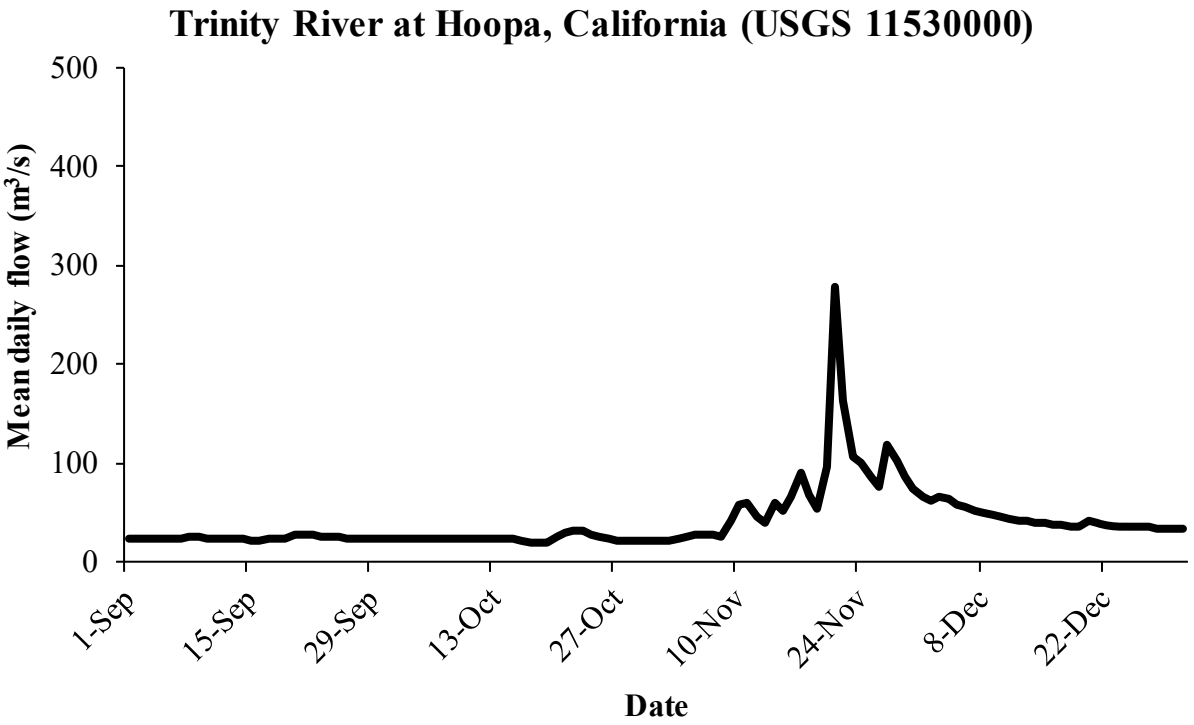
Week start	Reach											
	1	2	3	4	5	6	7	9	10	12	13	14
Aug. 27	1.5-3.0	-	-	-	-	-	-	-	-	-	-	-
Sep. 3	0.9-1.5	0.9-1.5	0.9-1.5	NS	NS	NS	NS	-	-	-	-	-
Sep. 10	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	0.9-1.5	0.9-1.5	<0.9	0.9-1.5	-	-	-
Sep. 17	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	0.9-1.5[b]	0.9-1.5[b]	-	-	-	-	-
Sep. 24	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	0.9-1.5	NS	0.9-1.5	0.9-1.5	-	-	-
Oct. 1	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0[a]	NS	-	-	1.5-3.0	>3.0	>3.0
Oct. 8	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	>3.0	>3.0	1.5-3.0[b]	0.9-1.5	-	-	-
Oct. 15	1.5-3.0	1.5-3.0	1.5-3.0[a]	0.9-1.5	1.5-3.0[a]	>3.0	>3.0	-	-	>3.0	>3.0	NS
Oct. 22	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0[b]	1.5-3.0[b]	1.5-3.0[b]	NS	-	-	-
Oct. 29	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0[b]	1.5-3.0[b]	-	-	>3.0	>3.0	>3.0
Nov. 5	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0	>3.0	>3.0	>3.0	>3.0	-	-	-
Nov. 12	1.5-3.0	1.5-3.0	1.5-3.0	1.5-3.0[a]	1.5-3.0	0.9-1.5	0.9-1.5	-	-	NS	NS	NS
Nov. 19	1.5-3.0	1.5-3.0	0.9-1.5	NS	NS	0.9-1.5	NS	NS[c]	NS[c]	-	-	-
Nov. 26	1.5-3.0	1.5-3.0	1.5-3.0[b]	1.5-3.0[b]	1.5-3.0[b]	1.5-3.0	1.5-3.0	1.5-3.0	>3.0	NS[c]	NS	NS
Dec. 3	1.5-3.0	1.5-3.0	1.5-3.0[b]	1.5-3.0[b]	1.5-3.0[b]	>3.0	>3.0	NS[c]	NS[c]	1.5-3.0	-	-
Dec. 10	1.5-3.0	1.5-3.0	1.5-3.0[b]	1.5-3.0[b]	1.5-3.0	NS	NS	1.5-3.0[b]	>3.0	NS[c]	>3.0	1.5-3.0
Dec. 17	1.5-3.0	1.5-3.0	1.5-3.0[b]	>3.0	-	-	-	-	-	>3.0	>3.0	-

[a] this is the higher visibilty reported by the two crews. The other crew reported visibilty 0.9-1.5 m

[b] this is the lesser visibilty reported by the two crews. The other crew reported visibilty >3.0 m

[c] missed survey rescheduled for following week





Appendix B. Trinity River mean daily discharge at Lewiston (USGS Gage 11525500) and Hoopa, California (USGS Gage 11530000) during the 2017 survey season.

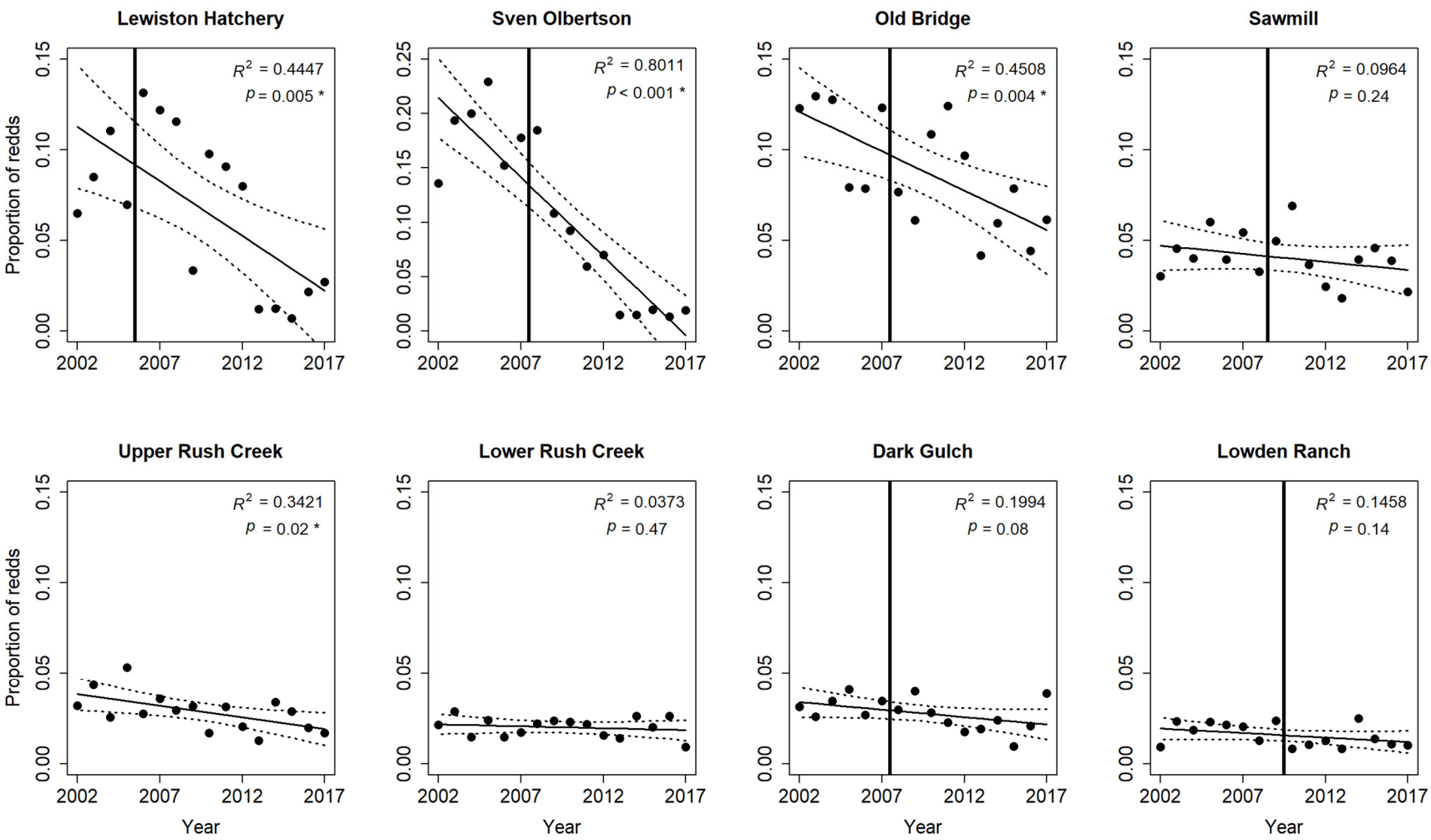
Appendix C. Pre-spawn mortality numbers by week and reach of unmarked and ad-clipped fresh (conditions 1 and 2) female Chinook Salmon carcasses, mainstem Trinity River surveys 2017. Also included are weekly pre-spawn mortality proportions among like mark-type carcasses. Ad-clipped carcass numbers were not expanded by CWT-specific production multipliers and are therefore about 25% of hatchery-origin carcass numbers. Likewise, unmarked carcass numbers include hatchery-origin carcasses that were not ad-clipped. 'NS' = no survey and dashes (-) represent a sample size of zero.

Unmarked

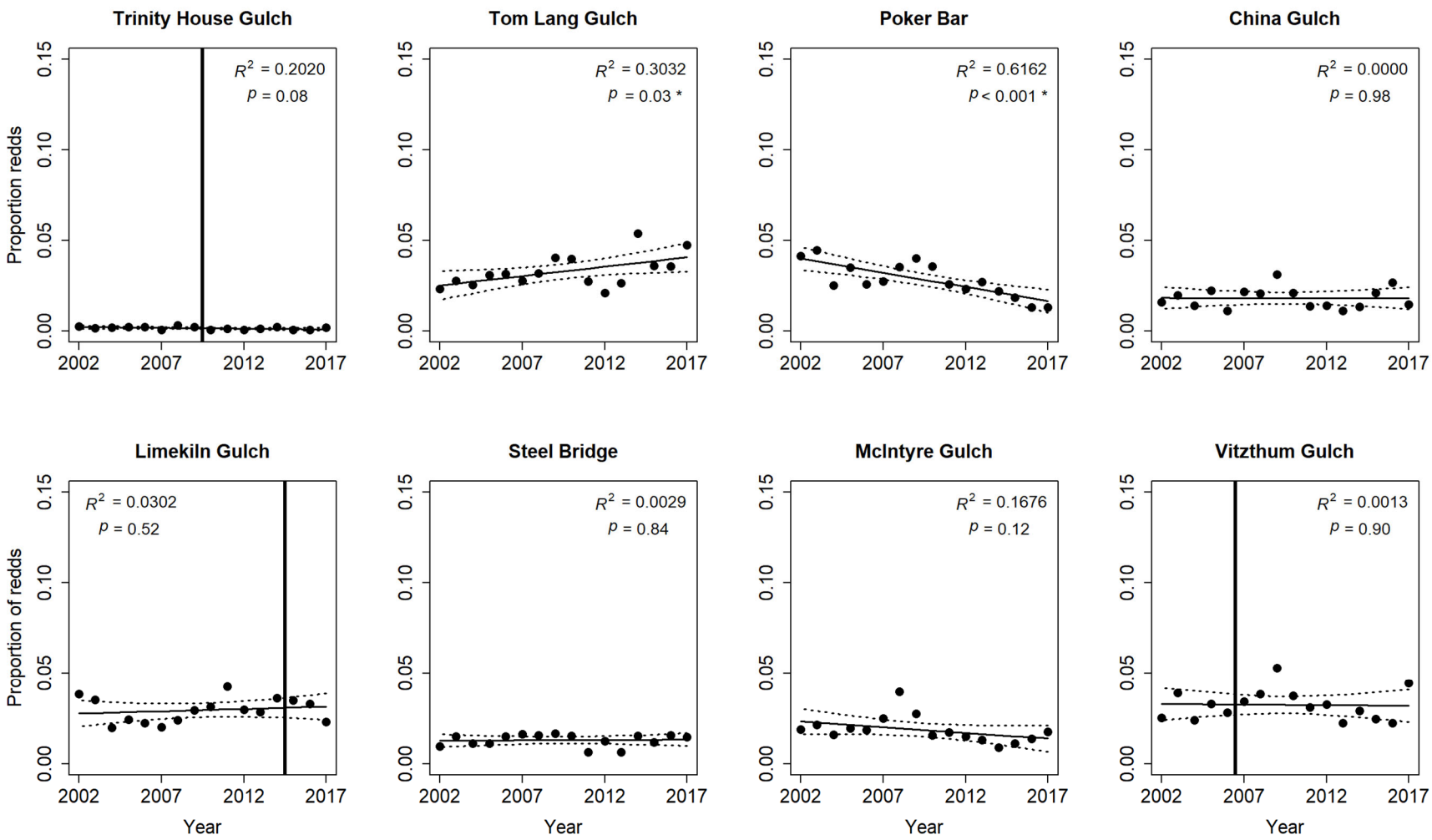
Calendar		Reach												All reaches	
week	Dates	1	2	3	4	5	6	7	9	10	12	13	14	n	Pct.
35	Aug. 27 - Sep. 2	-	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
36	Sep. 3 - 9	-	-	-	-	-	-	NS	NS	NS	NS	NS	NS	-	-
37	Sep. 10 - 16	-	-	-	-	-	-	-	-	-	NS	NS	NS	-	-
38	Sep. 17 - 23	1	0	-	-	1	-	-	NS	NS	NS	NS	NS	**2**	**40.0%**
39	Sep. 24 - 30	-	0	-	-	-	-	NS	-	-	NS	NS	NS	**0**	**0.0%**
40	Oct. 1 - 7	0	0	0	0	-	0	NS	NS	NS	-	-	-	**0**	**0.0%**
41	Oct. 8 - 14	0	0	0	0	0	1	0	-	0	NS	NS	NS	**1**	**4.2%**
42	Oct. 15 - 21	0	0	0	0	0	0	0	NS	NS	-	-	NS	**0**	**0.0%**
43	Oct. 22 - 28	0	0	0	0	0	1	0	0	0	NS	NS	NS	**1**	**1.9%**
44	Oct. 29 - Nov. 4	0	0	0	0	0	0	0	NS	NS	-	0	-	**0**	**0.0%**
45	Nov. 5 - 11	0	0	0	0	0	0	0	0	0	NS	NS	NS	**0**	**0.0%**
46	Nov. 12 - 18	0	0	0	0	-	-	-	NS	NS	NS	NS	NS	**0**	**0.0%**
47	Nov. 19 - 25	1	0	0	NS	NS	0	NS	NS	NS	NS	NS	NS	**1**	**3.7%**
48	Nov. 26 - Dec. 2	1	0	0	0	-	0	-	-	0	NS	NS	NS	**1**	**3.2%**
49	Dec. 3 - 9	0	0	0	-	-	-	-	NS	NS	-	NS	NS	**0**	**0.0%**
50	Dec. 10 - 16	0	0	-	-	-	-	NS	-	-	NS	-	-	**0**	**0.0%**
51	Dec. 17 - 23	-	0	-	-	-	NS	NS	-	-	-	-	-	**0**	**0.0%**
	All weeks	**3**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**-**	**-**	**-**	***6***	***2.0%***

Ad-clipped

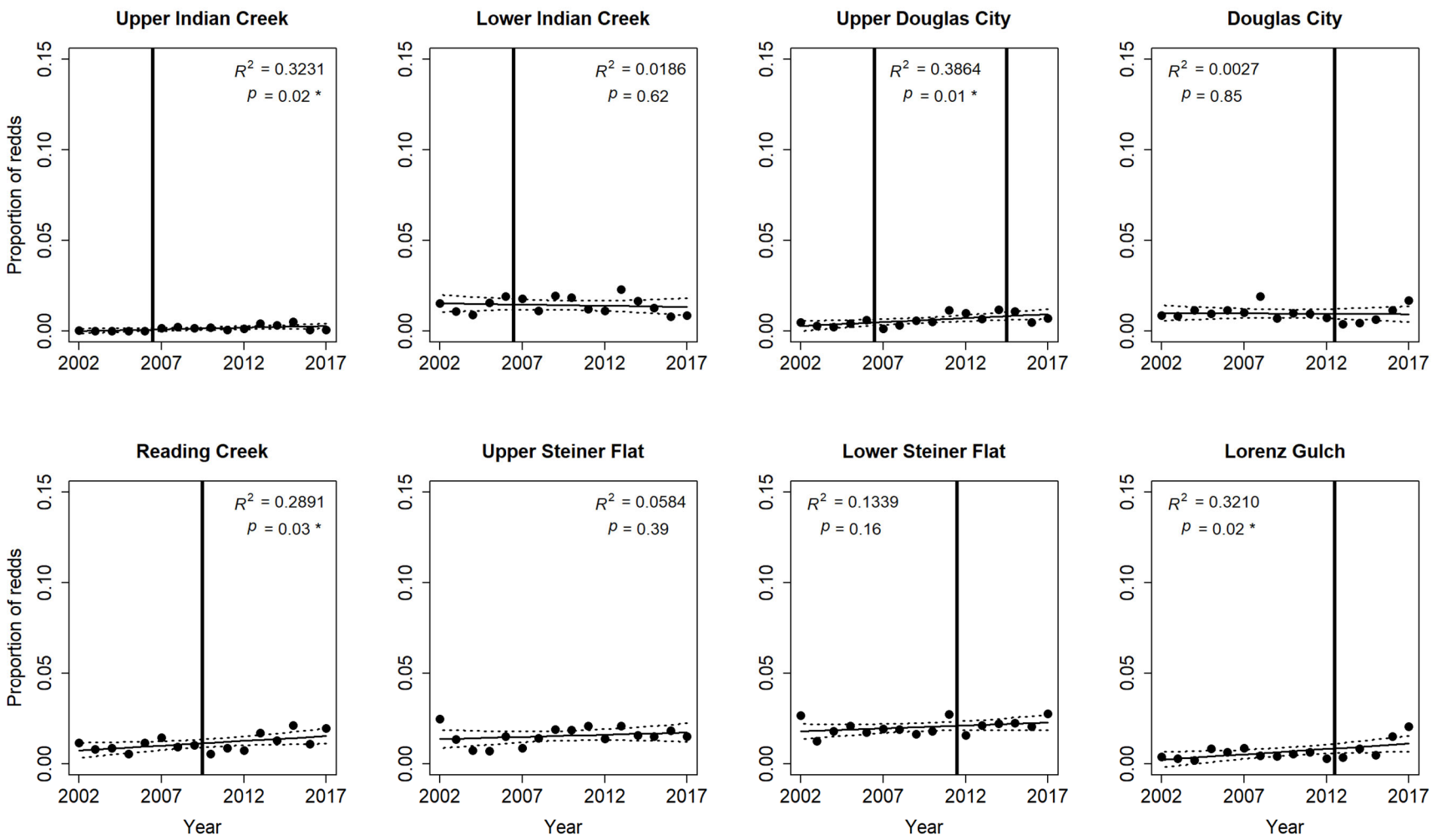
Calendar		Reach												All reaches	
week	Dates	1	2	3	4	5	6	7	9	10	12	13	14	n	Pct.
35	Aug. 27 - Sep. 2	-	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-
36	Sep. 3 - 9	-	-	-	-	-	-	NS	NS	NS	NS	NS	NS	-	-
37	Sep. 10 - 16	-	-	-	-	-	-	-	-	-	NS	NS	NS	-	-
38	Sep. 17 - 23	-	-	-	-	-	-	-	NS	NS	NS	NS	NS	-	-
39	Sep. 24 - 30	-	-	-	-	-	0	NS	-	-	NS	NS	NS	**0**	**0.0%**
40	Oct. 1 - 7	-	0	0	-	-	-	NS	NS	NS	-	-	-	**0**	**0.0%**
41	Oct. 8 - 14	0	-	-	-	0	-	-	-	-	NS	NS	NS	**0**	**0.0%**
42	Oct. 15 - 21	-	0	-	-	-	-	-	NS	NS	-	-	NS	**0**	**0.0%**
43	Oct. 22 - 28	0	-	-	-	-	-	-	-	-	NS	NS	NS	**0**	**0.0%**
44	Oct. 29 - Nov. 4	0	0	-	-	0	-	-	NS	NS	-	-	-	**0**	**0.0%**
45	Nov. 5 - 11	-	-	-	-	-	-	-	-	-	NS	NS	NS	-	-
46	Nov. 12 - 18	0	-	-	-	-	-	-	NS	NS	NS	NS	NS	**0**	**0.0%**
47	Nov. 19 - 25	0	0	-	NS	NS	-	NS	NS	NS	NS	NS	NS	**0**	**0.0%**
48	Nov. 26 - Dec. 2	0	0	-	-	-	-	-	-	-	NS	NS	NS	**0**	**0.0%**
49	Dec. 3 - 9	0	-	-	-	-	-	-	NS	NS	-	NS	NS	**0**	**0.0%**
50	Dec. 10 - 16	-	-	-	-	-	-	NS	-	-	NS	-	-	-	-
51	Dec. 17 - 23	-	-	-	-	-	NS	NS	-	-	-	-	-	-	-
	All weeks	**0**	**0**	**0**	**-**	**0**	**0**	**-**	**-**	**-**	**-**	**-**	**-**	***0***	***0.0%***



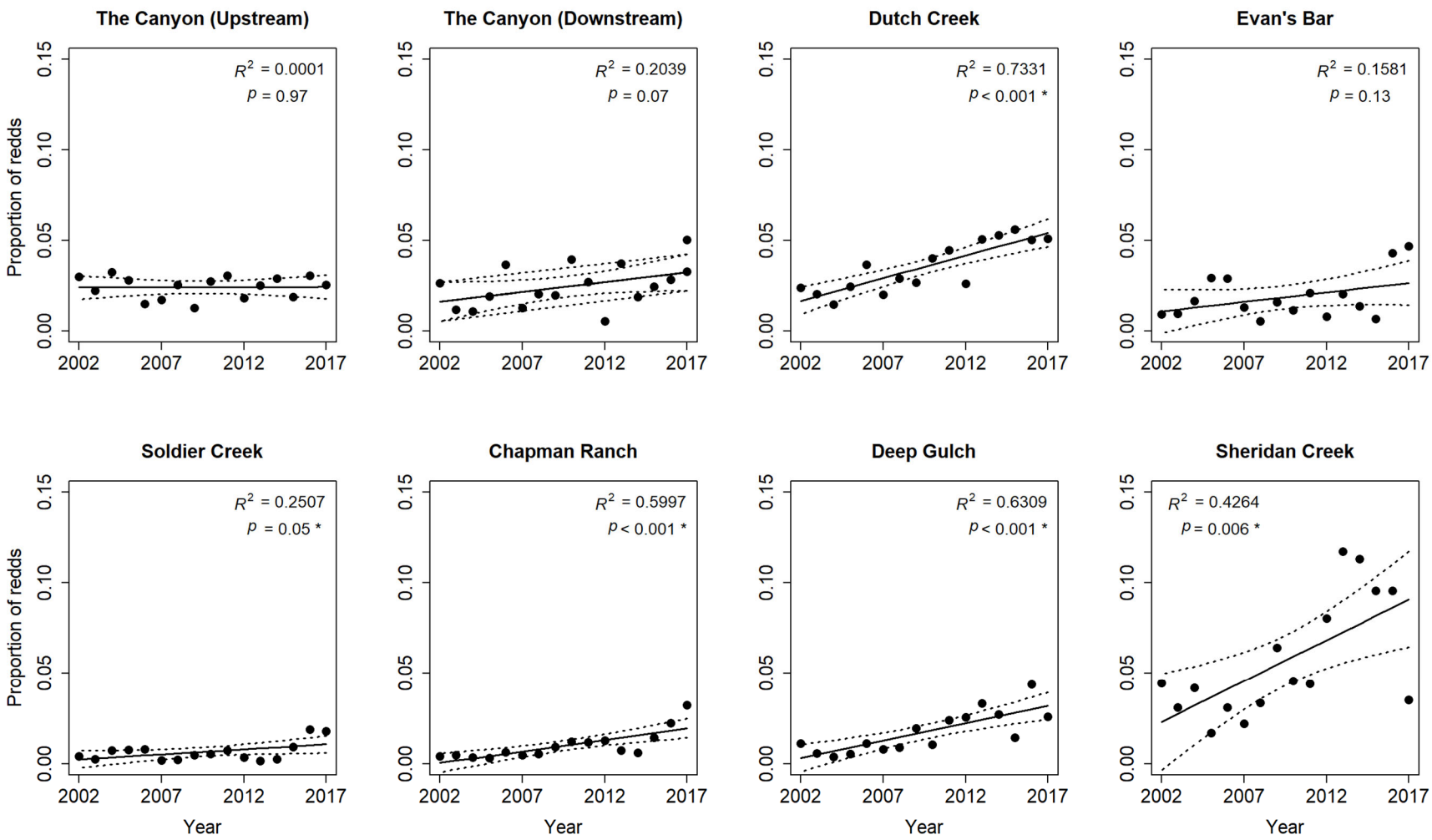
Appendix D. Proportion of TRRP restoration reach natural-origin Chinook Salmon redds within site-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines). The time mechanical channel rehabilitation was initiated is shown as black vertical bars. Note the change in y-axis scale in the Sven Olbertson site.



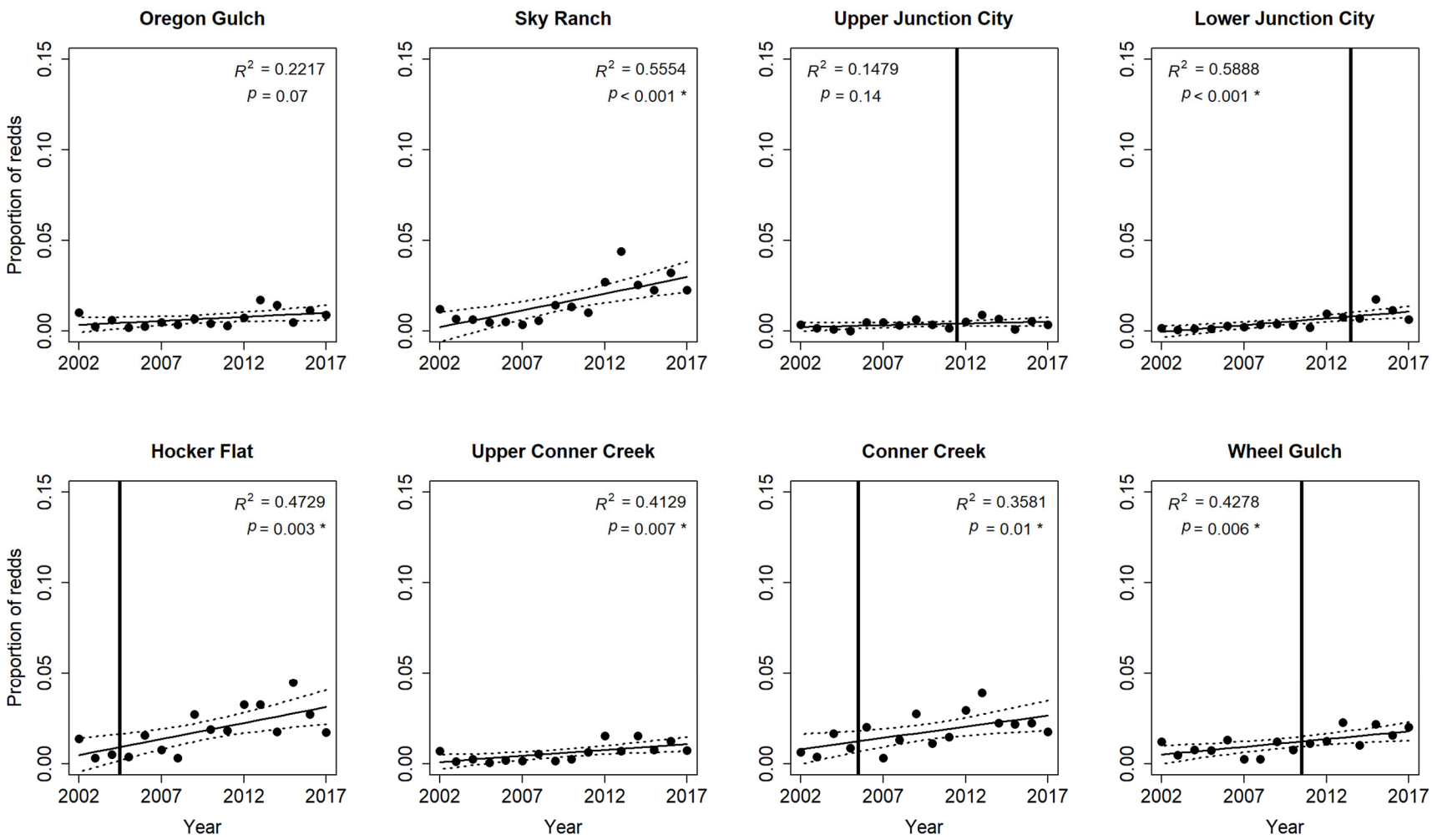
Appendix D (continued). Proportion of restoration reach natural-origin Chinook Salmon redds within site-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines). The time mechanical channel rehabilitation was initiated is shown as black vertical bars.



Appendix D (continued). Proportion of restoration reach natural-origin Chinook Salmon redds within site-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines). The time mechanical channel rehabilitation was initiated is shown as black vertical bars.



Appendix D (continued). Proportion of restoration reach natural-origin Chinook Salmon redds within site-scale sections, 2002–2017. Each plot includes a linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines).



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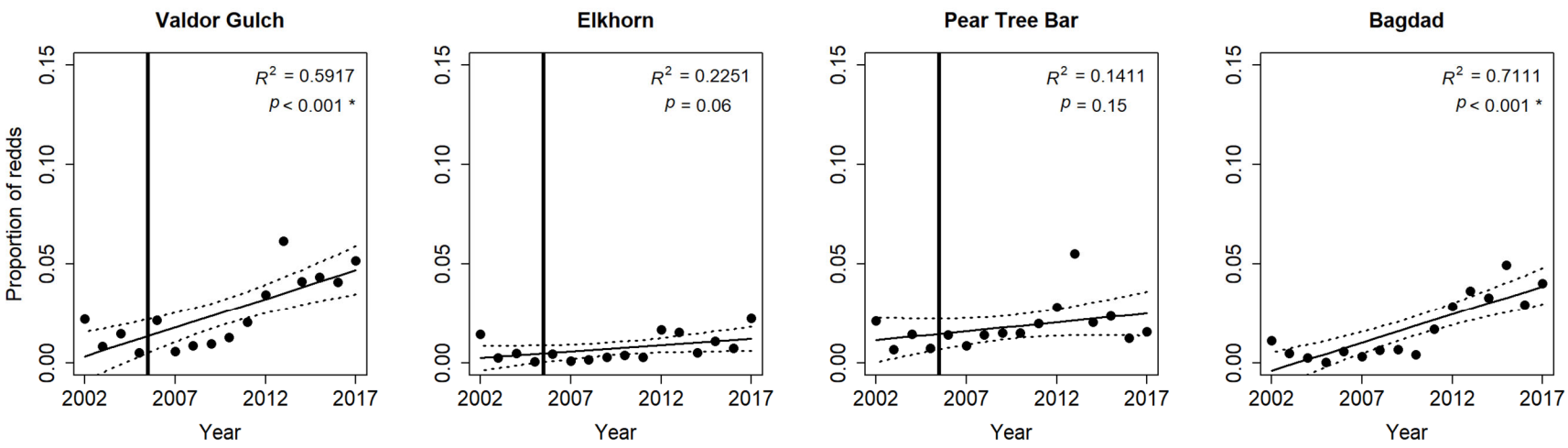

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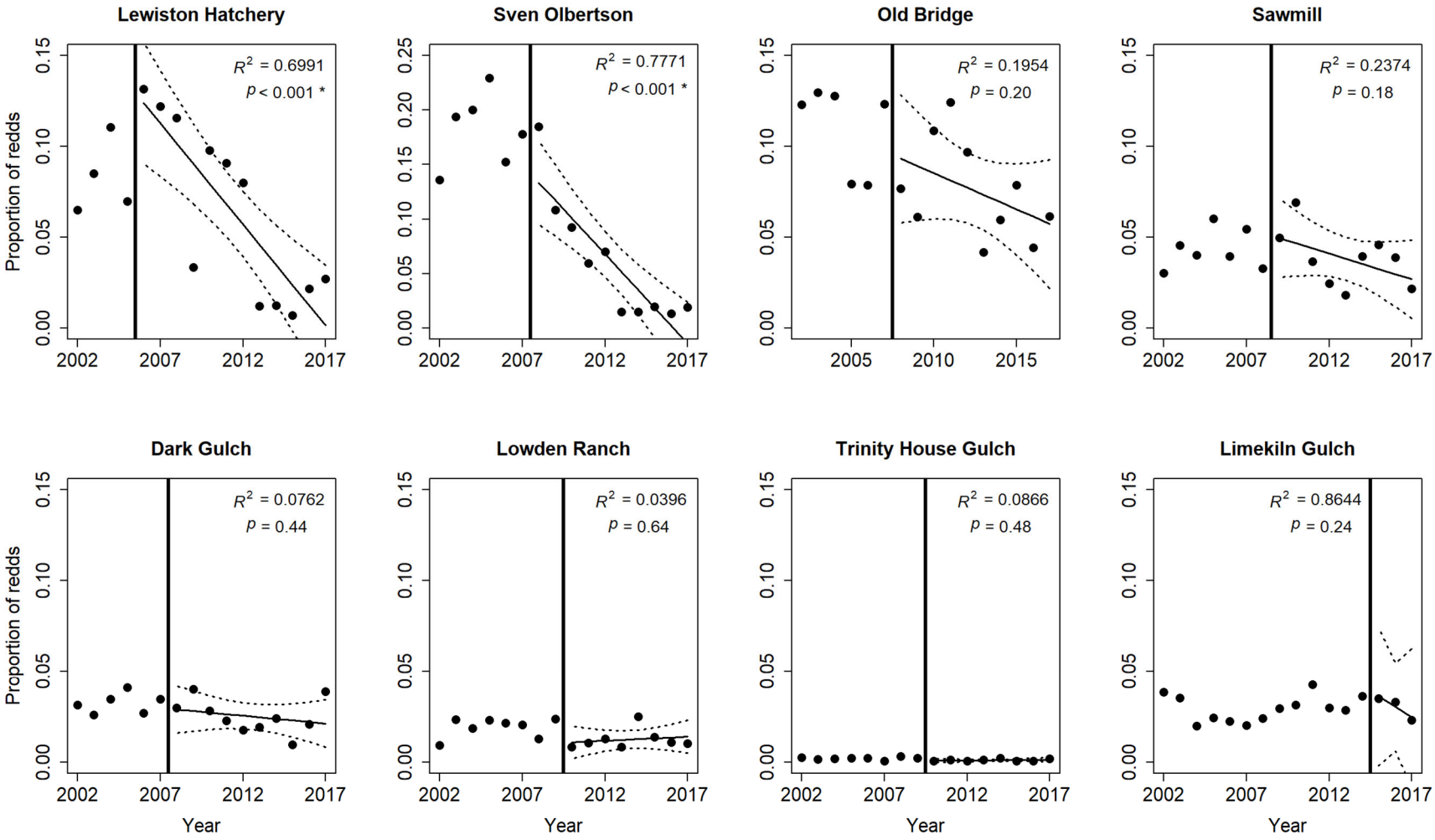
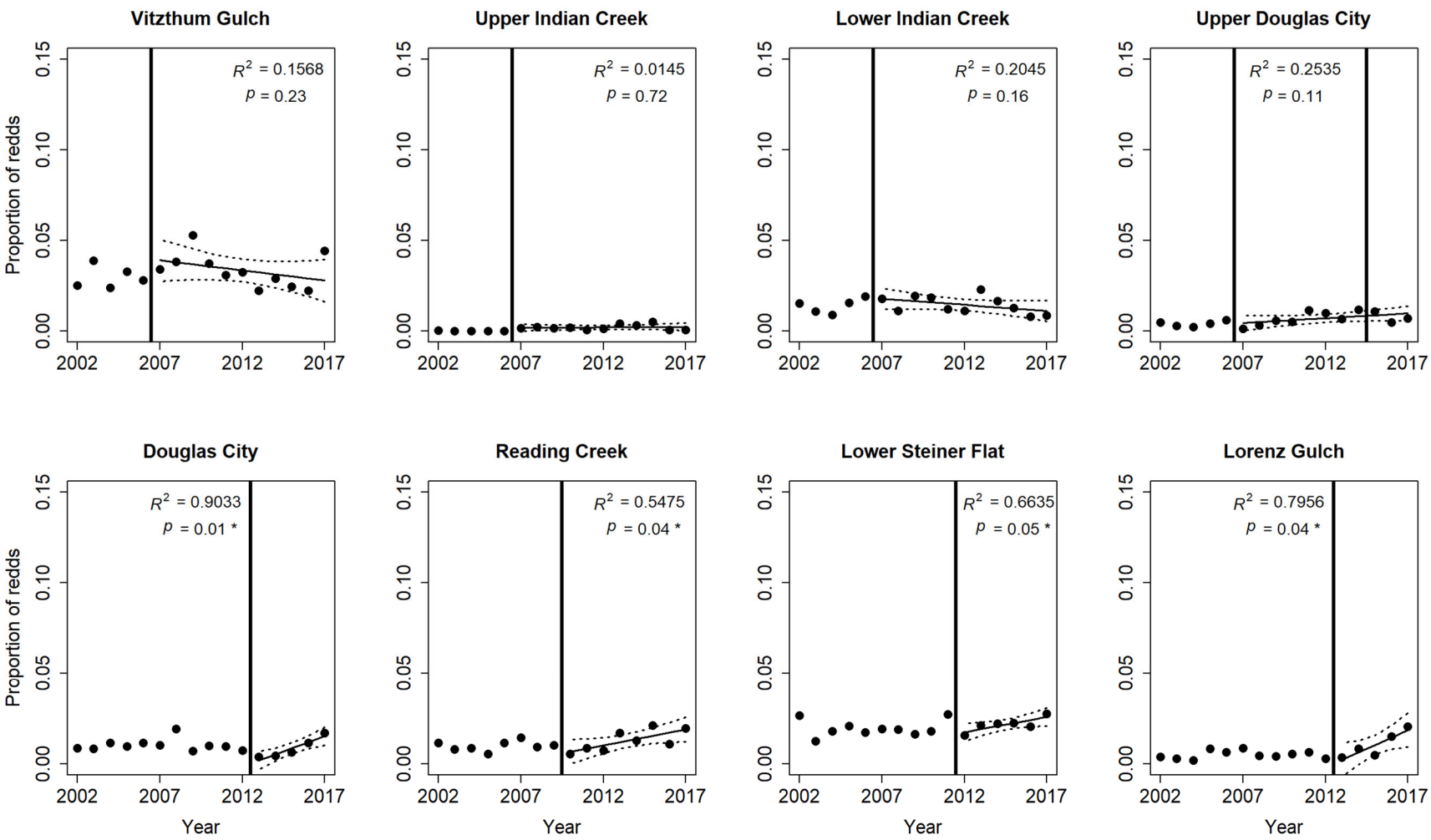


Appendix E. Proportion of natural-origin Chinook Salmon redds within site-scale sections in the TRRP restoration reach that encompass mechanical channel rehabilitation locations, 2002–2017. Each plot includes a post-construction linear model with the R^2 value, p-value (noted with an '*' if <0.05), and 95% confidence limits (dotted lines). The time mechanical channel rehabilitation was initiated is shown as black vertical bars.



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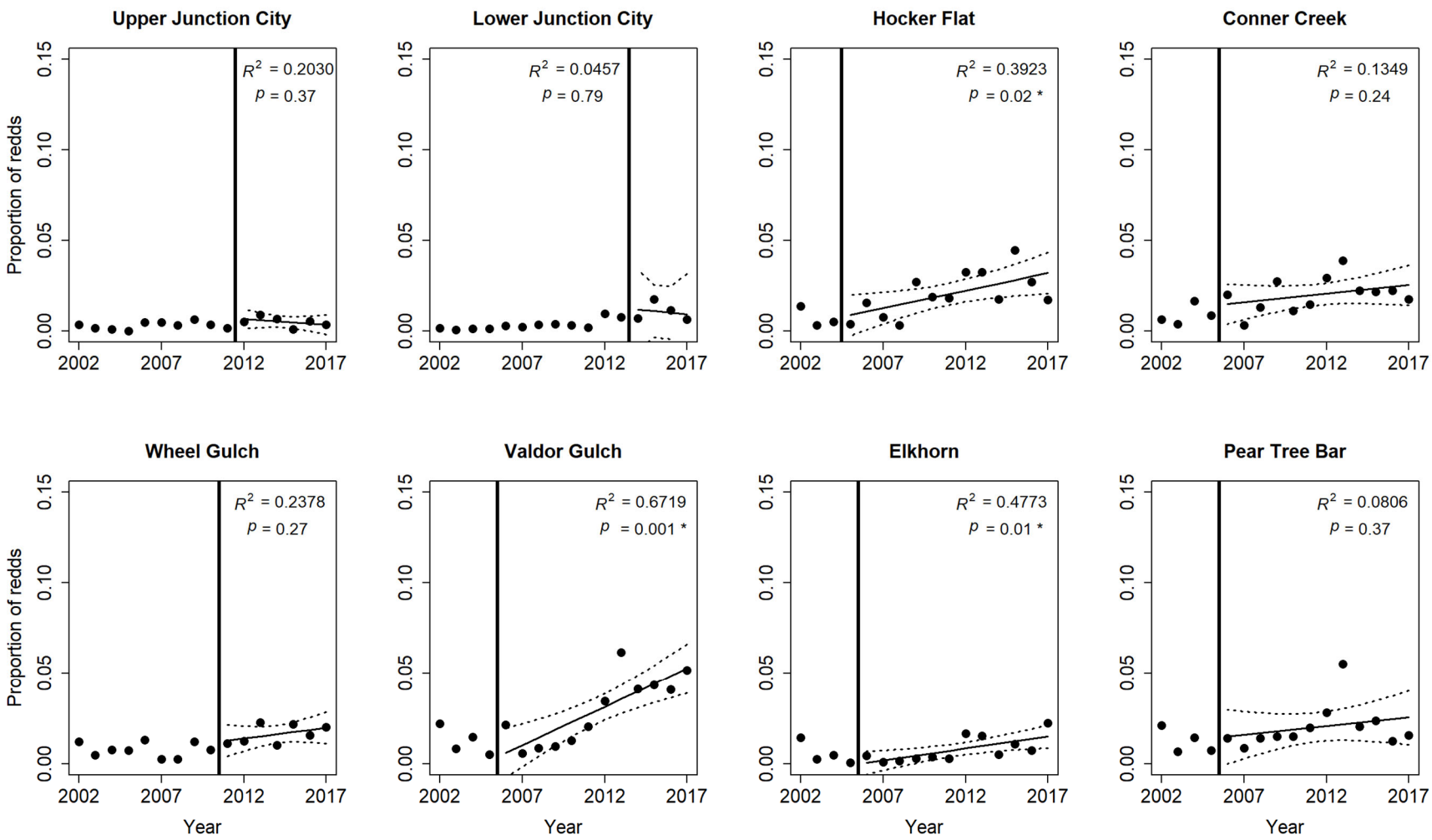

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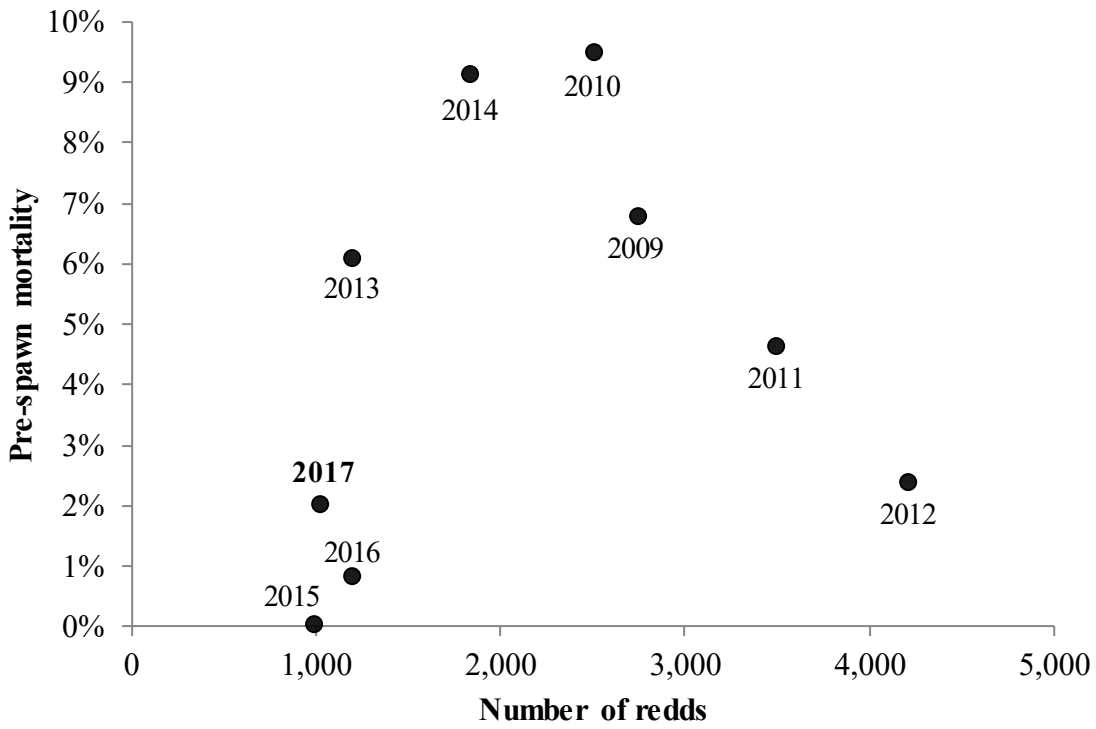

Appendix F. Natural-origin Chinook Salmon redd counts versus estimates of pre-spawn mortality from Lewiston Dam to the North Fork confluence, Trinity River surveys, 2009–2017.

PREDATION BY HATCHERY STEELHEAD ON NATURAL SALMON FRY IN THE UPPER-TRINITY RIVER, CALIFORNIA

by

Seth W. Naman

A Thesis
Presented to
The Faculty of Humboldt State University

In Partial Fullfillment
Of the Requirements for the Degree
Masters of Science
In Natural Resources: Fisheries

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ABSTRACT

Predation by Hatchery Steelhead on Natural Salmonid Fry in the Upper-Trinity River, California

Seth W. Naman

Hatchery fish have been implicated in the decline of stocks of naturally produced anadromous salmonids in the Pacific Northwest. I investigated the extent of predation by hatchery steelhead on naturally produced salmonid fry in the upper-Trinity River, California. During spring of 2007, 315 residualized hatchery steelhead and 1,636 juvenile hatchery steelhead were captured and examined for the presence of salmonid fry in the gut. Residualized steelhead consumed 435 salmonid fry and 2,685 salmonid eggs. Juvenile hatchery steelhead consumed 882 salmonid fry. Predation by juvenile hatchery steelhead was significantly greater near a side channel where a high percentage of adult salmonids were known to spawn. I used mark-recapture techniques to estimate the population of residualized hatchery steelhead and PIT tag recoveries to estimate the population of juvenile hatchery steelhead. Using the population estimates and predation rates, I estimated that 24,194 [95% CI = 21,066-27,323] salmonid fry and 171,018 [95% CI = 155,272-186,764] salmonid eggs were consumed by 2,302 residualized hatchery steelhead in 21 days from 10 February to 2 March 2007. Excluding the results from the side channel, I estimate that 437,697 juvenile hatchery steelhead consumed 61,214 [95% CI = 43,813-78,615] salmonid fry in 30 days from 28 March to 26 April 2007. Assuming

a constant population of 1,500 juvenile hatchery steelhead in the side channel during the 30 day period, an additional 49,445 salmonid fry were consumed. Managers should carefully consider all of the risks to naturally produced fish populations from hatchery fish in order to determine if the effects of hatchery releases are consistent with management goals.

ACKNOWLEDGMENTS

Numerous friends, colleagues, and professors provided much needed help and support in the last three years. Dr. Margaret A. Wilzbach willingly accepted me as a graduate student and provided advice and support. Dr. Walter Duffy and the USGS California Cooperative Fish and Wildlife Research Unit provided financial assistance for coursework. Kay Brisby was always willing to help with problems and administrative questions. Dr. Bret Harvey provided useful insight and advice throughout the planning and development of this research. My friends and colleagues of the Yurok Tribal Fisheries Program supported this research with their help, funding, and advice. Jeremy Alameda and Henry C. Alameda Jr. provided excellent assistance with field work and data collection. Drs. D. G. Hankin, R. W. Van Kirk, and H. B Stauffer were essential for their input regarding mathematics and statistics. I would also like to thank my father, who always had time to take me fishing, and my mother who encouraged me to follow my dreams.

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INTRODUCTION

Although several researchers have concluded that predation can influence the population dynamics of anadromous salmonids (Mather 1998), little is known about the extent to which hatchery salmonids prey upon naturally produced salmonids. Nonetheless, millions of hatchery salmonids are released into rivers throughout the western United States annually (Levin et al. 2001). Several researchers have studied competition between hatchery and naturally produced salmonids (e.g. Pollard and Bjornn 1973, McMichael et al. 1997, Fleming et al. 2000, Kostow and Zhou 2006), but predation by hatchery salmonids on naturally produced salmonids remains virtually undocumented in the peer-reviewed literature. Several studies have examined predation by naturally produced salmonids on naturally produced salmonids (e.g. Ruggerone and Rogers 1992, Beauchamp 1995), and others have investigated smallmouth bass predation on salmonids (e.g. Fritts and Pearsons 2004, Naughton et al. 2004), but none specifically address predation by hatchery salmonids on naturally produced salmonids. However, there are a variety of contract reports and technical memoranda on the subject (Table 1). Most of these studies documented low rates of predation, and those that have attempted to estimate the total number of fry consumed have reported relatively low numbers (e.g. Cannamela 1993).

Each year, Trinity River Hatchery releases roughly 800,000 steelhead smolts and 500,000 coho salmon smolts at the base of the Lewiston Dam, directly into an important

Table 1. Review of hatchery steelhead predation studies.

Citation	River System	State	Methods	Sample size	Fry ingested (n)	Fry/Stomach
Beauchamp 1995	Cedar	Washington	Electrofishing	18	0	0.00
Canamella 1993	Upper Salmon	Idaho	Hook and line/electrofishing	6,762	10	0.00
Hawkins and Tipping 1999	Lewis	Washington	Seine	74	1	0.01
Hawkins and Tipping 1999	Lewis	Washington	Seine	110	2	0.02
Hawkins and Tipping 1999	Lewis	Washington	Seine	48	52	1.08
Jonasson et al. 1994	Imnaha/Grande Rhonde basins	Oregon	Hook and line/electrofishing	358	1	0.00
Jonasson et al. 1995	Imnaha/Grande Rhonde basins	Oregon	Electrofishing	175	2	0.01
Martin et al. 1993	Lower Snake (Tucannon)	Washington	Hook and line	1,713	3	0.00
Whitesel et al. 1993	Imnaha/Grande Rhonde basins	Oregon	Screw trap/electrofishing	611	8	0.01

spawning region. The release occurs at a time when many naturally spawned fry and juveniles are emerging from spawning gravels or rearing. Because of the size differential between predator and prey (Pearsons and Fritts 1999) and the spatial and temporal overlap of predator and prey (Mather 1998; Hatchery Scientific Review Group 2004) there is strong potential for predation by hatchery-reared steelhead to significantly impact the abundance of natural salmonid fry.

The upper Trinity River is relatively clear, often averaging less than 2 nephelometric turbidity units (NTU) and sometimes less than 1 NTU during the Chinook salmon and coho salmon fry emergence period. Studies have shown that low turbidity promotes high foraging efficiency by piscivorous fishes (Gregory and Levings 1998; Robertis et al. 2003). However, no estimates of the amount of naturally produced salmonid fry consumed by hatchery salmonids in the Trinity River are available.

There is currently no information available on the extent to which hatchery steelhead residualize in the Trinity River. Hatchery reared steelhead are known to residualize in river systems throughout the western United States (Beauchamp 1995; Viola and Schuck 1995, McMichael and Pearsons 2001). They residualize in greatest numbers near the site of release, decreasing in number as the distance from the point of release increases (Viola and Schuck 1995, McMichael and Pearsons 2001). Negative impacts from predation (Hatchery Scientific Review Group 2004), competition (McMichael et al. 1997), or genetic interactions (Reisenbichler and Rubin 1999), may affect naturally spawned salmonids resulting from the presence of residualized hatchery steelhead. Hatchery reared steelhead have also been shown to be more aggressive than

wild steelhead (Berejikian et al. 1996, McMichael et al. 1999, McMichael and Pearsons 2001), which may exacerbate the effects of competition between hatchery and wild fish. In the uppermost 3.2 km of Trinity River, residualized hatchery steelhead cannot be legally removed by fishermen, as fishing regulations specify that the area is "fly only" and "catch and release only."

The objectives of this study are to 1) estimate the proportion of piscivores in the residualized hatchery steelhead population and juvenile hatchery steelhead population of the upper Trinity River; 2) estimate the rate (fry/piscivore) at which piscivores in the residualized hatchery steelhead population and juvenile hatchery steelhead population prey upon naturally produced salmonid fry; 3) estimate the population sizes of residualized hatchery steelhead and juvenile hatchery steelhead; and 4) estimate the number of naturally produced salmonid fry consumed by residualized hatchery steelhead and juvenile hatchery steelhead on the upper Trinity River, in the study reach, during the period of study. This information could be used to help guide hatchery policies and is critical to understanding one of the impacts that Trinity River Hatchery may have on natural populations of salmonids.

STUDY SITE

The study area extended from Lewiston Dam, downstream 3.2 km to Old Lewiston Bridge (Figure 1). Trinity River Hatchery is located at the base of the dam, which is the terminus of anadromous fish migration in the Trinity River. This study reach is characterized by a largely confined channel and an alternating series of runs, pools, glides and riffles. Mean channel width is 30.2 m with a mean channel slope of 0.3% (Trinity River Flow Evaluation 1999). Throughout much of fall and winter, discharge from Lewiston Dam is at a base flow of approximately 8.5 m^3s^{-1}, and water from Trinity and Lewiston reservoirs keeps daily maximum river temperature, even in the heat of the summer, at approximately 12°C (Trinity River Flow Evaluation 1999). Beginning in the end of April, discharge from Lewiston Dam increases in accordance with the Trinity River Flow Evaluation (Trinity River Flow Evaluation 1999) to serve a variety of fisheries and geomorphological functions. Discharge then decreases, generally in the end of July, to 12.7 m^3s^{-1}, and remains at this level through the summer and fall until the beginning of October when it returns to a base flow of 8.5 m^3s^{-1} (Trinity River Flow Evaluation 1999).

Elevation of the study reach is roughly 549 m. Summers are hot and dry followed by a mixture of rain and snow in the winters, typical of northern-California mid-elevation regions that are on the cusp of coastal and arid climates. Average annual precipitation for Weaverville, California, located approximately ten miles northeast of the study area, is 92.8 cm of rain and 45.2 cm of snowfall (National Weather Service 2008).

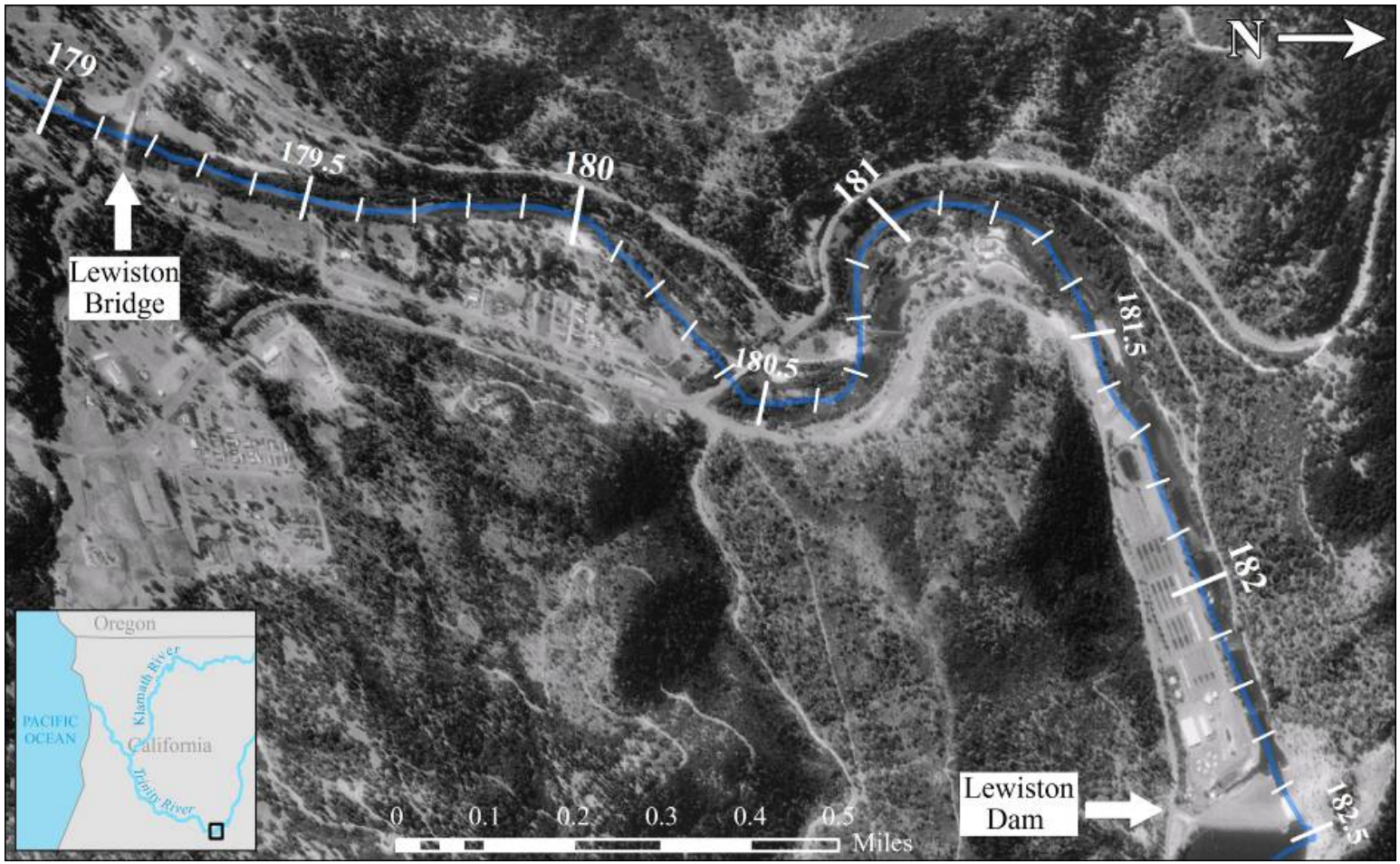

Figure 1. Map of the study location, and river kilometers (in white) on the upper-Trinity River, California. River kilometers increase in an upstream direction and begin at zero at the confluence of the Trinity and Klamath rivers near the town of Weitchpec, California.

The study reach is inhabited by spring- and fall-run Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*), Pacific lamprey (*Lamptera tridentata*), and brown trout (*Salmo trutta*). Coho salmon are listed under both the federal Endangered Species Act (Good et al. 2005), and the California Endangered Species Act (California Department of Fish and Game 2002).

The upper river provides spawning grounds for anadromous species which are harvested by tribal, recreational and sport fishermen. In the uppermost 3.2 km of the Trinity River, the terminus of anadromous fish migration, estimated redd totals for 2006 were 2,302 redds for Chinook salmon and coho salmon combined. This represents 53% of all redds that were counted from the dam to the North Fork Trinity River, 63.4 km downstream. This high concentration of redds in this section of river is typical for any given year (United States Fish and Wildlife Service 2007). While no data are recorded on the number or distribution of steelhead redds, it appeared to me that a similarly high percentage of the total number of redds were concentrated in the uppermost 3.2 km of river (personal observation).

According to data collected by the California Department of Fish and Game (CDFG) at weirs operated on the Trinity River, the majority of anadromous spawners are of hatchery origin. Returns of hatchery coho salmon have been relatively robust in recent years, but the proportion of natural coho salmon returning to the Trinity River has remained around 10% for many years (Trinity River Flow Evaluation 1999; California Department of Fish and Game 2005). There have been relatively strong runs of hatchery steelhead in the recent past, but the proportion of natural fall-run steelhead returning to

the Trinity River has remained around 20% of the total for many years (Trinity River Flow Evaluation 1999; California Department of Fish and Game 2005). The majority of both spring- and fall-run chinook salmon adults are also of hatchery origin, with natural Chinook salmon making up roughly 25% of the total (Trinity River Flow Evaluation 1999; California Department of Fish and Game 2005).

METHODS

General Field Methods

Prior to release, all hatchery steelhead are marked by adipose fin excision at Trinity River Hatchery, making the distinction between naturally produced steelhead, few of which were captured, and hatchery steelhead, straightforward. Prior to 15 March, any fin-clipped steelhead present in the study reach, excluding anadromous steelhead, were characterized as a residualized hatchery steelhead. Residualized hatchery steelhead were sampled from 6 February to 28 February 2007 and juvenile hatchery steelhead from 27 March to 26 April 2007. Sampling by the Yurok Tribal Fisheries Program in 2005 indicated that the maximum size of residualized hatchery steelhead was roughly 500 mm (Yurok Tribal Fisheries Program 2008). In addition to this size threshold, behavioral and morphological traits were used to distinguish between residualized and anadromous hatchery steelhead. After 15 March, hatchery steelhead that were 250-500 mm in fork length, excluding anadromous steelhead, were considered to be residualized. I used a cut off of 250 mm because only 3 out of 316 residualized hatchery steelhead captured prior to the release of juveniles on 15 March were less than 250 mm. Scale samples were collected from 99 residualized hatchery steelhead to determine age classes and to verify that none of the steelhead identified as residuals showed signs of ocean entry or ocean growth in scale patterns (Holtby et al. 1990). No attempt was made to determine the age of residualized hatchery steelhead considered to be older than age 3.

Three sites were sampled on a weekly basis throughout the duration of the study: Old Lewiston Bridge (rkm 179), Old Weir Hole (rkm 180.7) and the hatchery area (rkm 182.0, Figure 1). River kilometers begin at zero at the confluence of the Trinity and Klamath rivers near the town of Weitchpec, California and increase in an upstream direction. These sites were roughly located at the downstream end, middle, and upstream end of the study zone. Additionally, one or more of the following sites were sampled on a weekly basis: River Oaks Resort (rkm 180.0), New Lewiston Bridge (rkm 180.4), riffles between Old Weir Hole and New Lewiston Bridge (180.6) and Bear Island Area (rkm 181.5). Within the study reach this regime gave equitable spatial distribution to sampling locations.

Steelhead were captured using hook and line with wet or dry flies. Fish were almost exclusively taken using flies (either dry or wet invertebrate patterns). Using lures might have biased the data because fish that strike lures may have a greater propensity toward piscivory than the population as a whole. It should be noted that great care was taken in selecting small flies (≤ size 16 hooks) so that small fish could be caught as effectively as larger ones. The use of hook and line made it possible to collect fish from a wide range of locations and habitat types that would be inaccessible using other methods such as seining or electrofishing.

On four occasions, the sampling crew captured juvenile hatchery steelhead with hook and line, and then captured juvenile hatchery steelhead with a seine net or backpack electrofishers, generally in the same locale on the same day. This was done in order to

compare the rate of predation between fish that were captured using hook and line and other methods, to check for bias resulting from capturing fish with hook and line.

When sampling fish with electrofishers, a single pass was utilized, with personnel moving upstream expeditiously because the electrical current can disable fry and make them easy targets for hatchery steelhead in the area. If temporarily disabled fry float downstream during the electrofishing process and are consumed by hatchery steelhead downstream, and those steelhead are captured and examined within the next 25-30 hours, one might overestimate the number of fry consumed.

In addition to the comparisons of sampling methods, I checked for differences in size between fish that were captured in the river and that of the hatchery population as a whole. Size difference could bias the estimate of total number of fry consumed. On 14 March 2007, one day prior to the release of juvenile hatchery steelhead from Trinity River Hatchery, 50 fish were weighed and measured from each of ten raceways for comparison with the size of individuals captured by hook and line during the first week of study. Testing was constrained to the first week of study because growth, high mortality of small fish, emigration of larger fish, high mortality of sick or weak fish, etc., might change the population characteristics over the course of the study from the original characteristics of the hatchery population.

Captured fish were placed in five gallon buckets before being transferred to a live well that was placed directly in the river. They were examined within 2 hours of being captured. Fish were measured to fork length, visually examined for body morphology, spotting, coloration and skin silvering, then given a smoltification rating of not smolting,

transitional, or smolting (Viola and Schuck 1995). Both body morphology (Beeman et al. 1995) and skin reflectance (Haner et al. 1995, Ando et al. 2005) have been successfully used to discriminate between fish that are smolting, and those that are not. I compared condition of juvenile hatchery steelhead among the smolting categories using Fulton's K (Cone 1989). Prior to analysis and testing, each group was tested for isometric growth by regressing the natural log of fork length on the natural log of weight to determine if the slope differed significantly from three (Cone 1989). Additionally, I tested if the regressions of K on fork length were significantly different than zero, in order to check for dependence of condition on fish length (Cone 1989).

A 7.6 L hand pump garden sprayer was used to perform pulsed gastric lavage (Light et al. 1983). Stomach contents were flushed onto a white dish, examined for the presence of fish or fish parts, and recorded as empty, or containing one or more of the following: inorganic or organic material, invertebrates, salmonids, and (or) other fish species. After examination, captured steelhead were revived and released except for approximately 20 samples that were sacrificed to check the effectiveness of the lavage technique. All salmonid fry detected in samples of stomach contents were enumerated.

I did not attempt to identify consumed salmonid fry to species. Both Chinook salmon fry and coho salmon fry were prevalent in the study reach during this study, with steelhead fry beginning to emerge from the spawning gravel towards the end of the study period.

Consumed fry were known to be of natural origin for several reasons. Chinook salmon are not released from the hatchery until June on the Trinity River, whereas this

study was conducted from February to May. Hatchery Chinook salmon are also released at a size that is typically larger (roughly 80 mm) than the size of consumed salmonids, which were generally less than 50 mm. Additionally, 100% of coho salmon and steelhead are marked before being released from Trinity River Hatchery, making it easy to distinguish between these hatchery "smolts" and naturally produced eggs, alevin, and fry.

Residualized hatchery steelhead population estimation

Upon examination, all residualized hatchery steelhead were marked with a fluorescent yellow 16 mm Petersen Disc™ applied below the dorsal fin, except for those considered to be smolting or injured. This allowed for re-sighting of marked fish, making a mark-recapture population estimate possible. I used a modified Petersen estimator (Seber 1982) to estimate the number of residualized hatchery steelhead that were present in the reach during the study period. The marking of fish began on 12 February. After the completion of gastric sampling on 1 March, fish were re-sighted using four divers swimming abreast of each other. I assumed no mortality or immigration or emigration of residualized hatchery steelhead during this 17 day period. Nominal mortality of residualized hatchery steelhead (naturally caused or otherwise) would have little bearing on results of this study. It is unlikely that there were large scale movements into or out of the study reach during the period of study by these non-migratory fish. For example, river discharge and temperature, which might influence movement of residuals, were generally constant during the period of study.

Juvenile steelhead population estimation

At Trinity River Hatchery, steelhead eggs are taken in winter and spring. Progeny are raised for approximately one year before being released the following spring. The release strategy is volitional, beginning on 15 March each year and continuing for 10-14 days, at which time hatchery personnel force the remaining fish from the hatchery. This makes the estimation of the number of juvenile steelhead in the study reach at any given time inherently difficult as the proportion that exits the hatchery volitionally, and the proportion that is forced out, are not known.

In order to estimate the population of juvenile hatchery steelhead in the study reach on a daily basis, 991 steelhead were implanted with 23 mm half duplex Passive Integrated Transponder (PIT) tags (Zydlewski et al. 2006). This tagging occurred on 5 February and 6 February 2007, approximately 6 weeks prior to the beginning of volitional release from the hatchery. Juvenile hatchery steelhead in 9 of 10 raceways received approximately 110 PIT tags. The other raceway contained fish that were too small (≤ 100 mm) at the time to implant with the 23 mm PIT tags. The number of hatchery steelhead in each raceway at the time of tagging is known as they are hand counted and marked with an adipose fin clip by hatchery personnel and staff from Hoopa Valley Tribal Fisheries.

To gain an understanding of the proportions and timing of juvenile hatchery steelhead that entered and exited the study reach, two antennas were placed in the hatchery flume (hatchery antennas) and 2 antennas spanning the river were placed near the end of the study reach (river antennas). Sampling of juvenile hatchery steelhead

began on 27 March 2007, the day that personnel at Trinity River Hatchery forced steelhead out of the hatchery that remained in raceways after the two week volitional release period.

The two antennas that made up the hatchery array were constructed of wood frames and measured approximately 0.9 m by 1.3 m. Each antenna was wrapped in three loops of eight gauge speaker wire which fit into channels that were routed into the wood frames. Antennas slid neatly into pre-existing slots contained within the walls of the flume, and spanned both the width and depth of the flume.

The first river antenna was installed on 19 March, the second on 21 March. This array consisted of two antennas that were 15 m apart, one measuring 13.6 m and the other 18.2 m wide. The distance between the upper and lower loops of the antennas was approximately 0.45 m. The top portion of the antenna loop remained below the water surface to avoid ensnaring boaters. The antennas were formed from a single loop of 8 gauge speaker wire enclosed in standard garden hose that was attached to steel cable affixed to trees on each stream bank. Rock walls were constructed on the edges of each antenna where they met the stream bank to keep hatchery steelhead from migrating around the side of the antennas. This made the path efficiency (Zydlewski et al. 2006), the probability that a fish swimming downstream will pass through the antenna, approximately 100%. Antenna efficiency at both the hatchery and river arrays was tested weekly, sometimes bi-weekly, with test tags placed in oranges, neutrally buoyant pieces of wood, and on the end of an eight foot pole.

Using data from the hatchery antennas, I determined the proportion of PIT-tagged fish that were forced out of the hatchery. I then multiplied this proportion by the number of hatchery steelhead that were in the 9 raceways which received tags such that

$$\hat{S}_1 = \hat{P}_f \times 729{,}760, \tag{1}$$

where $\hat{P}_f$ is the proportion of PIT-tagged fish that were forced out of the hatchery, $729{,}760$ is the total number of fish in each of the 9 raceways that contained marked fish and $\hat{S}_1$ is the number of steelhead that entered the study reach from the hatchery on the day that sampling of juvenile hatchery steelhead began, 27 March 2007.

I used data from the two river antennas to estimate the proportion of juvenile hatchery steelhead that both emigrated volitionally and exited the study reach prior to the end of the volitional emigration period. I then subtracted this proportion from 1 and multiplied the result by the number of hatchery steelhead that emigrated volitionally- which I obtained by subtracting the number of juvenile hatchery steelhead that emigrated volitionally from the total number released from the 9 raceways as:

$$\hat{S}_2 = \left(1 - \hat{P}_e\right) \times \left(729{,}760 - \hat{S}_1\right), \tag{2}$$

where $\hat{P}_e$ is the proportion of juvenile hatchery steelhead that both emigrated volitionally and exited the study reach prior to the end of the volitional emigration period, and $\hat{S}_2$ is the number of hatchery steelhead that were already present in the study reach on the day sampling of juvenile hatchery steelhead began, 27 March 2007.

I estimated the total number of juvenile hatchery steelhead in the study reach on the day sampling began, defined as:

$$\hat{S}_0 = \hat{S}_1 + \hat{S}_2 , \quad (3)$$

where $\hat{S}_0$ is the total number of juvenile hatchery steelhead in the study reach on the day sampling began, $\hat{S}_1$ is the number of hatchery steelhead that entered the study reach from the hatchery on the day that sampling began and $\hat{S}_2$ is the number of hatchery steelhead that were already present in the study reach on the day sampling of juvenile hatchery steelhead began.

To estimate the number of juvenile hatchery steelhead in the study reach on each day of the study, I regressed the number of unique PIT tag detections (y) against the day of study (x). Visual inspection of a plot of the data, and trials with various model types, indicated that a power function of the form

$$y = b_0 x^{b_1} \quad (4)$$

best fit the data. I substituted the y-intercept (b_0) in this equation with $\hat{S}_0$, the total number of juvenile hatchery steelhead in the study reach on the day sampling began (obtained from equation 3), with x as the day of study. To obtain the variance for this function in the original units, both the x and y values were $\log_{10}$ transformed. I fit a linear regression of $\log_{10}$ x versus $\log_{10}$ y, to obtain the variance of the regression line. The square root of this variance was exponentiated with a base of 10 and squared to get the variance in original units.

Predation Estimates

I selected an equation developed by He and Wurtsbaugh (1993) that describes the gastric evacuation rate of brown trout that were fed salmonid fry. This equation resulted in a slower rate of gastric evacuation than the equation developed by Elliott (1991), thereby helping to err on the side of underestimating the total number of fry consumed. The equation is given as:

$$\theta_1 \cdot e^{\left(-\theta_2 \cdot T\right)}, \tag{5}$$

where θ_1 is 56.2 hours, θ_2 is -0.073, and T is water temperature in degrees Celsius. The equation had an R^2 of 0.98.

To calculate a daily fry consumption rate, the amount of hours in a day (24) must be divided by the gastric evacuation rate. To be conservative in the estimate of the total number of fry consumed, I used the number of daylight hours for each day (H_j), which was based on nautical twilight (United States Naval Observatory 2007), instead of 24 hours, because it was not known if piscivorous hatchery steelhead of the Trinity River feed continuously throughout the night. While some salmonids are known to feed continuously throughout the 24 hour period, such as piscivorous coho salmon (Ruggergone 1989), other piscivorous salmonids have been shown to have a diel feeding pattern that is not continuous throughout the 24 hour period (Beauchamp 1990).

Estimates of the proportion of fish that were piscivorous, mean rate of predation by piscivores, and total consumption of salmonid fry were made separately for residualized hatchery steelhead and juvenile hatchery steelhead. The proportion of

piscivorous fish in any given week ($\hat{P}_w$) was estimated by dividing the number of hatchery steelhead that consumed one or more fry in week *w* by the total number of steelhead examined in week *w*. To estimate the total proportion of piscivorous fish throughout the study period, the weekly total numbers of hatchery steelhead that consumed one or more fry were divided by the total number of juvenile steelhead examined. A 95% confidence interval of the proportion (Agresti and Coull 1998, Thompson 2002) of piscivorous fish in any given week was approximated with

$$\hat{P}_w \pm t\sqrt{\frac{\hat{P}_w(1-\hat{P}_w)}{m_w - 1}}, \qquad (6)$$

where $\hat{P}_w$ is the estimated proportion of hatchery steelhead that are piscivores from the hatchery steelhead population as a whole during week *w* of the study period, m_w is the total number of steelhead examined during week *w,* and *t* is the upper α / 2 point of the *t*-distribution with m_w-1 degrees of freedom.

For steelhead identified as piscivores, the weekly predation rate ($\bar{y}_w$) was given by

$$\bar{y}_w = \frac{\sum_{i=1}^{n_w} y_{iw}}{n_w}, \qquad (7)$$

where y_{iw} is the number of fry observed in the stomach of fish *i* in week *w*, and n_w is the number of piscivores observed in week *w*, yielding salmonid prey per piscivore. A 95% confidence interval (Thompson 2002) of the mean predation rate was estimated as

$$\bar{y}_w \pm t\sqrt{\frac{\sum_{i=1}^{n_w}\left(y_{iw}-\bar{y}_w\right)^2 \Big/ \left(n_w-1\right)}{n_w}}, \qquad (8)$$

where y_{iw} is the number of fry observed in the stomach of fish *i* in week *w*, and n_w is the number of piscivores observed in week *w* and t is the upper α / 2 point of the *t*-distribution with n_w-1 degrees of freedom.

The total number of salmonid fry consumed during the period of study, in the study reach was estimated as:

$$\hat{F} = \sum_{j=1}^{30} \hat{S}_0 \cdot j^{\hat{b}_1} \cdot \frac{H_j}{\theta_1 \cdot e^{(-\theta_2 \cdot T_j)}} \cdot \hat{P}_j \cdot \bar{y}_j, \qquad (9)$$

where $\hat{F}$ is the estimated total fry consumption in the study reach during the study period, $\hat{S}_0$ is the total number of juvenile hatchery steelhead in the study reach on the day sampling began, *j* is the day of study, H_j is the number of daylight hours on the *j*th day (based on nautical twilight), θ_1 is 56.2 hours and θ_2 is -0.073 (see equation 5), T_j is water temperature in degrees Celsius on day *j*, b_1 is the coefficient for the rate of decay of the power function described in equation 4, $\hat{P}_j$ is the estimated proportion of hatchery steelhead that are piscivores from the hatchery steelhead population on day *j*, and $\bar{y}_j$ is the predation rate for steelhead identified as piscivores on day *j*. For the residualized

hatchery steelhead, the same formula was utilized, except the summation was over 21 days.

For $\hat{P}_j$ and $\bar{y}_j$, the weekly values of the piscivore proportion, $\hat{P}_w$, and predation rate, $\bar{y}_w$, were utilized. For example, for any given day in week two of the study, the estimated piscivore proportion and estimated predation rate for week two were used for calculating equation 9. It was assumed that the daily proportion of piscivorous fish and predation rate did not vary within any given week.

Over the five week period during which juvenile hatchery steelhead were studied, 5 days were included in week 1 of the study, 4 days were included in week 5 of study, and 7 days were included in weeks 2-4 yielding 30 days. The timing of the release of hatchery steelhead at the beginning of the study, as well as the timing of water releases from Lewiston Dam at the end of the study, prevented the inclusion of a full 7 days in weeks 1 and 5. Prey consumption of juvenile hatchery steelhead was estimated over a 30 d period and prey consumption of residualized hatchery steelhead was estimated over a 21 d period.

To estimate the number of fry consumed by residualized hatchery steelhead, equation 9 was used, except that $\hat{S}_0 \cdot j^{\hat{b}_1}$ was substituted with the population estimate resulting from the modified Petersen estimator. This population level was held constant for the 21 day residualized hatchery steelhead period of study, assuming no immigration or emigration, and no mortality, natural or otherwise.

To estimate variance of the number of fry consumed by residualized hatchery steelhead and juvenile hatchery steelhead, Gray's (1999) estimator for the variance of a two factor product,

$$\hat{V}(xy) = \bar{x}^2\hat{V}(y) + \hat{V}(x)\bar{y}^2 - \hat{V}(x)\hat{V}(y), \qquad (10)$$

was modified to accommodate constants and a three factor product following Gray (1999). Variance of the total number of fry consumed was estimated assuming daylight hours, temperature, gastric evacuation rate, and survival rate were measured without error. Variances in the proportion of piscivorous fish, predation rate (salmonid fry per piscivore), and population were incorporated into the three factor variance estimator to develop a 95% confidence interval for the number of fry consumed by residualized hatchery steelhead and juvenile hatchery steelhead. Separate estimates of the 95% confidence interval of the number of fry consumed were made for residualized hatchery steelhead and juvenile hatchery steelhead as follows:

$$1.96\sqrt{\sum_{j=1}^{30}\left(\frac{H_j}{\theta_1 \cdot e^{(-\theta_2 \cdot T_j)}}\right)^2\begin{pmatrix}[\hat{P}_j\bar{y}_j]^2\hat{V}(\hat{S}_j) + \hat{P}_j^{\,2}\hat{V}(\bar{y}_j)\hat{S}_j^{\,2} \\ +\hat{V}(\hat{P}_j)\bar{y}_j^{\,2}\hat{S}_j^{\,2} - \hat{V}(\hat{P}_j)\hat{V}(\bar{y}_j)\hat{S}_j^{\,2} \\ -\hat{P}_j^{\,2}\hat{V}(\bar{y}_j)\hat{V}(\hat{S}_j) - \hat{V}(\hat{P}_j)\bar{y}_j^{\,2}\hat{V}(\hat{S}_j) \\ +\hat{V}(\hat{P}_j)\hat{V}(\bar{y}_j)\hat{V}(\hat{S}_j)\end{pmatrix}} \qquad (11)$$

where H_j is the number of daylight hours on the *j*th day, T_j is the temperature on the *j*th

day, $\frac{H_j}{\theta_1 \cdot e^{(-\theta_2 \cdot T_j)}}$ is the temperature based gastric evacuation rate described in equation 9, $\hat{P}_j$ is the estimated mean proportion of predators on day j, $\hat{V}(\hat{P}_j)$ is the estimated variance of proportion of predators on day j, $\bar{y}_j$ is the estimated mean predation rate of piscivores, $\hat{V}(\bar{y}_j)$ is the estimated variance of predation rate of piscivores, $\hat{S}_j$ is the estimated mean of either the residualized hatchery steelhead population or the juvenile hatchery steelhead population, and $\hat{V}(\hat{S}_j)$ is the estimated variance of either the residualized hatchery steelhead population or the juvenile hatchery steelhead population.

As in equation 9, for $\hat{P}_j$ and $\bar{y}_j$, the weekly values of the piscivore proportion, $\hat{P}_w$, and predation rate, $\bar{y}_w$, were utilized. I assumed that the daily piscivore proportion and predation rate did not vary within any given week.

For estimation of the number of eggs consumed by residualized hatchery steelhead, I employed the same process used to estimate the number of salmonid fry. I assumed that salmonid fry and salmonid eggs were evacuated from the stomach of piscivorous salmonids at the same rate, although I am not aware of any study that has evaluated the evacuation rate of salmonid eggs from stomachs of salmonids that consume eggs.

Use of equation 11 to estimate the confidence intervals should be regarded as an approximation of confidence intervals. Because PIT tag recovery data collected over the

study period were used to fit a model that was then used to estimate $\hat{S}_0$, $\hat{S}_0$ for the different days are not statistically independent of one another. The expression for estimating variance over time (summations over j = 1 to 30) are likely incorrect because they do not account for covariance among successive estimated values of $\hat{S}_0$. The use of literature based gastric evacuation rates, amount of daylight hours, and water temperature, as constants measured without error, also likely introduces some additional estimate error, but the amount is unknown.

RESULTS

During the course of this study, 315 residualized hatchery steelhead and 1,636 juvenile hatchery steelhead were captured and examined. Of these, 20 (0.95 %) did not have adipose fin clips. One brown trout was also captured during the 3 month duration of study.

Residualized Hatchery Steelhead

A total of 285 residualized steelhead were marked during the period 12 February to 28 February. Snorkelers counted 313 residuals during the resight event on 1 March, of which 38 were marked. Based on these data, I estimate the population of residualized hatchery steelhead in the study reach to be 2,302 (95% CI = 1,681-2,922).

When snorkelers surveyed the reach on 5 February 2007, prior to capture or examination of individual fish, 280 (86%) residualized hatchery steelhead were counted above the large cascade rapid at the Old Weir (rkm 180.7) that lies half way through the study section (Figure 1), while 46 were counted below. On the same date, snorkelers surveyed 3.0 km of the Trinity River downstream of the end of the study area, and counted seven residualized hatchery steelhead.

The 315 residualized hatchery steelhead examined during this study averaged 331 mm in length (SD = 51 mm; range = 243-494 mm), and 408.4 g in weight (SD = 215.2 g; range = 148.7-1415.8 g) (Table 2). Of the residuals examined, 90 % were smaller than 420 mm, which is the cut-off in fork length below which steelhead are considered to

Table 2. Age composition for 98 residualized hatchery steelhead from the upper-Trinity River, California.

	Age		
	2	3	>3
Sample size	54	33	11
Mean fork length (mm)	310	383	459
Mean weight (g)	328.5	614.0	1001.3

exhibit a half-pounder life-history by CDFG (California Department of Fish and Game 2005). There were 29 fish (9%) that were considered to be transitional or smolting. Mean fork length was greater for non-smolting individuals (mean = 333 mm) than for transitional or smolting individuals (mean = 306 mm) (*t*-test, $t = 4.38$; df = 48; $P < 0.001$).

Scale samples of residualized steelhead were collected to evaluate the duration of residualism in the upper Trinity River, and to inspect for evidence of anadromy. Of 99 samples collected, one came from an individual that was 427 mm in length and showed signs of ocean entry and ocean growth. Of the remaining scales, 54 were collected from individuals that were 2 years old, 33 were from individuals aged at 3 years old, and 11 were from fish older than 3 years of age (Table 2). Mean fork length was larger for individuals that were aged (mean = 351 mm) than for individuals that were not aged (mean = 320) (*t*-test, $t = 4.82$; df = 139; $P < 0.001$). This suggests that residualized steelhead that were aged may not be entirely representative of the population as a whole. Ocean growth was clearly evident in the anadromous hatchery steelhead scales. In the residualized hatchery steelhead scales, the spacing of circuli was much tighter and more consistent than that of anadromous hatchery steelhead (Figure 2). Growth in the hatchery was also evident in most residualized steelhead samples, with circuli in the first year of life spaced noticeably greater than in successive years (Figure 2).

Hatchery steelhead residuals were generally smaller than their anadromous counterparts and typically more football shaped than the streamlined anadromous hatchery steelhead. Body morphology, in combination with more colorful fins, a more

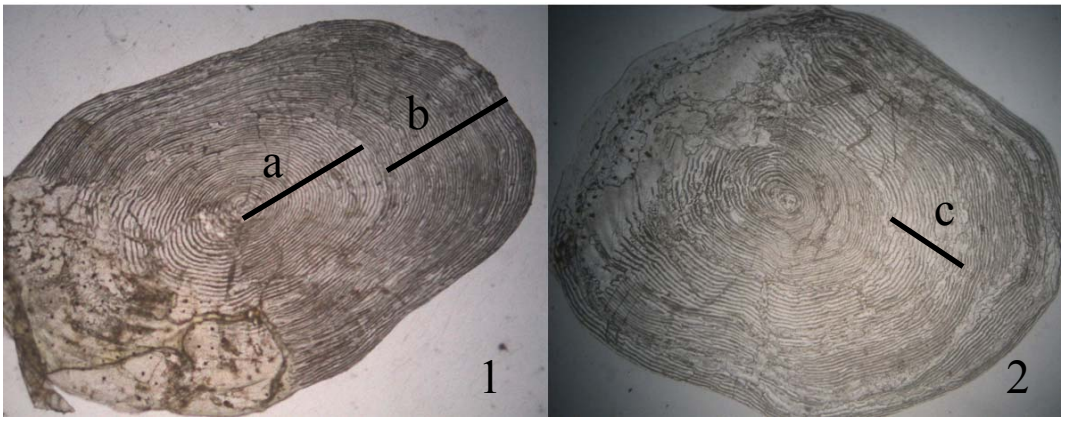

Figure 2. Images of hatchery steelhead scales from the upper-Trinity River, California, 2007. From left to right: 1) a residualized hatchery steelhead >3 years old (468 mm in length) showing wide spacing of first 30-35 circuli from 1 year of robust hatchery growth (a), followed by tightly spaced and uniform circuli from several years of river growth (b) and; 2) an anadromous hatchery steelhead (635 mm in length) showing several signs of anadromy including ocean growth (c) with wider spacing of circuli than that of the first 30-35 circuli of hatchery growth, as well as ocean entry/exit markings.

vibrant pink stripe on the body, and spotting dissimilar to anadromous steelhead, gave the residuals a "troutlike" appearance. Many residuals, including some as small as 285 mm, were observed to be in full spawning colors. Several were ripe males that excreted milt upon examination. I often observed residuals positioned behind spawning anadromous steelhead.

Juvenile Hatchery Steelhead

Of the 1,636 juvenile hatchery steelhead captured during this study, 771 were captured below the Old Weir Hole, located half way through the study reach, while 865 were captured above it (Table 3). Average fork length and weight for juvenile hatchery steelhead was 167 mm (SD = 29 mm; range = 84-249 mm) and 54.6 g (SD = 30.6 g; range = 6.8-217 g), respectively (Table 4). The fork length of juvenile hatchery steelhead differed among smolting categories (not-smolting, transitional, and smolting) (ANOVA; $F = 107.12$; df = 1,554; $P < 0.001$). Multiple comparisons showed each group was significantly different from the other (Tukey's 95% Simultaneous Confidence Intervals = 98.06%). Individuals that were not smolting (mean fork length = 159 mm; SD = 31 mm; range = 84-249 mm) were the smallest group, followed by transitional fish (176 mm; SD = 20 mm; range = 125-240 mm), with smolting fish having the largest average fork length (186 mm, SD = 17 mm, range = 154-240 mm). Condition factors also differed among groups (ANOVA; $F = 113.5$; df = 1,554; $P < 0.001$). Multiple comparisons showed each group was significantly different from the other

Table 3. Sampling locations, method of capture, and sample size of juvenile hatchery steelhead captured at each location in the upper Trinity River, California, in March of 2007.

Location	rkm	Electrofishing	Hook and line	Seine	Total
Old bridge	179.2	0	272	163	435
Cableway	179.5	0	44	0	44
New bridge	180.4	0	169	0	169
Corner	180.5	0	123	0	123
Weir	180.7	0	256	0	256
Sven Oldertson	181.1	58	0	0	58
Bear Island	181.4	151	247	0	398
Three pipes	181.9	0	72	0	72
First Riffle	182.2	0	81	0	81

Table 4. Fork length, weight, and fry consumption of non-smolting, transitional, and smolting juvenile hatchery steelhead captured in the upper-Trinity River, California 2007, using hook and line, seine, and electroshocker.

	Areas other than Bear Island				Bear Island only[a]				
	Juvenile category				Juvenile category				
Variable	Non-smolting	Transitional	Smolting	Sub-total or mean	Non-smolting	Transitional	Smolting	Sub-total or mean	Grand total or mean
Sample size	696	419	123	1,238	295	92	11	398	1,636
Mean fork length (mm)	156	175	186	166	169	184	199	173	167
Mean weight (g)	43.8	57.6	66.0	50.9	63.5	67.8	83.8	65.0	54.6
Piscivores (*n*)	45	28	9	82	120	17	2	139	221
Piscivore proportion	0.06	0.07	0.07	0.07	0.41	0.18	0.18	0.35	0.14
Fry consumed	65	32	12	109	715	53	5	773	882
Fry per piscivore	1.4	1.1	1.3	1.3	6.0	3.1	2.5	5.6	4.0

[a] The data are given for one location called Bear Island and the rest of the river separately, due to the high rate of salmonid fry consumption by juvenile hatchery steelhead at the Bear Island site.

(Tukey's 95% Simultaneous Confidence Intervals = 98.06%). Mean condition factor of individuals that were not smolting was the highest (1.11) followed by fish that were transitional (1.05), with smolting individuals having the lowest condition factor (1.01).

Mean fork length and weight for 500 (50 from each of 10 raceways) juvenile hatchery steelhead examined in the hatchery on 14 March 2007, one day prior to the beginning of the volitional release period, were 178 mm (SD = 34 mm; range = 62-246 mm) and 76.2 g (SD = 34.4 g; range = 2.1-188.1 g), respectively. Overall, the difference in fork length between 108 juvenile hatchery steelhead captured by hook and line during the first week of study (mean = 182 mm; SD = 27 mm; range = 121-242 mm) and that of the 500 juvenile hatchery steelhead examined one day prior to the beginning of the volitional release period was not significant (*t*-test; $t = 1.29$, df = 184, $P = 0.198$).

Mean fork length and weight of juvenile hatchery steelhead captured by seining and electrofishing in the river ($n = 371$) were 162 mm (SD = 31 mm, range = 95-248 mm) and 52.2 g (SD = 34.0 g, range = 10.4-217.5 g), respectively. For juvenile hatchery steelhead captured by hook and line on the same dates and locations as those captured by seining and electrofishing ($n = 317$), mean fork length and weight were 166 mm (SD = 27 mm, range = 100-249 mm) and 52.9 g (SD = 29.3 g, range = 13.4-198.0 g), respectively. Fork length of juvenile hatchery steelhead captured within the river differed between capture methods (*t*-test, $t = 2.18$, df = 685, $P = 0.030$). However, it is unknown if these differences, which appear to be small, are biologically meaningful.

PIT-tag antenna performance and juvenile hatchery steelhead population estimation

The read range and efficiency of PIT-tag antennas was greater in the hatchery than in the river. Hatchery antennas had a read range of approximately 102 cm, and tests indicated an efficiency close to 100% with that read range. Of 991 PIT tags that were implanted in the juvenile hatchery steelhead 6 weeks prior to the beginning of the volitional release period, 877 (88%) were subsequently detected by the hatchery array (Figure 3). Of these, 859 (98%) were detected on both hatchery antennas. Given the high detection efficiency, undetected tags likely reflected either rejection by the fish, or fish mortality prior to release.

Read range of the river antennas was roughly 25 cm, and their efficiency ranged between 65% and 80% throughout the study. Measuring efficiency of the river antennas accurately was difficult with test tags because the orientation of the test tags could not always be controlled, which can greatly affect antenna performance (Zydlewski et al. 2006). Of 877 tagged juvenile steelhead that were detected leaving the hatchery, 663 were detected with the river array, with an overall efficiency of at least 76% (Figure 4). Some of the tagged fish that were detected in the hatchery may have residualized upstream of the river array, or died before reaching it.

The river array was not operational until 19 March, 4 days after the volitional release period began. During this four day period, 33 PIT-tagged steelhead exited the hatchery, 9 of which were eventually detected at the river array.

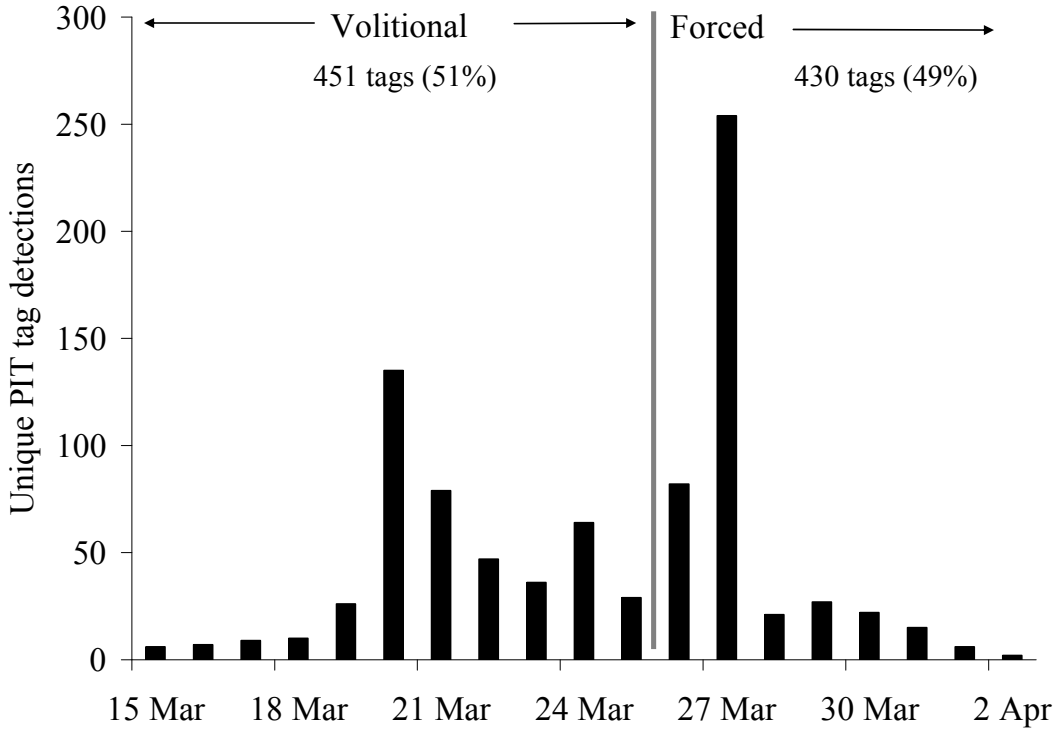

Figure 3. The number of unique detections (first date a tag was detected) of PIT-tagged juvenile steelhead by day, for an array of 2 antennas located in Trinity River Hatchery Juvenile steelhead were forced from the hatchery on 26 and 27 March 2007 following an 11 day volitional emigration period.

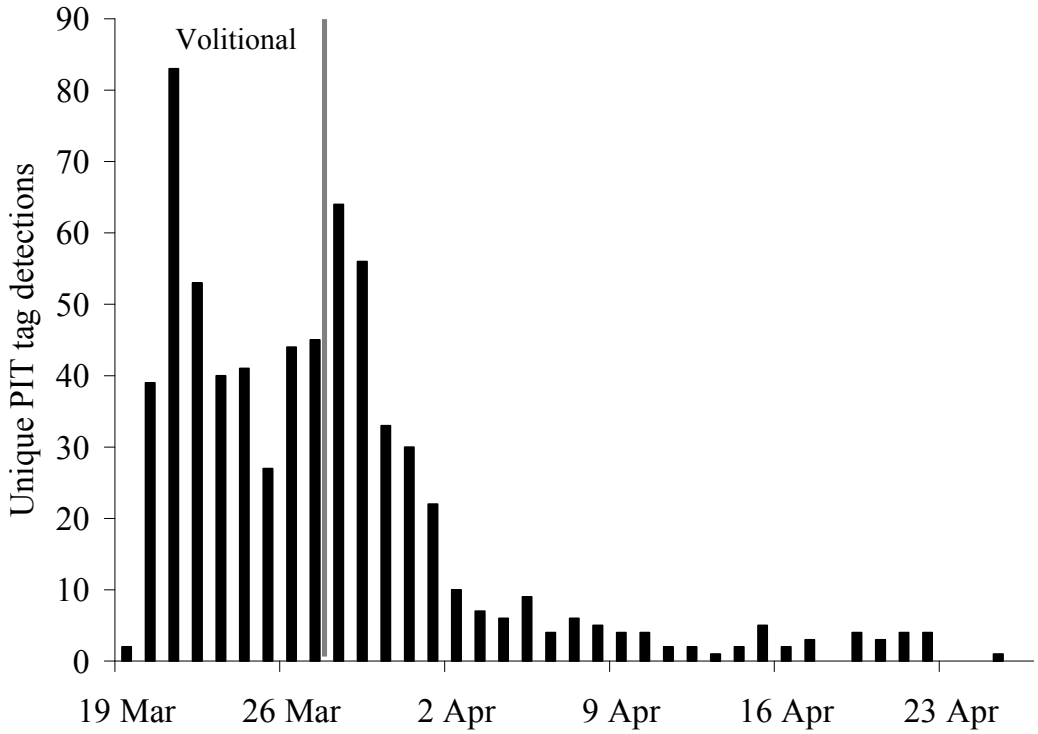

Figure 4. The number of unique detections (first date a tag was detected) of an array of 2 antennas located 3.2 km downstream in the Trinity River (right). Juvenile steelhead were forced from the hatchery on 26 and 27 March 2007 following an 11 day volitional emigration period.

The supporting cable of the downstream river antenna broke on 11 April and was not repaired. During the time that two antennas were in operation, 564 tagged fish were detected. Of these, 276 (49%) were detected at both antennas, while 288 (51%) were detected at only one of the two antennas. Downstream and upstream river antennas appeared to perform similarly. Of the 288 tags detected on one of two antennas, 156 were detected on the upstream antenna and 132 were detected on the downstream antenna.

An estimated 356,975 juvenile hatchery steelhead failed to migrate volitionally from the hatchery. These fish entered the river at the end of the volitional release period, at which time sampling of juvenile steelhead in the river began. A total of 823,210 juvenile hatchery steelhead were released from Trinity River Hathcery between 15 to 27 March 2007. The number of juvenile hatchery steelhead released from 9 raceways that contained PIT-tagged fish was 729,760. Fifty-one percent (n = 448) of tagged fish exited the hatchery volitionally (Figure 3). Remaining fish (P_f = 0.49) were forced from the hatchery by dewatering of raceways by hatchery personnel.

Prior to 27 March 2007, the end of the volitional release period, 326 of 448 juvenile steelhead that were detected leaving the hatchery were also detected by the river array (Figure 4). This suggests that at least 73 % (P_e) of volitional migrants exited the study reach prior to collection of stomach contents of juvenile steelhead. Multiplying the number of juvenile hatchery steelhead that migrated volitionally by 0.27 (1-0.73) yielded a product of 100,488 fish ($\hat{S}_2$). The number of juvenile hatchery steelhead that failed to migrate volitionally and entered the river on the day sampling commenced was estimated

to be 357,582 ($\hat{S}_1$). The total number of juvenile hatchery steelhead present in the study reach on 27 March ($\hat{S}_0$) was estimated as the sum of $\hat{S}_1$ and $\hat{S}_2$. An estimated 458,070 ($\hat{S}_0$) juvenile hatchery steelhead were present in the study reach on 27 March 2007.

To estimate the number of juvenile hatchery steelhead present in the study reach during each day of the study, the number of unique tag detections (first date and time a particular tag was detected) from the river array was regressed over time. Examination of a plot of the data, and trials with various model types, indicated that a power function of the form $y = b_0 x^{b_1}$ provided the best fit ($r^2 = 0.89$). The equation was:

$$y = 73.44\, j^{-0.92}, \qquad (12)$$

where j is the number of days beyond 27 March 2007. The value for b_0 was substituted with 438,304, the number of hatchery steelhead that were estimated to be in the study reach on 27 March. Model results suggest that the hatchery steelhead population decreased sharply in the beginning of the study, losing roughly half of the total population within the first 24 hours (Figure 5).

Fry consumption

Consumption of salmonid fry varied among juvenile hatchery steelhead. The smallest piscivorous hatchery steelhead had a fork length of 108 mm, and it consumed 2 salmonid fry. A juvenile hatchery steelhead that was 200 mm in length consumed 52 salmonid fry, which was the maximum amount of salmonid fry consumed by any

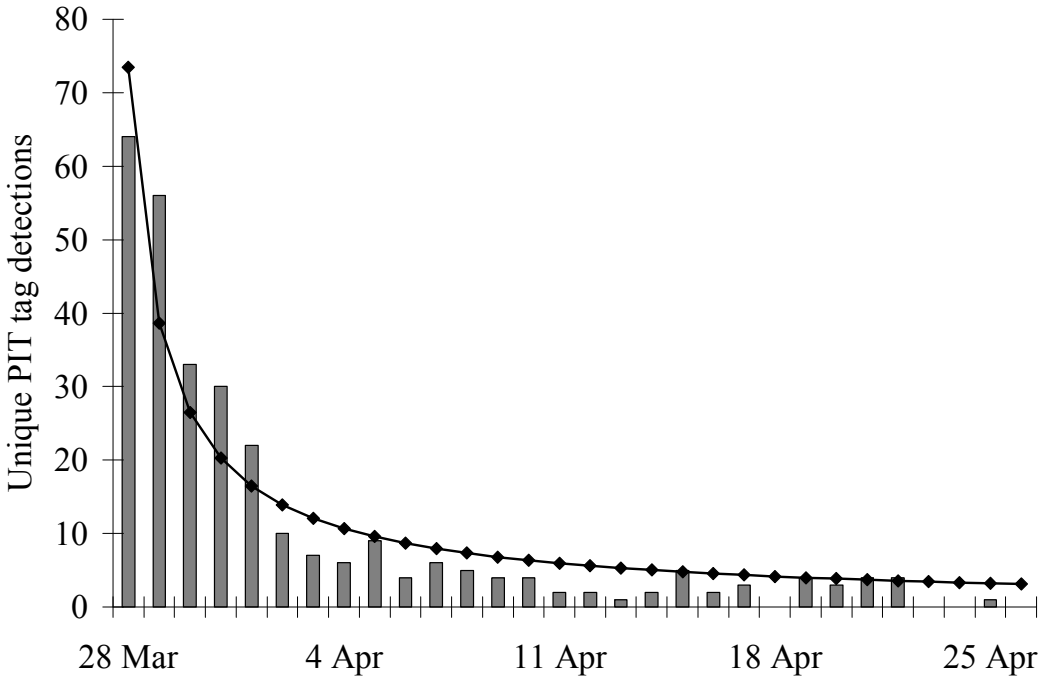

Figure 5. The number of unique detections (first date a tag was detected) of PIT-tagged juvenile steelhead, by day, for an array of 2 antennas located in the Trinity River, California, 2007, 3.2 km downstream from the release site, and a regression of the data with a power function. The data were fit to a power function as $y = 73.44x^{-0.923}$, $R^2 = 0.89$.

hatchery steelhead during this study. Eighty-one of 316 residualized hatchery steelhead (26%) consumed a total of 435 salmonid fry. Additionally, 97 residualized steelhead consumed a total of 2,685 salmonid eggs. The maximum number of salmonid fry consumed by any residualized steelhead was 35, while the maximum number of eggs consumed by any one residualized steelhead was 162. The proportion of piscivores in the residualized steelhead population ranged between 0.20 and just over 0.30 (Figure 6). The number of fry consumed per piscivore decreased from a high of around eight in the first week of study, to roughly 4 in the last week of the study (Figure 6). The average fork length of residualized hatchery steelhead piscivores (363 mm; SD = 61 mm) was greater than that of non-piscivores (319 mm; SD = 41 mm) (*t*-test, $t = 6.08$, df = 104, $P < 0.001$).

Of 1,636 juveniles examined, 221 piscivores (13.5 %) consumed 882 salmonid fry (Table 4). The proportion of piscivores in the juvenile steelhead population increased from about 0.02 in the beginning of the study to about 0.1, before falling back down to around 0.04 by the end of the study (Figure 7). Excluding those hatchery steelhead captured at Bear Island, the amount of fry consumed per piscivore remained consistent between weeks, slightly greater than 1.0 (Figure 7). The average fork length of juvenile hatchery steelhead piscivores (173 mm, SD = 28 mm) was greater than that of non-piscivores (168 mm, SD = 29 mm) (*t*-test, $t = 2.85$, df = 295, $P = 0.005$). The differences between the proportion of piscivores and the number of fry consumed per piscivore for the three smoltification groups were small (Table 4).

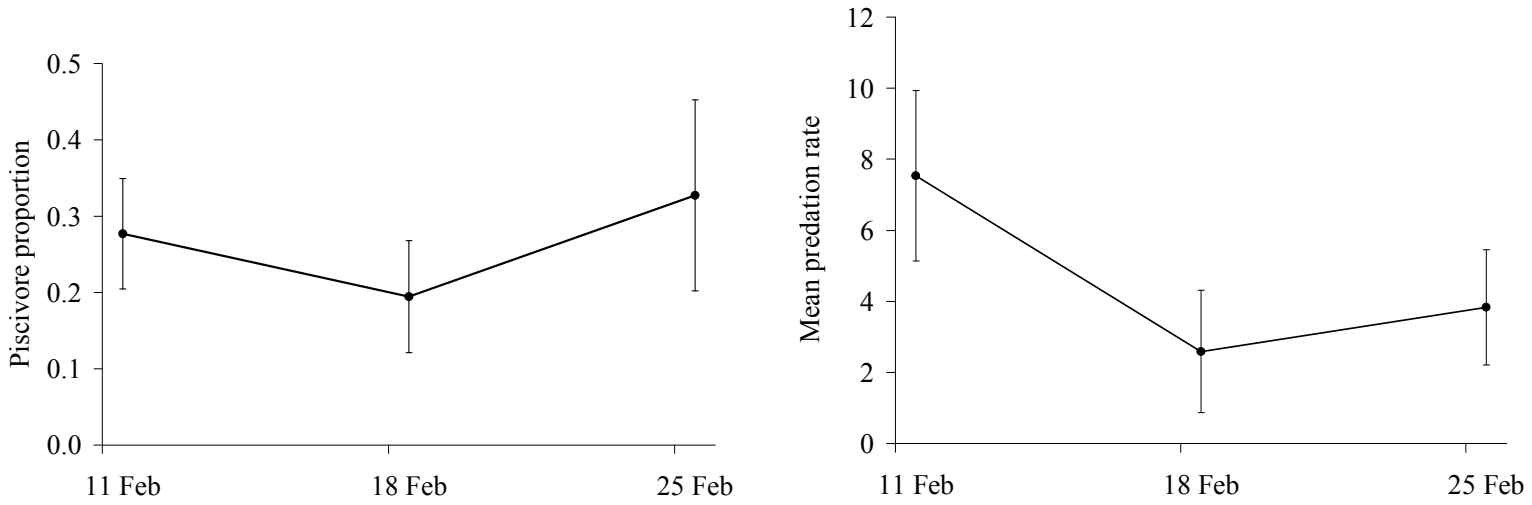

Figure 6. The proportion of piscivores (piscivores/ number of fish examined) ± 95% CI and the mean rate of predation (number of salmonid fry/piscivore) ± 95% CI for residualized hatchery steelhead captured from the upper Trinity River, California, 2007.

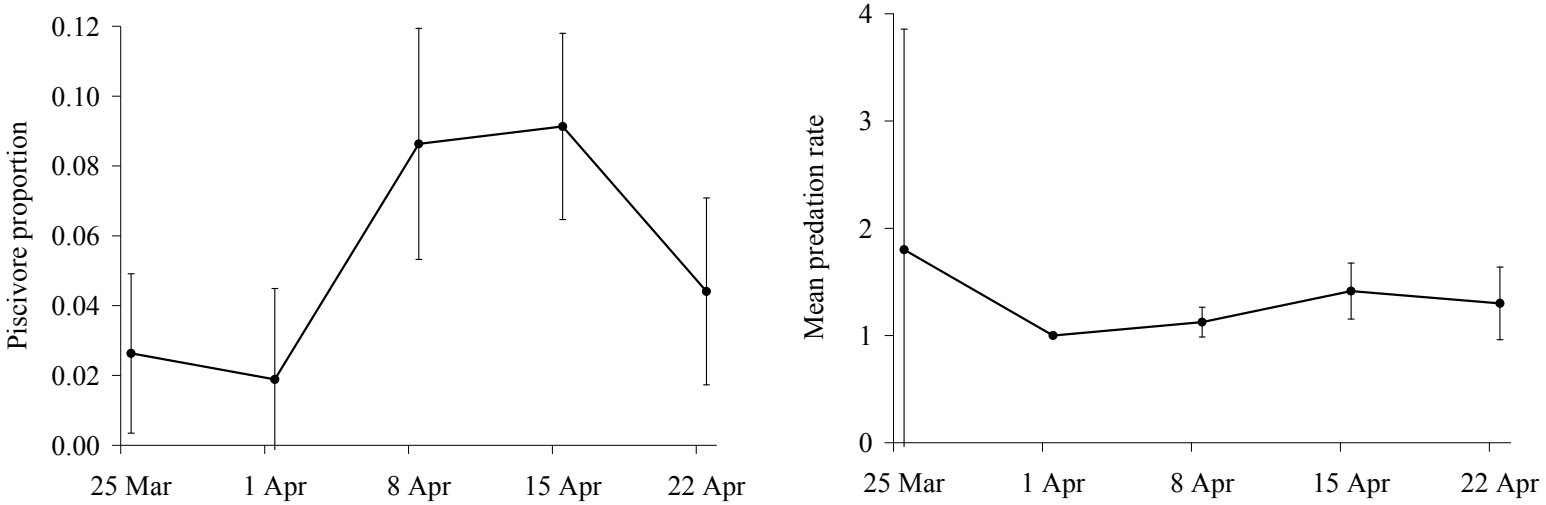

Figure 7. The proportion of piscivores (piscivores/ number of fish examined) ± 95% CI and the mean rate of predation (number of salmonid fry/piscivore) ± 95% CI for juvenile hatchery steelhead captured from the upper-Trinity River, California, 2007. The juvenile data excludes those fish captured at Bear Island.

Two years earlier, 2,479 juvenile salmonids consumed 135 salmonid fry in the same study reach (Yurok Tribal Fisheries Program 2008). Differences in fry consumption between the two years likely arises from a single sampling location, a side channel at Bear Island (rkm 180.4), which was sampled in 2007, but not 2005.

The observed count of piscivores between the juveniles captured at Bear Island and those not captured at Bear Island (Table 4) differed from the expected count (χ^2 = 140.897, $P < 0.001$). Likewise the amount of fry consumed per piscivore between the two groups differed from the expected count ($\chi^2 = 75.581$, $P < 0.001$). Prior to this study, the initial investigation of predation rates by hatchery steelhead had not uncovered the high rate of predation that was recorded at Bear Island.

Samples obtained by seining and electrofishing were compared with samples obtained by hook and line on the same dates and in the same locations (4 different occasions in total). Of 372 juvenile hatchery steelhead captured by seine and electrofishing, 100 piscivores consumed a total of 635 salmonid fry. Of 317 juvenile hatchery steelhead captured by hook and line, 62 fish consumed 159 salmonid fry. Fish sampled by seining and electrofishing consumed 6.4 salmonid fry per piscivore, while fish sampled by hook and line consumed 2.6 fry per piscivore. The proportion of piscivorous hatchery steelhead did not differ with capture technique (seining/electrofishing versus hook and line) ($\chi^2 = 3.179$, $P = 0.075$), but the number of fry consumed per piscivore did ($\chi^2 = 25.204$, $P < 0.001$).

I estimate that 24,194 [21,066-27,323] salmonid fry were consumed by 2,302 residualized hatchery steelhead in 21 days from 10 February to 2 March 2007.

Additionally, I estimate that the residualized hatchery steelhead consumed 171,018 [155,272-186,764] salmonid eggs during the same period. Assuming an egg-to-fry survival rate of 0.25, the 171,018 eggs consumed by the residualized hatchery steelhead would equate to 42,755 salmonid fry.

Excluding results from the Bear Island side channel, I estimate that 437,697 juvenile hatchery steelhead consumed 61,214 [43,813-78,615] salmonid fry in 30 days from 28 March to 26 April 2007. Assuming a constant population of 1,500 juvenile hatchery steelhead in the Bear Island side channel in the 30 day period, an additional 49,445 salmonid fry were consumed.

DISCUSSION

This study documents the highest rate of predation by hatchery salmonids on naturally produced salmonids that has been reported (Table 1). Some attributes of the upper Trinity River setting contribute to high predation risk for naturally produced salmonid fry. These include spatial and temporal overlap of predator and prey (Hatchery Scientific Review Group 2004), size differential of predator and prey (Pearsons and Fritts 1999), high concentrations of predators (Mather 1998), as well as abiotic factors including low, regulated flow (8.5 ms^{-1}) and high water clarity (< 2 NTU; Gregory and Levings 1998, Robertis et al. 2003). Because salmonids are visual predators, another factor controlling the encounter rate of prey is prey density (Beauchamp et al. 1999). The study area is heavily used by spawning adult salmonids, resulting in high concentrations of prey, relative to other parts of the river with lower redd densities.

The release of large numbers of hatchery steelhead can lead to substantial numbers of fry being consumed, even with relatively low predation rates. For example, if 500,000 hatchery steelhead are released, and 5% of these hatchery steelhead consume 1 fry per day, then 25,000 fry can be consumed in one day. The amount of fry consumed is additive, with hatchery steelhead continuing to consume fry each successive day.

The majority of salmonid spawning in the uppermost 40 km of the Trinity River (California Department of Fish and Game 2005) takes place within 3.2 km of the release location of hatchery juvenile salmonids, so that both predator and prey exist in close

proximity to each other. In 2006, there were an estimated 2,302 redds for Chinook salmon and coho salmon combined, although some coho salmon and Chinook salmon may have spawned after redd surveys were terminated on 16 December 2006. Assuming 3,000 eggs per redd and an egg-to-fry survival rate of 0.25, approximately 1,726,500 salmon fry were produced in the study reach. Assuming all fry consumed by hatchery steelhead were Chinook salmon or coho salmon fry, half of the eggs consumed by residualized steelhead were Chinook salmon or coho salmon (the other half being steelhead), and an egg-to-fry survival rate of 0.25, then I estimate that 156,231 Chinook salmon and coho salmon fry were consumed over the 21 d residualized hatchery steelhead study period and the 30 d juvenile hatchery steelhead study period. This represents 9.0 % of Chinook salmon and coho salmon fry that were produced.

For several reasons, the estimate above is not a complete estimate of the number of fry consumed by hatchery steelhead in 2007. The estimate covers only the 21 d and the 30 d periods of study for residualized hatchery steelhead and juvenile hatchery steelhead, respectively. Additionally, almost half of the juvenile hatchery steelhead produced at Trinity River Hatchery in 2007 were not included in this study. The study reach was only a 3.2 km long, the fly only hook and line method utilized may lead to underestimation of fry consumption, and the study only covered a relatively short portion of the entire year. Also, dividing the number of daylight hours by the temperature-based gastric evacuation rate of steelhead resulted in a "correction" of the fry consumption data by approximately one-half throughout the study. Trinity River Hatchery also releases roughly 500,000 coho salmon annually that were not included in this study. Coho salmon

have also been documented to consume salmonid fry (Ruggergone and Rogers 1992, McConnaughey 1999).

I found that the average fork length of juvenile hatchery steelhead piscivores was greater than that of non-piscivores. However the difference was five mm, which, while statistically significant, may not be biologically significant. Because the difference between these two groups was relatively small, and the fact that a wide range of juvenile steelhead size classes consumed salmonid fry, it is unlikely that there is a size at which juvenile hatchery steelhead can be released that would reduce the probability that they would consume salmonid fry. The differences between the proportion of piscivores and the number of fry consumed per piscivore for the three smoltification groups were small (Table 4). This indicates that hatchery rearing strategies aimed at increasing the number of steelhead that are ready to smolt upon release may not affect the number of fry consumed by hatchery steelhead. However, because non-smolting hatchery steelhead are more likely to residualize, non-smolting hatchery steelhead may consume more salmonid fry simply because they spend more time in the river than those that are capable of smolting when released.

Both juvenile hatchery steelhead and juvenile coho salmon are released on 15 March of each year. March is a time of year when many fry are either newly emerged, or just emerging from the gravel (Trinity River Flow Evaluation 1999), making the fry susceptible to predation. Residualized hatchery steelhead are present throughout the months that all salmonids spawn and rear. This study has shown that residualized steelhead take advantage of both fry and eggs in the drift, as well as actively pursuing

rearing fry. For instance, I saw hundreds of adult steelhead spawning in February in areas where Chinook salmon and coho salmon had already spawned (redd superimposition). Spawning adult hatchery steelhead, upon creating their own nests, would excavate the yolk sac fry and eyed eggs of salmon, sending them into the water column, making for a readily available food resource for residualized hatchery steelhead.

Data from a comparison of fish samples collected by hook and line and those captured by other means suggests that hook and line may underestimate the number of salmonid fry consumed. This indicates that by relying on invertebrate fly patterns to attract juvenile hatchery steelhead, I may have failed to capture those juveniles that specialize in piscivory. For instance, if one casts a floating insect to a group of juvenile hatchery steelhead, an individual that typically focuses on pursuing salmonid fry may be less likely to be the first to look up and strike the dry fly than an individual that focuses on preying upon insects. I often witnessed juvenile hatchery steelhead pursuing salmonid fry in the shallows along the stream banks. It became clear after spending hours watching individual steelhead rush into groups of fry, that some hatchery steelhead tend to specialize in the pursuit of fry, while others do not. This has implication for the results of this research because the majority of the samples (77%) were captured using hook and line with invertebrate fly patterns, possibly underestimating the number of fry consumed.

Undoubtedly, several of the juvenile hatchery steelhead in raceway F, the only raceway that was not included in this study or in the calculations of fry consumption, were larger in size than the smallest piscivore that was recorded during this investigation, and therefore capable of consuming salmonid fry. This means that it is possible that

some juvenile hatchery steelhead from raceway F, which on average contained the smallest steelhead released from Trinity River Hatchery, also consumed salmonid fry, thereby underestimating of the total number of fry consumed during the period of study in the study reach. In total, 384,906 juvenile hatchery steelhead were not included in the calculation of the number of fry consumed.

The relatively high rate of predation by juvenile hatchery steelhead on naturally produced fry at the Bear Island side channel was suprising. The number of fry per piscivore at Bear Island was roughly four times that of the rest of the study site (Table 4). Previous sampling by the Yurok Tribal Fisheries Program did not reveal large variation in predation rates at various locations throughout the study reach, but their survey did not sample juvenile hatchery steelhead at the Bear Island site. High predation may reflect a higher concentration of fry per unit of volume than in other areas of the river, and (or) it could reflect learned behavior by hatchery fish. Several juvenile hatchery steelhead had both feed pellets and invertebrates in their stomachs on the first day of our study, indicating that they quickly begin feeding on insects and other food particles in the drift.

Length of juvenile hatchery steelhead in my study was considerably smaller than in the survey conducted by the Yurok Tribal Fisheries Program in 2005 (Yurok Tribal Fisheries Program 2008). Average length differed by 30% (214 mm versus 167 mm) between the two studies. The study by the Yurok Tribal Fisheries Program (2008) found that 78% of juvenile hatchery steelhead examined were transitional or smolting. In this study, only 39% of juvenile hatchery steelhead were transitional or smolting. This is evidence that the average difference of 47 mm in fork length between juvenile steelhead

captured in 2005, and those captured in 2007, is not only statistically significant, it is also biologically meaningful. Variability in release size affects inferences regarding survival and adult returns because both survival (Tipping 1997, Miyakoshi et al. 2001, Jokikokko et al. 2006) and smoltification, to a point (Chrisp and Bjornn 1978, Tipping et al. 1995), are positively correlated with juvenile size. Annual variability in release size of juvenile steelhead from Trinity River Hathcery may reflect variability in air temperature, weather, and water temperature, as fish are reared in outdoor raceways.

Chrisp and Bjornn (1978) determined that steelhead parr must reach a minimum total length of 140-160 mm before they have the capability to become smolts and migrate to the sea. Those that were greater than 170 mm in length had more pronounced changes associated with smoltification, and migrated in larger numbers, than smaller juveniles. Rhine et al. (2002) found that steelhead classified as smolts were significantly longer, heavier, and had lower mean condition factor than steelhead classified as transitional or not smolting. This agrees with my findings. Additionally, larger smolt size has been linked with increased rates of survival (Ward and Slaney 1988, Henderson and Cass 1991, Tipping 1997, Miyakoshi et al. 2001, Jokikokko et al. 2006), especially in years with poor ocean conditions (Saloniemia et al. 2004). However, the positive correlation between steelhead smolt size and percentage migrating (Chrisp and Bjornn 1978, Tipping et al. 1995) and survival (Tipping 1997) tends to disappear at roughly 190-210 mm, after which point residualism and precocialism begin to increase (Schmidt and House 1979, Partridge 1986, Viola and Schuck 1995, Newman 2002, Rhine et al. 2002). Tipping et al. (1995) reported that for optimum emigration rates, steelhead smolt lengths should be at

least 190 mm and that Fulton's K values should be 0.90-0.99. Excessively large smolts conferred no clear emigration advantage, and were costlier to produce. However, average fork length should exceed 190 mm, in order to account for the normal distribution of a population (Tipping et al. 1995, Tipping 1997).

Because they are not, on average, physiologically capable of smolting, the 175,210 juvenile hatchery steelhead in raceways F (mean fork length = 125 mm) and N (mean fork length = 128 mm) of Trinity River Hatchery were forced into one of two probable pathways which are both undesirable from a management perspective: death or residualism. As mentioned above, mortality tends to be highest for smaller steelhead smolts (Seelbach 1987, Ward and Slaney 1988). Those that do survive compete with naturally produced salmonids for food and habitat (McMichael et al. 1997), exhibit aggression toward other salmonids (Berejikian et al. 1996, McMichael et al. 1999), and consume other salmonids (this study).

Although estimates of the number of residualized steelhead that exist in the upper Trinity River during summer months are not available, tens of thousands may persist throughout the summer (in any given year). Researchers have estimated residualism rates of 10-17% on other river systems (Viola and Schuck 1995, Rhine et al. 2002, Bumgarner et al. 2002). Snorkel surveys in June from previous years have documented tens of thousands of juvenile hatchery steelhead in the upper Trinity River (personal communication, P. Garrison, 2007 California Department of Fish and Game, P.O. Box 1185, Weaverville, CA 96093). For example, Bumgarner (2002) estimated that the number of residualized steelhead present in the Touchet River on 27 May 1999 was

18,411, or 14.7% of the 125,000 released. Assuming a minimum of 10% of steelhead from Trinity River Hatchery fail to migrate by 1 June, roughly 80,000 hatchery steelhead could be present in the Trinity River, most likely in the uppermost reaches.

In two separate years (2005 and 2007) only a few thousand fish were estimated to persist into March from releases of roughly 800,000 the previous year (Yurok Tribal Fisheries Program 2008, this study). The fate of the large number of steelhead that likely remain in the Trinity River between the time of release and the spring of the following year is not known. Most of the fish probably perish, as non-migratory juvenile steelhead tend to have high rates of mortality in freshwater (Chrisp and Bjornn 1978, Seelbach 1987), although some probably continue to smolt throughout the summer months. For example, Chrisp and Bjornn (1978) found that for yearlings planted in the spring, high mortalities (70%) occurred the following summer. It is not advantageous, from a management perspective, for juvenile hatchery steelhead to remain in the river for one year after release, and then migrate to the ocean, because they interact with naturally produced salmonids in the river (McMichael et al. 1997, McMichael et al. 1999, Kostow et al. 2003) and they have low survival rates (Chrisp and Bjornn 1978, Seelbach 1987).

Overall mean fork length for juvenile hatchery steelhead that were captured during the first week of this study was not significantly different from the mean for the 500 juvenile hatchery steelhead that were measured one day prior to release from the hatchery. This indicates that the hook and line method provided a reasonable means to sample fish without bias in relation to fish size. Because longer steelhead, up to roughly 200 mm, smolt at a greater frequency than smaller steelhead (Chrisp and Bjornn 1978,

Rhine et al. 2002), it is possible that longer fish continually exited the study reach throughout the course of the investigation, making the mean fork length decrease over time. For instance, the mean length of fish captured during the first week of the study was 182 mm, while the overall mean for the duration of the study was 167 mm.

Even though Trinity River Hatchery serves as one of the large mitigation hatcheries in California, fishing regulations on the uppermost 3.2 km of the Trinity River are "fly only" and "catch and release only". These regulations have no apparent biological justification. Fish and game agencies in some western states rely on angler harvest to eliminate residualized hatchery steelhead (Partridge 1985). Without this tool, river managers have few available means to eradicate non-anadromous steelhead from the river. Catch and release regulations that are, in this case, closely associated with a large hatchery, may obscure the overall purpose and ethic of catch and release angling from the fishing public, which is meant to preserve wild fish. The California Fish and Game Commission Policy (2004) states that

> "Resident fish will not be planted or resident fisheries developed in drainages of salmon [or steelhead] waters, where, in the opinion of the Department, such planting or development will interfere with salmon [or steelhead] populations. Exceptions to this policy may be authorized by the Commission (a) where the stream is no longer adaptable to anadromous runs, or (b) during the mid-summer period in those individual streams considered on a water-by-water

> basis where there is a high demand for angling recreation and such planting or development has been determined by the Department not to be detrimental to salmon [or steelhead]."

A fishery for non-anadromous hatchery steelhead now exists on the Trinity River. These residualized fish cannot legally be removed by anglers; however, they are targeted by fly fishermen. To date, the California Department of Fish and Game has not examined whether or not this resident fishery is detrimental to salmon or steelhead. Without this information, it is not possible to determine if the fishery is in conflict with the stated policies of the California Fish and Game Commission. Additionally, in some years, tens of thousands of adult hatchery salmonids, in excess of hatchery egg take goals, are returned to the river after entering the hatchery, and they cannot be harvested.

During the course of this study, I learned that virtually 100% of the steelhead broodstock at Trinity River Hatchery is of hatchery origin (personal communication, L. Marshall, 2007, California Department of Fish and Game, 1000 Hatchery Rd., Lewiston, CA 96052). Hatchery-reared, adipose fin clipped anadromous steelhead have been bred at Trinity River Hatchery for decades, with little, if any, genetic input from naturally produced steelhead. In order for the selection regimes in the natural environment to dominate the mean fitness of the hatchery and naturally produced population as a whole, it is recommended that the proportion of hatchery broodstock composed of naturally produced fish must exceed the proportion of hatchery fish spawning in the river (Hatchery Scientific Review Group 2004). For example, if the hatchery uses 10%

naturally produced steelhead for broodstock, then only 10% of steelhead that spawn naturally should be of hatchery origin so that the hatchery does not produce deleterious changes in the hatchery and naturally produced populations. Since Trinity River Hatchery uses virtually 100% hatchery steelhead broodstock, and the percentage of naturally spawning adults in any given year is roughly 75% (Trinity River Flow Evaluation 1999, California Department of Fish and Game 2005), the hatchery, and not the Trinity River, may be driving the natural selection process. This means that steelhead in the upper Trinity River mainstem might be better adapted to reproduction in the hatchery than in the Trinity River. This has bearing on this study and on the restoration of naturally produced fish in the Trinity River. This is because hatchery programs have the potential to significantly alter the genetic composition (Crozier 1998, Lynch and O'Hely 2001, Saisa et al. 2003), phenotypic traits (Einum and Flemming 1997, Hard et al 2000, Kostow 2004, Wessel et al. 2006), behavior (Mesa 1991, Berejikian et al. 1996, Fleming et al. 1996, Jonsson 1997), survival (Jonnnson et al. 2003, McGinnity et al. 2003, Kostow 2004) and ultimately the reproductive success (Reisenbichler and Rubin 1999, Fleming et al. 2000, Mclean et al 2003, Araki et al. 2007) of anadromous salmonids, potentially in a matter of a few generations (Araki et al. 2007). Egg transfers from Iron Gate Hatchery to Trinity River Hatchery were routine until at least 1994, and hatchery steelhead of the Trinity River are more genetically similar to Klamath River steelhead than they are to wild steelhead from Horse Linto Creek, a tributary to the Trinity River (Pearse et al. 2007).

While I did not study the effects of competition between hatchery and naturally produced salmonids in the river, others have reported negative impacts on naturally produced salmonids (Kennedy and Strange 1986, McMichael et al. 1997, McMichael et al. 1999), even to the point of measurably impacting the population of natural salmonids (Kostow et al. 2003, Kostow and Zhou 2006). Competition between hatchery and naturally produced salmonids may be more harmful than predation by hatchery salmonids on naturally produced salmonids, but its effects can be less visible. The end result of the competition may be dead naturally produced fish, which cannot be held in hand and counted as in this study.

Interactions in the freshwater environment between hatchery and naturally produced salmonids are likely to disproportionately affect those species which spend the most rearing time in the river. Naturally produced steelhead, spring Chinook salmon, and coho salmon juveniles typically spend at least one year in freshwater (Healey 1991, Sandercock 1991, Moyle 2002). Fall Chinook salmon, however, are unambiguously ocean-type (Moyle 2002). Fall Chinook salmon juveniles emerge from the gravel in late winter or early spring, and within a matter of months, migrate downstream to the estuary and the ocean (Moyle 2002, Quinn 2005). Therefore, naturally produced steelhead, spring Chinook salmon, and coho salmon juveniles are more likely than fall Chinook salmon to experience competition for food and resources in the river, triggering mechanisms such as density dependent mortality (Kostow et al. 2003, Kostow and Zhou 2006), that may ultimately impact the populations of those species. It then follows that in the upper Trinity River, the stocks which have the lowest proportion of naturally

produced individuals returning to the upper Trinity River are coho salmon (~10%) and steelhead (~25%), while fall Chinook salmon have the highest proportion of naturally produced individuals (~40%) (Trinity River Flow Evaluation 1999, California Department of Fish and Game 2005). It should be noted that naturally produced salmonids have also been affected by reductions in available fry rearing habitat of the Trinity River in previous decades resulting from the erection of dams (Trinity River Flow Evaluation 1999, Record of Decision 2000).

Quantifying impacts on naturally produced salmon from predation by hatchery reared fish is one of the steps that can help inform decision makers. For example, one might estimate the number of fry that survive to reach smoltification as a result of a habitat improvement project that would not have survived to smoltification otherwise. This benefit to natural production as a result of a project like habitat enhancement could then be compared with the detriment to natural production caused by predation. This would let managers gauge, with a cost-benefit type analysis, the potential for conflict between the operational regime of a hatchery and river restoration projects. For instance, of 44 different river restoration sites aimed at improving the survival rate of naturally produced fry in the Trinity River, 4 are located in the study reach for this project. Benefits to natural production resulting from these habitat enhancement projects could be compared to the results of this study.

Northern-California Native American Tribes, the State of California, and the U.S. Government have agreed that restoring naturally produced salmonids to "pre-dam levels" is a priority, collectively creating and operating the Trinity Management Council, and the

Trinity River Restoration Program (Trinity River Flow Evaluation 1999, Record of Decision 2000). When ecological and genetic interactions between hatchery and natural salmonids are placed in the greater context of Trinity River restoration, the interactions between these fish has the potential to become problematic, as the goals of Trinity River Restoration Program may be in conflict with the current management regime of hatchery fish. Whether or not the extent of the conflict warrants action by river and hatchery managers is a decision that should be carefully considered.

Other river systems that might be at risk for predation by hatchery salmonids on naturally produced salmonids are those which have similar conditions as that on the Trinity River. Those conditions are relatively low flows, low turbidity, and release location near areas in which spawning adults congregate to build redds.

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From: Walter Lamb <landtrust@ballona.org>
Sent: Monday, March 30, 2020 12:52 PM
To: FGC <FGC@fgc.ca.gov>; Cornman, Ari@FGC <Ari.Cornman@FGC.ca.gov>
Subject: Re: Attached letter from Melissa Miller Henson

Hi Melissa, Ari and FGC staff,

I hope that you are all managing as well as possible during these challenging times. Thank you for sharing the letter regarding our petition. As the letter notes, our petition was filed in time to be received at the February meeting but will instead be received at the April meeting for action at the June meeting. Given the delay in receiving our petition, I respectfully request that the Fish and Game Commission not use the June meeting to simply defer to CDFW, which would result in the unnecessary delay of another two months. CDFW is very familiar with this issue and should be able to prepare its staff recommendation in time for consideration at the June meeting. As I have noted in previous communications, it is our expectation that the Commission will review evidence and make clear factual findings for the record in support of any action on this petition.

With this ongoing public health crisis it is difficult to predict the format of those meetings, but it seems likely one or both may be held remotely. I will look forward to additional information as it becomes available. Thank you again for your assistance.

Walter

Walter Lamb
Ballona Wetlands Land Trust
310-384-1042
Facebook

On Fri, Mar 20, 2020 at 10:23 AM FGC <FGC@fgc.ca.gov> wrote:
Dear Mr. Lamb,

Please see attached letter from California Fish and Game Commission Executive Director Melissa Miller Henson.

Best regards,

California Fish and Game Commission staff

From: Ken Loomis [redacted]
Sent: Saturday, February 22, 2020 01:13 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Supporting petition 2019-003

As an avid diver in the area for 12 years it is extremely disturbing to watch as the kelp forests are being destroyed at a rapid rate. At this rate I can see all kelp forests gone by this time next year. Please allow divers to try to help prevent this from happening. Nature is out off balance likely due to mankind's disturbance. We owe it to nature to help correct the problem we contributed too.

Thank you
Ken Loomis
Santa Clara, CA

From: Chris Markoff [redacted]
Sent: Saturday, March 28, 2020 11:11 AM
To: FGC <FGC@fgc.ca.gov>
Subject: Re: Fish and Game Commission meeting agenda - April 15-16, 2020

I think you really should postpone meetings as this CV epidemic is ramping up in CA. My wife is a physician. Her and all her physician community know CA will look like New York soon. I think people should not be distracted from their social responsibility of doing everything they can to mitigate this slow moving disaster.

Chris Markoff
F/V JOANNA
[redacted]

On Mar 27, 2020, at 4:32 PM, California Fish and Game Commission <fgc@fgc.ca.gov> wrote:

California
Fish and Game Commission
www.fgc.ca.gov

Dear fish and wildlife stakeholder,

The April 15-16, 2020 Commission meeting will be held via webinar and teleconference; specific details for this meeting are forthcoming.

Pursuant to Executive Order N-29-20, commissioners may participate in meetings remotely. The public may observe, provide public comment during the public comment periods, and observe remotely in accordance with the Bagley-Keene Open Meetings Act. As always, there will also be a live stream (webcast) for viewing and/or listening only.

The agenda is now available on the Commission's website at http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=177983&inline.

Please refer to the agenda for important meeting information and deadlines.

Sincerely,

Craig Castleton
California Fish and Game Commission
Every Californian should conserve water. Learn how at: SaveOurWater.com

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Know someone else who would be interested in our organization?

SHARE THIS EMAIL

Not yet signed up to receive our informative emails?

SIGN UP

March 25, 2020

Melissa Miller-Henson, Executive Director
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2040

Sent via email to: fgc@fgc.ca.gov

RE: Response to your March 20 letter

Dear Ms. Miller-Henson,

Thank you for your March 20, 2020 letter following your January 24, 2020 receipt from the California Department of Fish and Wildlife (CDFW) of:

1) Their memo recommending an Environmental Impact Report (EIR) for the Santa Barbara Sea Ranch, Inc. (SBSR) proposed offshore shellfish aquaculture operation.
2) The SBSR draft initial study.

Now, nearly two years after SBSR's submittal of its application for a state water bottom lease on May 31, 2018, the key messages in your letter can be simply summarized as follows:

1) CDFW has now recommended a full environmental impact review (EIR) after their review of the SBSR draft initial study.
2) FGC is waiting to receive the SBSR initial study.
3) Randy Lovell, CDFW Statewide Aquaculture Coordinator, has offered his assistance in completing an initial study.
4) Susan Ashcraft, FGC Marine Advisor, is also willing to assist, where appropriate.

After all this time, and everything that has transpired (and has not transpired), your letter was very disappointing. I will explain why below. However, I also know that your appointment to FGC Executive Director came after SBSR's lease application, and that you have many, many other matters besides SBSR to be concerned with. So, in the interest of being constructive and communicative, I think it would be helpful to include herein a review of the SBSR progress timeline since its state water bottom lease application submittal.

History of Events:

::

May 31, 2018: SBSR submitted an application to the FGC, along with a $500 application fee, for a state water bottom lease for a proposed offshore shellfish aquaculture operation.

June 28, 2018: Susan Ashcraft provided SBSR with a MSWord version of Santa Barbara Mariculture Company's (SBMC) recently approved Mitigated Negative Declaration (MND) and

initial study document (see email below). We agreed, since SBSR's proposed operations are identical to SBMC's operations, and since the bethnic conditions are likely to be the same due to proximity, that SBSR would use SBMC's MND and initial study as a starting point to "tier" off the work that had already been done in order to save time and money.

From: Ashcraft, Susan@FGC
Sent: Thursday, June 28, 2018 10:59 AM
To: David Willett <dwillett@santabarbarasearanch.com>
Cc: Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov>
Subject: Word version of initial study and MND from SB Mariculture

Hi David,

Nice talking with you. Per your request, I have attached the Word version of the Initial study and mitigated negative declaration approved by the Fish and Game Commission for Santa Barbara Mariculture earlier this year. It will be useful to consider the questions and analytical suggestions from the California Coastal Commission letter (penned by Cassidy), which you've already reviewed.

Best regards,
Susan

SUSAN ASHCRAFT | MARINE ADVISOR
California Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814
Office: 916.653.1803

August 22-23, 2018: At its August 22-23, 2018 meeting in Fortuna, the FGC made a determination that the 176 acres of state water bottoms applied for leasing by SBSR is available for lease and that the lease would be in the public interest.

September 10, 2018: Valerie Termini, FGC Executive Director, directed FGC and CDFW staff to schedule the lease application for consideration after completion of a CDFW and interagency review; tribal notification; and environmental review conducted by SBSR pursuant to the California Environmental Quality Act (CEQA). In the letter it said, "**Randy Lovell, statewide aquaculture coordinator with the Department, and Susan Ashcraft, marine advisor to the Commission, will be contacting you to discuss how to accomplish the necessary project submissions**."

September 19, 2018 phone call with Randy Lovell: Randy outlined three potential options for moving forward with the CEQA process. He suggested that since Santa Barbara Mariculture Company's (SBMC) operations are identical to those proposed for SBSR, since SBSR's proposed location is nearby SBMC's location, and since SBMC's mitigated negative declaration document was recently approved by FGC, "SBSR should 'tier' from the work done by SBMC" and repurpose the SBMC mitigated negative declaration (MND) and initial study for SBSR. We discussed three possible options to move forward with that:

1) SBSR could pay CDFW's consultants to modify the SBMC initial study. Randy could not provide an estimate of the what it would cost to do that at that time.

2) SBSR could pay a 3rd party consultant to modify the SBMC initial study, and then additionally pay CDFW's consultants to review the initial study.
3) SBSR could modify, to the extent it was able, the SBMC initial study and CDFW would review the draft and make suggestions for what needed to be done to get the draft as far along as possible, after which SBSR would engage CDFW's consultants to complete the initial study for submittal to FGC.

We agreed that this third option would save SBSR considerable time and money and, therefore, that was the path we chose. Randy said that SBSR would have to enter into a "reimbursement agreement" with CDFW, and that SBSR would have to pay upfront for the work that CDFW's consultants would do to complete the initial study. Over the course of the last 18 months, SBSR has not been provided with any information about this reimbursement agreement, despite it being acknowledged and discussed for many months in the early bi-weekly meetings that began on December 7, 2018, and it being a key element of the path that we chose to take to complete the initial study.

October 11, 2018:

1) Phone call with Cassidy Teufel at the California Coastal Commission (CCC): The purpose of the call was to discuss with the CCC the direction CDFW and SBSR had agreed upon for completing the initial study in order to gather CCC input, and incorporate it into the process upfront, in an effort to streamline the overall process of approval from both FGC and CCC. Mr. Teufel said that "a site-specific, high-resolution video survey of the bottom" would be required. He suggested that I look into purchasing an off-the-shelf ROV to perform the survey transects.
2) After the call with Cassidy I called Randy and he confirmed that we "will need something that shows images."

November 28, 2018: Susan Ashcraft suggests bi-weekly Friday calls with herself, Randy, and Elizabeth Pope to discuss the project. The first call is scheduled for December 7.

December 5, 2018: SBSR submits the first initial study draft to CDFW.

December 7, 2018: First bi-weekly call. Participants: Randy, Susan, and me. Significant outcomes:

- Good discussion about the December 5 version of the draft initial study. Randy provides good feedback and suggestions for areas that need more work.
    - SBSB needs to complete emissions estimates section.
    - SBSR needs to perform a bottom Survey.
    - **Initial study will be reviewed by marine region staff. That didn't finally happen for nearly five months.**
    - Randy to provide updated map for page 22 with credits.
    - Randy estimated the cost of bethnic sampling to be about $80k. I asked if this is necessary since SBMC already did the sampling and the bethnic conditions are

very likely identical (this was shown in the USGS bottom survey that was later included in the September 6, 2019 revision to the initial study).
    - Randy says that he needs to get Cassidy Teufel (CCC) and the U.S. Army Corp of Engineers (USACE) involved with the calls. **That never happened.**
- Randy says he is working on getting me a clearer understanding of the process and costs (reimbursement agreement) to complete the initial study. **That never happened.**
- Randy says he is still working on pulling together a "project coordination team" and putting the SBSR project on the "Aquaculture Permit Counter." **That didn't happen for another three months.**

December 8, 2018: SBSR purchases an ROV for doing the bottom survey for Blue Robotics (https://bluerobotics.com/store/rov/bluerov2/).

December 18, 2018: California Department of Public Health issues SBSR a water sampling plan for the proposed 176 acre SBSR lease area. SBSR commences taking monthly water samples and "adverse production condition" (APC) samples any time more than 0.5" of rain is recorded in a 24 hour period. **(Today, a total of 28 water samples have been collected and sent to the San Luis Obispo County Public Health Laboratory for testing, 17 of which were APC samples. Test results indicate that the water quality at the proposed lease location is very good.)**

December 21, 2018: Second bi-weekly call. Participants: Randy, Susan, and me. Significant outcomes:

- Randy still working on providing SBSR with an understanding of the process to collect advanced payment for cost to have CDFW complete the initial study.
- Project coordination team still not formed.
- Putting the SBSR project on the Aquaculture Permit Counter still not done due to updates being made to the Aquaculture Permit Counter website.
- Randy said CCC cannot move forward with their permit process until I have the lease, but USACE could.

January 4, 2019: Third **bi-weekly call cancelled** due to there being no progress over the holidays. The call was rescheduled for January 16.

January 12, 2019 call with Randy to discuss bottom survey:

- Randy makes a great suggestion that the bottom survey transect pattern should take a path over the anchors. This was a logical way to ensure that if there was any rocky structure, the anchors would not be placed in those locations. This meant six north/south passes 800 feet apart. He also suggested two east/west passes.
- **Randy said that James Ray is still working on reviewing the initial study document.**

January 16, 2019: Fourth bi-weekly call. Participants: Randy and me only. Significant outcomes:

- Randy **still working on providing SBSR with an understanding of the process to collect advanced payment for cost to have CDFW complete the initial study.**
    - Says he needs to review and make a recommendation to the department.
    - **Still no progress.**
- Project coordination team **still not formed.**
- SBSR project **still not on the Aquaculture Permit Counter**.

January 30, 2019:

1) Received the following email from Randy saying he was **unavailable for our next bi-weekly call** scheduled for February 1, and that he had no alternative time suggestions before our next scheduled call on February 15:

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> Jan 30, 2019, 2:19 PM
to Susan@FGC, David

Hi David and Susan -

Although Susan may be returning to work this week, I will unfortunately be unavailable for our regular call this Friday. Sorry, but I don't have alternative time suggestions before our next one.

Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
916-445-2008
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

2) I sent the following response to Randy's email **expressing my concern about the lack of progress**. In this email "MNDA" was meant to mean initial study.

David Willett [redacted] Jan 30, 2019, 4:22 PM

to Randy@Wildlife, Susan@FGC

Hi Randy,

I was really hoping to hear that you had made some progress on your end with the permit counter, pulling together the project coordination team, and with the reimbursable agreement. It has been nearly two months since our December 7th call when I provided the draft MNDA and you told me that those were the next steps in the process. We spoke about it again on December 21 and again on January 16. This Friday, it will be eight weeks since we first agreed that those were the next steps. Has any progress been made?

Our next call is now set for February 15 and I am beginning to feel very anxious about this. I have already invested considerable time and money to get this going, including purchasing a small ocean worthy skiff and ROV to support water sampling and surveying, business planning, drafting the MNDA, and other activities related to getting this business off the ground. I am now, in a large way, betting my future on its success.

Is there anything that I can do to help get things moving? Am I missing something? Is there some other time in the next few days that we could have our call?

Thanks and best regards,

David

February 3, 2019: I received the following response from Susan Ashcraft in which she says that **there has not been a new lease application in over 25 years. "We are all working through this together as we determine the proper pathway for each step."** I appreciated her feedback. **This condition was understood back then and was restated by CDFW staff in the March 17, 2020 FGC MRC meeting, over a year later.**

Ashcraft, Susan@FGC Susan.Ashcraft@fgc.ca.gov via cdfw.onmicrosoft.com Feb 3, 2019, 9:03 PM

to me, Randy@Wildlife

Hi David,
I appreciate your message and the concerns you have about progress. I didn't realize our next call wasn't scheduled for another two weeks.

I have been in contact with Randy in response to your email; he has been working with Legal on the process for the reimbursable contract, with an intent to set it up as soon as possible. It has been over 25 years since a completely new lease area and new lease applicant have applied to FGC. We are all working through this together as we determine the proper pathway for each step. That said, our goal is to provide responsive service and i hope we can be in touch with an update soon.

Susan Ashcraft
Fish and Game Commission
916-653-1803

February 15, 2019: Sadly, Randy's mother passed. Understandably, there was no bi-weekly call.

March 1, 2019: Randy **proposed rescheduling the bi-weekly call** due to Susan Ashcraft's unavailability. I sent two responses with **suggested times for the call but got no response**. **There was never a call. At this point it had been almost four months with no progress from CDFW.**

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> Feb 28, 2019, 4:10 PM
to David, me, Susan@FGC

Hi David -

I have not been able to confirm with Susan regarding her availability for tomorrow's call. I am available, but cannot do it in the afternoon. Would you have availability early next week (M – Tu – W) ?

I am on a conf call now through the day's end, but am able to email. Am working concurrently on an invite to the Project Coordination Team for Aquac Permit Counter, which is now set up.
Please follow the instructions for establishing a login acct using the attached.

Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
916-445-2008
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

David Willett Mar 1, 2019, 8:50 AM
to Randy@Wildlife, Susan@FGC

Hi Randy,

Thanks for letting me know. Monday or Tuesday would be good for me. Wednesday's are generally really impacted on my end.

What time works for you?

Best regards,

David

David Willett <dwillett@santabarbarasearanch.com> Mar 4, 2019, 11:16 AM
to Susan@FGC, Randy@Wildlife

Hi Randy and Susan,

Just wanted to follow-up this morning about setting a new time for a call. These are good times for me:

- Anytime today
- Tomorrow anytime after 10:00 AM (taking water samples again all week this week after the big rain we had over the weekend)
- Wednesday after 1:00 PM

Thanks and best regards,

David

March 1, 2019: SBSR's project was finally listed on CDFW's "Aquaculture Permit Counter" website, a site meant to provide interdepartmental coordination for approval of this type of project.

March 6, 2019: SBSR uploaded its second update to the draft initial study document to the Aquaculture Permit Counter, including the requested updates to the emissions section. **At this point it had been four months without any progress from CDFW, and James Ray had still not done his review of the draft initial study document. I had no indication of when anything would get done.**

March 15, 2019: Randy sends the following email in advance of the bi-weekly call. **He had no progress to report on the call.**

Randy...@wildlife.ca.gov Mar 15, 2019, 12:54 PM

to me

Hi David -

In continuation of the circumstances we shared last time, regarding the budget drill we're struggling with right now, today's call at 1:30 will only include me, and will not likely be able to last more than about 5-10 minutes.
Will have some updates, though.

Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
916-445-2008
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

March 28, 2019: **I sent the following email to Randy and Susan expressing concern with the lack of progress and visibility on the project.**

SBSR Coordination Call Tomorrow at 1:30 PM FGC ×

David Willett <dwillett@santabarbarasearanch.com> Mar 28, 2019, 1:57 PM

to susan.ashcraft, randy.lovell, bcc: vwillett

Hi Susan and Randy,

I am looking forward to our call tomorrow. I really hope that we have a lot to talk about and that we can get things moving forward with the project. Since we began these calls on December 7, five out of eight of them have been either cancelled, postponed, or there has been no progress to discuss during the call.

It has now been almost four months since I sent you the draft of the Initial Study (December 5, 2018) and it took almost three months to get it posted to the permit counter (March 1, 2019).

As you know the draft is an adaptation of the SBMC CEQA document that was recently approved. SBSR's lease application location starts directly West (570 ft.) of SBMC's lease and the conditions are, therefore, highly likely to be completely identical (water, bathymetry, substrate, etc.). For that reason, at Randy's suggestion, and in order to save money and in an attempt to expedite the process, I did the leg-work to adapt the SBMC CEQA document to SBSR and I flagged areas that still needed to be addressed due to questions that I could not answer.

To my knowledge, the only questions/actions that remain to be addressed are:

1) Will a substrate study be required?
2) I need to add a culture species description for purple-hinge rock scallops. Carrie Culver from SeaGrant is helping me with this and it will be ready to be included with the next update of the draft, whenever it is an appropriate time to update it.
2) Will a lease inspection and bottom survey be required?

When we spoke last, Randy, you informed me that the estimate to complete the Initial Study was about $90k! Neither you or I could understand why that number was so high, given the nearly complete state of the SBSR draft, the similarity to to the recently approved SBMC CEQA document, and the proximity of SBSR to SBMC.

Additionally, at the suggestion of Cassidy Teuful at the Coastal Commission, I investigated low-cost ROVs that I might buy in order to be able to perform the bottom survey myself to save money, and also to end up with a tool that I can later use for inspection of gear and crops. On December 8, 2018, I purchased an ROV that is capable of recording high-resolution video inspection of the bottom. I have been prepared for months to commence the survey process, but do not wish to begin before I make sure that I know how to conduct the inspection in a way that will satisfy the requirements of all involved parties.

On November 16, 2018, the CDPH (Tricia Lee) came to Santa Barbara and trained me to take water samples. CDPH provided SBSR with an official water sampling plan on December 18, 2018. Due to the abundance of rain this winter, SBSR was able to obtain very nearly all the requisite adverse production condition water samples required under the plan, and by October this year will have completed one full year of monthly sampling, at which point the lease location for SBSR will be eligible for a grower's permit. As I have previously mentioned, it is my hope to have completed all of the other permitting/approval processes by that time, so that I can begin to put gear in the water this year and plant my first crops in the Spring of 2020.

It has been nearly ten months since I submitted my lease application to FGC, and seven months since the FGC determined that the lease would be in the public interest. As far as I am aware, I have done everything that I can do move this forward. I believe the ball has been out of my court since I submitted the Initial Study draft in early December, but if am missing something, please let me know and I will jump on it immediately.

I have been doing all that I can to create a successful aquaculture business that increases sustainable food supply and provides local jobs and opportunities. I have gone about this the best way I know how, have taken advice given, and have reached out to community stakeholders to ensure I have their support, which I do. I continue to invest significant amounts of time and money to get this business off the ground.

I am working hard to try to move this along efficiently and expediently, but it feels like I am the only one who has any sense of urgency about it. Do you have any suggestions for what I might do to change that? I am really hopeful that tomorrow's call will be substantive, and that we can quickly put in place and execute a plan to do what is necessary to allow me to get this business underway as quickly as reasonably possible without any unnecessary delays or expense.

Thank you and kind regards,

David

--

David T. Willett
President & Founder
dwillett@SantaBarbaraSeaRanch.com

March 29, 2019: Bi-weekly call. Here is the meeting summary I sent to Randy with his comments in red. **Randy said there is misalignment between the Dept. and their consultants**

that has not yet been resolved with regard to the completion of the CEQA work. It was never resolved.

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> Mar 29, 2019, 3:31 PM
to Susan@FGC, me

Some revisions below. Thanks for summarizing.
Randy.

From: David Willett <dwillett@santabarbarasearanch.com>
Sent: Friday, March 29, 2019 2:59 PM
To: Ashcraft, Susan@FGC <Susan.Ashcraft@fgc.ca.gov>; Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov>
Subject: Call Summary: CFW/CFG and Santa Barbara Sea Ranch

Dear Susan and Randy,

Here is a summary of our call today.

On the call: Randy Lovell (CFW), David Willett (SBSR)
Absent: Susan Ashcraft (CFG)

* Randy acknowledged the email I sent yesterday in advance of this call and said that he, too, was frustrated with the process.
* Susan is not performing the Marine Adviser function at this time due to another temporary assignment. He didn't want to bring in the person currently performing the Marine Adviser job because there wouldn't be time enough to get him/her up to speed before Susan resumed that role.
* James Ray in the "Marine Region Staff" will be looking over the Initial Study draft starting next week.
* Randy reached out to Cassidy Teufel (CCC) and Bryant Chesney (NOAA) about the project. Bryant is currently on vacation. No input on Cassidy. Randy wants to try to get the agencies to agree up front about what needs to be done to **standardize bottom survey methods for establishing baselines and ongoing monitoring that may be required.** ~~improve the efficiency of the overall process~~.
* Randy asked if I had reached out to any third party environmental consultants. I said I had not. That was not the game plan we agreed to. We agreed that I would do a first draft of the Initial Study based on the SBMC CEQA document and then Randy would have his internal consultants estimate the cost of completion and do the work, since they would ultimately have to review it anyway. We felt this would be the most cost effective and expedient way to proceed.

---

* Randy said that ~~his internal~~ **he and the Dept retained** consultants **may not be in concurrence with regard to the true scope of work needed to complete the CEQA work started by David, and that this misalignment has not yet been resolved.** ~~didn't look closely at the Initial Study draft and that there is a huge disconnect between what needs to be done and the $90k cost figure he relayed to me. Randy still has not followed up with these consultants to investigate this.~~
* Randy says a bottom study will be required to determine if there are any rock outcroppings. He **asked whether David has had a chance to practice** ~~suggested that I begin to undertake this myself~~ with the ROV I purchased **so that when methodology is determined by those agencies who require it, David will have more familiarity with the ROV's operation, data outputs, performance, and capabilities**. I agreed to do that, and will get it underway as soon as wind, wave, and water clarity conditions are right.
* I asked about side-scan sonar and Randy said he felt that that was complicated, expensive, and took a trained eye to interpret.
* Randy suggest that I check with SCCWRP to see if they have bethnic study **data** at my lease site. I will do that.

•••

* I asked Randy if we could have "event driven communication," rather that waiting to have a call for two weeks at a time. He said he would prefer that.

Please advise if you feel it needs anything to be changed or added.

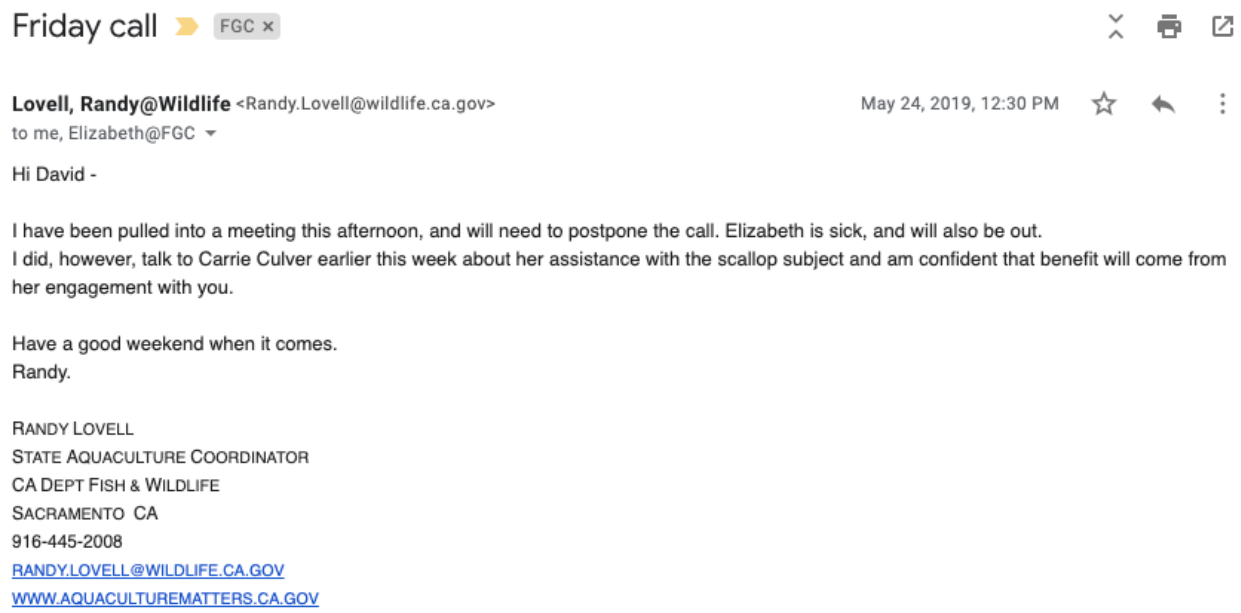
Best regards,

David

May 2, 2019: James Ray, CDFW Biologist, provided the first set of written comments to the initial study draft. **This was nearly five months after the first draft was submitted.**

May 10, 2019: Bi-weekly call. I have no notes from a call that day, so I cannot say whether or not a call took place.

May 24, 2019: Randy **cancelled the bi-weekly call** an hour before it was to start. It was not rescheduled.



Friday call FGC ×

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> May 24, 2019, 12:30 PM
to me, Elizabeth@FGC

Hi David -

I have been pulled into a meeting this afternoon, and will need to postpone the call. Elizabeth is sick, and will also be out.
I did, however, talk to Carrie Culver earlier this week about her assistance with the scallop subject and am confident that benefit will come from her engagement with you.

Have a good weekend when it comes.
Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
916-445-2008
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

June 7, 2019: Bi-weekly call. Participants: Randy and me only. Outcomes:

- Randy informed me that Elizabeth Pope was the new acting marine advisor for FGC.
- I told Randy that I had the ROV commissioned and ready to attempt performing the bottom survey.

June 11, 2019: SBSR submitted an updated version of the initial study that included my responses to James Ray's May 2 comments in the document.

June 17, 2019: James Ray provides some suggestions for the bethnic survey:

Willet benthic survey considerations FGC ×

Ray, James@Wildlife <James.Ray@wildlife.ca.gov> Jun 17, 2019, 10:03 PM
to me, Kirsten@Wildlife, Randy@Wildlife

Hello Mr. Willett,

Here are some considerations for your proposed benthic survey transects. It appears this proposal is focused on a visual survey of the substrate using your ROV, but does not include sampling to characterize the sediment composition and biological assemblage in the proposed lease area. As long as your ROV footage is of sufficient resolution to clearly distinguish surface conditions of the seafloor, it will have some utility in providing a preliminary characterization of habitat conditions, especially in the areas that will receive the long-line anchors. However, your current transect layout has spatial bias, with large areas at the edges of the lease (particularly the West and East sides) receiving little survey effort compared to areas closer the center of the lease. If your objective is to broadly characterize benthic surface conditions throughout the lease, I'd suggest using a more typical vertical/horizontal grid pattern and increasing the number of horizontal transects, so that your survey coverage is more evenly distributed. Finally, as described in my comments on your previous draft initial study, conducting sampling to characterize the sediment composition and benthic assemblage will be important for monitoring the potential impacts of your proposed operation should it be permitted. A visual ROV survey alone will likely not be sufficient to satisfy these monitoring requirements.

Best regards,

James

James Ray
Biologist
Aquaculture & Bay Management
California Dept. Fish and Wildlife | Marine Region
619 2nd Street, Eureka, 95501
Office: (707) 441 5755

June 18, 2019: I responded to Mr. Ray and **I asked him if there was any way that we could create a comprehensive list of what needs to be done, and who will do it in order to accelerate the completion of the initial study.**

David Willett <dwillett@santabarbarasearanch.com> Jun 18, 2019, 6:44 AM
to James@Wildlife, Kirsten@Wildlife, Randy@Wildlife

Hi James,

Thank you for your feedback. The survey transects that I proposed were based on a constructive suggestion from Randy for limiting the effort to the areas where the anchors will contact the seafloor. The proposed vertical transects are where the anchors will be. The diagonals were suggested to augment. Horizontal transects are fine too. At this point, I am just trying to determine what needs to be done so I can get on with it.

As you know, I have provided an update to the draft initial study in which I have attempted to respond to all of your comments. It would be really great if we could create a comprehensive and definitive bullet list of exactly what needs to be done, and who will do it, to complete the initial study. What can I do to accelerate this process? It has now been over a year since I submitted my lease application.

Thanks for your help with this.

Best regards,

David

June 18, 2019: Randy Lovell **cancels another bi-weekly call**. I attempted to reschedule it but was unsuccessful. Elizabeth Pope was the only one to respond, and she had a conflict.

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> Jun 18, 2019, 9:53 PM
to Elizabeth@FGC, me, James@Wildlife

Hi David
I'll be tied up this week and cannot do Fri call. However I may make progress in discussions with other agencies while in these meetings.

Randy Lovell
State Aquaculture Coordinator
916-445-2008
randy.lovell@wildlife.ca.gov

(Apologies for thumb-ridden spelling from phone)

David Willett <dwillett@santabarbarasearanch.com> Jun 19, 2019, 12:32 PM
to Elizabeth@FGC, Randy@Wildlife, James@Wildlife

Hi All,

I don't have access to all of your calendars, so I just picked something. Can you all please let me know when you could be available for a call on Monday (if possible) so we can identify a time that will work?

Thanks,

David

--

David T. Willett
President & Founder
dwillett@SantaBarbaraSeaRanch.com

June 23, 2019 call with James Ray on a Sunday: Mr. Ray was concerned about calling me on a Sunday, but I assured him that I was glad to hear from him anytime. We spoke for 50 minutes:

- We talked about next steps.
- He made suggestions for my transect plan. Reduce spacing to 400' grid. Change diagonal transects to horizontal.
- He apologized that this is taking so long and said that they "just don't have enough people to support aquaculture."
- **He said that he would not review my last comments to the initial study until I had completed the bottom study, but he felt that the bottom study was all that was needed to be done to finalize the initial study draft. As it would turn out, SBSR did not receive any response to either the June 11 update to the initial study or the September 6 update to the initial study (which included the bottom study results) until January 2020, over six months later.**

June 28, 2019: I reached out to Randy to see if we could have a call since he cancelled on the last one. **He didn't respond.**

SBSR Call

David Willett <dwillett@santabarbarasearanch.com> Fri, Jun 28, 2019, 9:36 AM
to Randy@Wildlife

Hi Randy,

Given that we didn't have our call last week and that we have a holiday late next week, can we reschedule next week's call to early next week?

Thanks,

David

--

David T. Willett
President & Founder
dwillett@SantaBarbaraSeaRanch.com

July 2019: I was out of the country for most of the month and did not work on the project.

August 2019: Trial and error on the water coming up the learning curve for how to perform the bottom survey.

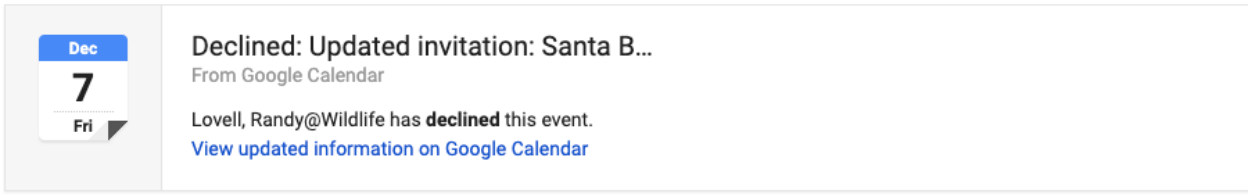
- Cut data cable to the ROV with my prop.
- Couldn't control ROV on the seafloor due to turbidity of the water which prevented me from seeing the bottom unless I was right above it (same as the USGS experienced)
- Had to design and build a tow vehicle to mount ROV to in order to control its altitude above the seafloor. (see picture below)
- Had to adjust ballast to get the tow vehicle to stay on the bottom without being too heavy, and to land on the bottom right side up when lowered into position.
- Had to build a protective and shaded compartment for my laptop above the helm in order to be able to see the real-time video capture while simultaneously driving the boat.
- Captured video of 6.6 miles of seafloor, over 8.5 hours of video, all at an exciting average pace of 0.78 knots.
- The entire lease area was shallow sloped sand/mud bottom with no structure, as was expected. The is no commercial or sport fishing activity in the lease area because there is literally nothing there.

ROV Mounted to Tow Vehicle for Performing Bottom Survey at the SB Harbor Launch Ramp

September 6, 2019: After spending over $7,000 to buy the ROV (which I had to build and commission myself) capable of recording video, GPS position, depth, and water temperature, weeks assembling and commissioning the ROV, another $1,000 and another week designing and building a tow-vehicle to mount the ROV to in order to be able to control its position above the sea floor, and multiple weeks out on the water conducting the bottom study, **SBSR submitted an updated initial study to CDFW for review that included the required bottom survey**. Also, while updating the initial study document, SBSR also found a very detailed multi-beam sonar bottom study that was conducted by the USGS (US Geological Survey) for the lease area that found identical results to SBSR's bottom survey. This USGS survey, in my opinion, made the survey that SBSR was required to perform seem to be completely unnecessary. **To add insult to injury, CDFW has STILL not provided SBSR a link to upload the 14.2 gigabytes of video footage that SBSR was required to capture before CDFW would review the draft initial study.**

September 12, 2019: Randy **cancels the bi-weekly meetings.**

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> Thu, Sep 12, 2019, 3:13 PM
to me



Requesting removal of this item from future calendars. Will convene as needed.
Thanks,

Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
916-445-2008
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

September 6, 2019 to November 1, 2019 communication with CDFW: The following email string documents my communication with CDFW during this time period. **Beyond frustrated, I begin copying you, Ms. Miller-Henson, on October 22, 2019.**

Revised Initial Study Document Including SBSR and USGS Bottom Survey Results

FGC ×

David Willett <dwillett@santabarbarasearanch.com> Sep 6, 2019, 12:49 PM
to Randy@Wildlife, James@Wildlife, Elizabeth@FGC

Hi All,

Please find attached the revised Initial Study draft in pdf format that now includes (in addition to my prior responses to James' comments/suggestions) a section on the USGS and SBSR bottom surveys of the propose lease area.

I will upload the Word version of this document when I am provided with a link to do so.

Looking forward to our call today at 1:30. Hopefully, we can agree upon a timeline for moving things forward now.

Best regards,

David

David Willett <dwillett@santabarbarasearanch.com> Sep 6, 2019, 1:11 PM
to Randy@Wildlife, James@Wildlife, Elizabeth@FGC

Hi All,

My mistake about the call today at 1:30. That wasn't scheduled until next week and the last time we spoke Randy suggested that we transition to having call on an as needed basis.

That being said, I think would should have a call now to discuss next steps. Can we schedule something for early next week? I am available this afternoon as well if that works.

Thanks and best regards,

David

Ray, James@Wildlife <James.Ray@wildlife.ca.gov> Fri, Sep 6, 2019, 1:22 PM
to Randy@Wildlife, Sara@Wildlife, me, Elizabeth@FGC

Hi David,

My new colleague, Sara Briley, and I will start review your document as soon as we can next week.

Best regards,

James

James Ray
CDFW | Marine Region
Office: (707) 441 5755

David Willett <dwillett@santabarbarasearanch.com> Sep 6, 2019, 3:06 PM
to James@Wildlife, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife

Hi James,

Thanks for letting me know. The Word document is 58 MB, so I am going to send everyone copied a link that will allow you to download it.

Hope you have a nice weekend.

David

David Willett <dwillett@santabarbarasearanch.com> Thu, Sep 12, 2019, 10:05 AM
to James@Wildlife, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife

Hi James and Sarah,

Sarah, nice to meet you.

Just thought I would check in with you to see if you have any questions or if you need anything else from me in order to complete your review of the document.

Looking forward to hearing from you.

Best regards,

David

Briley, Sara@Wildlife <Sara.Briley@wildlife.ca.gov> Thu, Sep 12, 2019, 2:58 PM
to me, James@Wildlife, Randy@Wildlife, Elizabeth@FGC

Hi David,

Nice to meet you as well! We are reviewing the document now and will let you know if we have any questions or need any other information.

Thanks,
Sara

Sara Briley
Environmental Scientist, Marine Region
Aquaculture and Bay Management Project
California Department of Fish and Wildlife
4665 Lampson Ave, Suite C, Los Alamitos, CA 90720

Phone: (562) 342-7161
Email: sara.briley@wildlife.ca.gov

Lovell, Randy@Wildlife <Randy.Lovell@wildlife.ca.gov> Sep 12, 2019, 3:15 PM

to me, Elizabeth@FGC, Sara@Wildlife, James@Wildlife

Hi David -

Another update on video storage: I have met with our IT folks, who are working on a solution to take in and archive the raw footage for ours and perhaps other agencies' needs to access along the permitting 'hallway' (over time in the future). Should have news and instructions in near future.

Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
916-445-2008
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

David Willett <dwillett@santabarbarasearanch.com> Sep 18, 2019, 11:33 AM

to Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife, James@Wildlife, bcc: Vanessa

Hi Sara and Ray,

Just following up again this week to see how your review of the SBSR Initial Study went last week. Randy mentioned that the next commission meetings are in October and December and that they need 4-5 weeks advance notice to get something on the agenda. It would be really great to be able to get on the October agenda if possible. Any update on your review/timing?

Randy, any update on the video storage?

On another note, SBSR has now purchased a slip in the Santa Barbara Harbor that will hold our first vessel. It can sometimes be difficult to able to get a slip in the Santa Barbara Harbor, so it is nice to take that concern off the table.

Looking forward to moving this ahead!

Thanks and best regards,

David

Ray, James@Wildlife <James.Ray@wildlife.ca.gov> Wed, Sep 18, 2019, 2:09 PM

to me, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife

Hi David,

Is it possible for you to send Figures 4-8 separately and at full size. I'd also recommend that these figures be presented at full size in an appendix rather than as figures as it makes it pretty hard to determine what is going on from the readers perspective.

Sara and I will be discussing your project this afternoon, so will be able to provide an update after that.

Thanks,

David Willett <dwillett@santabarbarasearanch.com> Wed, Sep 18, 2019, 3:01 PM

to James@Wildlife, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife

Hi James,

Please find attached Google Drive links to the files with sheets 5, 6, and 7 (the sheets from which figures 4-8 in the initial study originate).

As you will see, these are very large pdf files. I will be happy to include them in an appendix.

Alternatively, you can find all the files associated with that USGS map at:

https://pubs.er.usgs.gov/publication/sim3281

Looking forward to receiving your input and moving this forward.

Best regards,

David

sim3281_sheet5.pdf

sim3281_sheet6.pdf

sim3281_sheet7.pdf

David Willett <dwillett@santabarbarasearanch.com> Wed, Oct 2, 2019, 4:45 PM

to James@Wildlife, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife

Hi James and Briley,

It's been a couple weeks since we last exchanged emails about this project. I was wondering if you could please give me some update on your review. Is there anything that I can do to help?

Thanks and best regards,

David

David Willett <dwillett@santabarbarasearanch.com> Wed, Oct 9, 2019, 11:33 AM

to James@Wildlife, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife, bcc: Vanessa

Hi Randy,

Can we please schedule a call to discuss where we are at with the Initial Study draft and next steps? It has been a month since I delivered the last revision.

Also, I remain ready to upload the video files when you are ready.

Thank you to everyone helping this along. I know you all must be very busy.

Best regards,

David

David Willett <dwillett@santabarbarasearanch.com> Oct 22, 2019, 7:18 PM

to melissa.miller-henson, Randy@Wildlife, James@Wildlife, Elizabeth@FGC, Sara@Wildlife, bcc: Vanessa

Hi Randy,

I just want to recap the phone call I had with you this afternoon:

Once again, you said you had no new news for me, that you were waiting for some information, and also that you were tied up with Malibu Oyster Company's application. I spoke with those guys when they reached out to me for help, and they are frustrated too. You couldn't tell me when you expect to get the information you have been waiting on. I asked if we could have a conversation with the person(s) you are waiting on to find out what needs to be done, who will do it, and when we can expect to have it done. You committed to looking into it, and to calling me this Friday with an update.

You said that you needed to figure out how to get the draft Initial Study document into a format that works for the lead agency. I don't understand. The draft Initial Study was, at your suggestion, a modification of the Santa Barbara Mariculture Company document (which you sent to me for editing) that the lead agency had just recently approved. If anything, I made it better formatted with a better and easier to understand table of contents. I submitted the first draft of my Initial Study document on March 6, over six months ago. I recieved James Ray's comments to that draft on May 2. I responded to those comments on June 11, and subsequently was told that nothing further would be done with the document until I had performed a bottom survey. I asked for guidance on the survey, and you and James suggested a survey grid that I should follow.

I completed the bottom survey, as suggested, and have had the bottom survey video you asked for ready since 9/6/19. I still haven't been given instructions for where to upload it. I spent over $7,000 buying, assembling, and commissioning an ROV. I designed and built a subsea tow-vehicle to mount the ROV to in order to be able to capture the video. I spent weeks building everything. I spent many days on the water coming up the bottom-surveying learning curve, and then successfully performing the survey. My video quality is equal to that of the USGS, which they did nearby my lease application location. Additionally, I then found an extensive USGS multi-beam sonar study with ground-truthing that already existed which, in my opinion, makes the survey that I was asked to do seem completely unnecessary. I included the results from both surveys, which had identical findings at my requested lease location, in my draft Initial Study update on 9/6.

I expressed to you that I have been trying to be patient throughout this process, but that I am getting very frustrated with the slow progress, lack of clarity, and lack of responsiveness at this point. Over the last 6+ weeks I have periodically sent emails and have left multiple voicemails for you requesting an update on the Initial Study review and next steps, all of which you did not respond to. I mentioned that I spoke with James Ray last week (10/14) who said he had just received some input he was waiting on, that Sarah Briley was reviewing it last week, and that he thought we could have a call this week to discuss it. Nothing is scheduled. He said he thought you had called me about it the week prior. I told him you had not.

I have now completed a full year of monthly water sampling, including taking all the adverse production condition samples CDPH required after major rains. If I had the state water bottom lease now, they would now be able to grant me a grower's permit.

I have obtained the support of local fishermen for this project, including a written letter of support from Mike McCorkle, the president of the Southern California Trawler's Association.

I submitted my state water bottom lease application in June of 2018, over 16 months ago. As far as I know, I have done everything that has been requested of me to get the Initial Study document ready for approval. However, at this point, after all this time, I still have no indication, whatsoever, from you about what needs to happen next, who needs to do it, and when it will get done.

I don't want to have to write this kind of email, but without responsiveness, and with no indication of how and when this will move forward, I now feel I may be forced to try to escalate it. I don't want to have to go down that path.

I believe in this project. Everything about it indicates is should be a success and be good for all involved. I have invested a huge amount of time, effort, and money to try to make this happen. I have had tremendous local support for it from commercial fishermen. Thus far, there have been no indications, whatsoever, that anything about this project is cause for concern or hesitation.

Can't we figure out how to move this forward efficiently? Will this not serve to advance state and national goals for increased domestic aquaculture and seafood supply? Shouldn't we all be working together in earnest to promote aquaculture?

Sincerely,

David

David Willett <dwillett@santabarbarasearanch.com> Tue, Oct 29, 2019, 6:19 PM

to Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife, melissa.miller-henson, James@Wildlife, bcc: Vanessa

Hi Randy,

This email is to recap our phone conversation last Friday.

- You sent me a blank CEQA determination page listing the determination options (to be completed by the Lead Agency) minutes prior to our 2:00 PM scheduled call.
- You said your questions are "How is the determination made? Is it a vote? Is it a recommendation?" Its hard for me to understand how it is possible that FGC and CDFW can effectively and efficiently support and promote aquaculture when questions about fundamental actions like this remain unanswered.
- You said the SBSR Initial Study draft was finally reviewed by marine region staff and that they are recommending a full EIR. I asked why SBMC didn't need a full EIR when it reconfigured its lease since it is right next to mine and it is doing EXACTLY what SBSR proposes to do.
- I asked why SBMC wasn't required to do the same video survey that SBSR was when a large percentage of SBMC's new lease is in a new area directly adjacent to the one I applied for. That doesn't seem like fair and equitable treatment.
- You said "The agency is afraid of being taken to court. They have to go through this in as robust a way as possible." To me this sounds like they are just taking the path of lowest risk for them without reasonable rational. They just approved a mitigated negative declaration for SBMC right next door, doing exactly the same thing, in an area that the USGS survey shows has identical bottom conditions. There seems to be no concern for the delay and cost that this will introduce to the SBSR project.
- You recommended that I reach out to some consultants. You also agreed that after all this time (over 16 months since I applied for the lease) we still don't even know what is going to be required and that it would be foolish to start paying consultants without knowing what needs to be done.
- You said the department is shorthanded and that is why this is taking so long.
- You said that you have to "wake up an agency that hasn't done this in 20 years." I took this to mean FGC.
- You said you expect this will be taken up at the next commission meeting in December, but there is a possibility of some earlier action.
- You said we have two weeks before the agenda for the next commission meeting needs to be pulled together. I told you that I would like to have the SBSR project on the agenda and will do whatever is asked of me to make that happen.
- You said a weekly call to discuss this project would be counterproductive.
- You said you would get back to me as soon as you knew anything further.

Thank you for your help.

Best regards,

David

David Willett <dwillett@santabarbarasearanch.com> Nov 1, 2019, 10:08 AM

to Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife, melissa.miller-henson, James@Wildlife, bcc: Vanessa

Hi Randy,

Well, another week has gone by, so I am checking in again. Has anything happened on your end? Do you know if my project will be on the December FGC agenda? Is there anything else you need from me? Are you ready to have me upload the bottom-survey video that you required I capture last summer before any further review of my Initial Study revision (that I submitted on June 11, 2019) would be done?

One more month and it will have been a year and a half since I paid $500 and submitted my state water bottom lease application. I have done everything that has been asked of me, yet nothing happens on your end, and I still don't know what needs to be done, who needs to do it, and when to expect it to be done.

After a year and a half, the only thing that has happened on your end is:

1) FGC determined that my project was in the public interest (August 22-23, 2018 FGC meeting) and public notice of lease consideration was made (Santa Barbara News Press September 14 & 21, 2018). (Letter from Valerie Termini attached hereto)

"Further, the Commission directed staff to schedule the lease application for consideration after completion of California Department of Fish and Wildlife (Department) and interagency review; tribal notification; and environmental review conducted by Santa Barbara Sea Ranch, Inc. pursuant to the California Environmental Quality Act. Final Commission consideration will be scheduled following the required steps. Randy Lovell, statewide aquaculture coordinator with the Department, and Susan Ashcraft, marine advisor to the Commission, will be contacting you to discuss how to accomplish the necessary project submissions."

2) Over six months later, my project was finally listed on your permit counter website (March 1, 2019).
3) On May 2, 2019, James Ray provided an initial set of comments to the Initial Study draft that was submitted on March 6, 2019.

THAT'S ALL

Seventeen months later and, whatever the reason, that's the extent of what's been accomplished on your end. I am not trying to be a jerk about this. I am just trying to point out the reality of this situation with the hope that seeing it for what it is will help to get people to start getting something done.

I am trying to start a business. Time is money. There is opportunity cost to me to pursue this. I am very invested. I am spending money, time, and energy and have been counting on CDFW and CFG to do their part, but after all this time I am beginning to wonder if I will ever see any real progress or support. It's like pushing on a rope.

David

January 7, 2020: After receiving **no response and no action for the last four months** since submitting the last update to the draft initial study, and after all of the other **slow response and lack of action I had experienced throughout 2019**, I finally followed the advice I had been given and **reached out to California State Assemblymember Monique Limón and California State Senator Hannah-Beth Jackson for help.**

January 10, 2020: Now, I finally get a call from Randy.

January 13, 2020: I documented the January 10 call with Randy:

David Willett <dwillett@santabarbarasearanch.com> Jan 13, 2020, 10:46 AM

to Craig@Wildlife, Randy@Wildlife, Elizabeth@FGC, Sara@Wildlife, melissa.miller-henson, James@Wildlife, bcc: Vanessa, bcc: Steve

Hi Randy,

Thank you for your call last Friday to give me an update. Just to recap:

1) CFG/CDFW is generating a document outlining next steps that will be sent to me in 7-10 days (by Jan. 20).
2) You are going to send me the comments to the Initial Study draft that I submitted in September that were never sent to me.
3) You are still interested in seeing the bottom survey video that CDFW required me to capture last August and will send me a link to upload it.
4) You are going to send me the names of two environmental consulting firms that you recommend for supporting any additional work that may be needed to be able to issue the lease.

Also, as you are aware, because I had no response from CDFW for over 4 months, prior to your call last Friday I reached out to both Hannah-Beth Jackson and Monique Limon. I want you to know that I spoke with Monique Limon's office this morning so there are no surprises. They will not be contacting CDFW directly at this time, but will connect with Sophie Fox in Hannah-Beth Jackson's office and provide support as needed.

I am really hopeful that we can all turn this around and make it a great success story for everyone involved. As always, please let me know if there is anything I can do on my end to make progress.

Kind regards,

David

January 17, 2020: I received the following email from Randy, including an updated draft initial study that contained the first new comments from CDFW since James Ray's comments on May 2, 2019, the only other comments to the draft initial study that were ever made to the document by CDFW since it was first submitted on December 5, 2018. However, almost without exception, all the new comments said was to "address in an EIR" or "include in an EIR." After waiting all that time, that was it. No substance. No contribution. Just a punt. Randy never did provide me with a link to upload the bottom survey video that CDFW said I had to produce before the draft initial study would be reviewed.

From: Lovell, Randy@Wildlife
Sent: Friday, January 17, 2020 5:44 PM
To: David Willett <dwillett@santabarbarasearanch.com>
Cc: Briley, Sara@Wildlife <Sara.Briley@Wildlife.ca.gov>; Pope, Elizabeth@FGC <elizabeth.pope@fgc.ca.gov>; Ashcraft, Susan@FGC <Susan.Ashcraft@fgc.ca.gov>
Subject: CEQA consultants

Hi David -

Please find attached:

1. updated Initial Study containing comments from Dept staff meant to guide work on EIR – either by a consultant you retain or that the Dept engages through a reimbursement agreement. Further guidance on making that choice is expected through forthcoming communication, likely to come from the Commission.

2. there are many CEQA consultants who may help develop the document, and as mentioned previously, I encourage you to talk to others in the industry for potential references. These people may have experience to share from recent projects:

John Finger (Hog Island Oyster Co) - john@hogislandoysters.com – new hatchery built in Humboldt/Arcata Bay.
Greg Dale (Coast Oyster Co) - gdale@pacseafood.com – Corps permit renewal and expansion proposal in Humboldt/Arcata Bay.
Adam Wagschal (Humboldt Harbor District, and former consultant with ICF) - awagschal@humboldtbay.org – various projects, many focused on Humboldt Bay. Talk to Adam about his experiences and recommendations, as a former consultant who has produced aquaculture project CEQA documents himself, either under his employ with ICF or HT Harvey
Brian Pendleton (Ventura Port District) - bpendleton@venturaharbor.com – remains engaged with Ventura Shellfish Enterprise (using Dudek). He can provide his contact, which may differ from the DFW contact listed below.

Among the firms associated with these projects:
Confluence Environmental Company (Seattle WA)
ICF (global company)
H.T. Harvey (Los Gatos CA)

The two companies that are under retainer contract with the Dept are:

Ascent Environmental
Heather Blair (916-732-3337) or Chris Mundhenk (916-842-3161)

and
Dudek (which is also doing work for Ventura)
Sarah Lozano (760-479-4251) – is the CDFW point of contact

I should have more updates at the end of next week. I have field work and meetings during the first half, which will make me hard to reach, but work still being done on your behalf in the meantime.

Randy.

RANDY LOVELL
STATE AQUACULTURE COORDINATOR
CA DEPT FISH & WILDLIFE
SACRAMENTO CA
PLEASE NOTE: TELEPHONE CHANGE (DEC2019)
916-376-1650
RANDY.LOVELL@WILDLIFE.CA.GOV
WWW.AQUACULTUREMATTERS.CA.GOV

January 21-22, 2020: I had the following email communication with Dr. Craig Schuman. I really appreciate that Dr. Schuman has consistently been timely in his responses when I have reached out to him to try to understand why nothing was happening, and also that he does what he says he will do.

Shuman, Craig@Wildlife <Craig.Shuman@wildlife.ca.gov> Jan 21, 2020, 11:17 AM

to me

Hi David,

Can you please confirm if you received the follow up document you were expecting. I am working to confirm on my end if one was sent or not.

Thank you,
Craig

David Willett <dwillett@santabarbarasearanch.com> Jan 21, 2020, 11:41 AM

to Craig@Wildlife, bcc: Vanessa

Hi Craig,

I have not received the follow up document I was expecting. I got an email from Randy last friday about 6PM with some contact information for environmental consultants. He also sent me a link to download the Initial Study I submitted last September that had just a few new comments in it. However, they were very insubstantial and basically just punted to say that I needed to deal with some things in an EIR. I will forward the email and the link to you. He also didn't send me a link to upload the bottom survey video I was required to capture last summer.

So, I still have no official direction.

I have been doing my own reading of the CEQA Statutes and Guidelines, and I find it pretty hard to conclude that an EIR is justified given they just approved SBMC's mitigated negative declaration.

- Section 15064 (a)(1) says, "If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, the agency shall prepare a draft EIR."
- Section 15064 (f) says, "The decision as to whether a project may have one or more significant effects shall be based on substantial evidence in the record of the lead agency."
- Section 15064.7 (a) says, "A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant."

Thanks for following up on this.

Best regards,

David

Shuman, Craig@Wildlife <Craig.Shuman@wildlife.ca.gov> Wed, Jan 22, 5:15 PM

to me

Hi David,

It is my understanding that you need to submit a clean Initial Study to the Executive Director of the Fish and Game Commission who will make a determination on the next steps for CEQA compliance. Please let me know if this is inconsistent with your understanding of next steps.

Thanks,

•••

Craig

David Willett <dwillett@santabarbarasearanch.com> Jan 22, 2020, 5:30 PM

to Craig@Wildlife

Hi Craig,

I really appreciate you getting involved with this, but if that is true then it is really disturbing and frustrating that after all this time and all this communication nobody has told me that. Randy told me, as I put in the summary of our January 10, 2020 call that the FGC was crafting a letter to me outlining what the next steps would be, and that I would receive that letter in 7-10 days. I still have not received that letter.

Best regards,

David

February 10, 2019: You called me directly, for the first time, to tell me that you had written a letter describing next steps, that it was being reviewed by your legal counsel, and that I should expect to see it in a few days.

March 17, 2020: I waited on the phone (along with over 100 other people) listening to an FGC MRC commission meeting for over eight hours, waiting to hear item seven on the agenda regarding marine aquaculture, only to have the meeting terminated at the end of the day without discussing item seven. However, in the very brief mention of item seven that did take place, **CDFW staff said that they still did not have a process for dealing with state water bottom lease applications. That is why they were considering suspending taking new lease applications.**

7. Marine aquaculture in California

Receive update on marine aquaculture and discuss near-term priorities and potential committee recommendation.

(A) Receive Department informational report on marine aquaculture in California, discuss status of the programmatic environmental impact report, and consider proposed next steps.

(B) Discuss possible recommendation for a temporary hiatus in considering new applications for state water bottom leases for the purpose of aquaculture (excepting previously received applications currently under consideration).

March 20, 2020: **After all of this, your letter finally arrives with the news that CDFW has determined that an EIR will be required, that you are now waiting on my initial study, and that Randy Lovell and Susan Ashcraft are going to help me finish it. I honestly felt like I was in an episode of The Twilight Zone when I read it. I can only assume that you were not aware of all that has, and has not, transpired.**

::

CDFW Recommendation for an EIR:

After reviewing the CEQA Statutes and Guidelines, I find it difficult to conclude that an EIR is called for given the following:

- Section 15064 (a)(1) says, "If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, the agency shall prepare a draft EIR."
- Section 15064 (f) says, "The decision as to whether a project may have one or more significant effects shall be based on substantial evidence in the record of the lead agency."

- Section 15064.7 (a) says, "A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant."

SBSR will be an identical operation to SBMC, only about twice the size. There has been no evidence that SBMC has a significant effect on the environment after nearly 20 years of operation. FGC recently approved SMBC's mitigated negative declaration. There is also no evidence, or reason to believe, that SBSR will have a significant effect on the environment.

The concerns cited by CDFW leading them to suggest in EIR include:

- **Marine entanglements:** There have been no marine entanglements at SBMC, so how can an extrapolative analysis be performed? There is no reason to think that SBSR will have marine entanglements, and there is no way to prove it one way or the other. SBSR's lease application proposes to put "pingers" at the corners of the lease area. Pingers have been shown to be very effective and are used all over the world.
- **Navigational hazards:** A simple analysis will show that this is not a concern.
    - SBSR's proposed lease area is inside the halibut trawling zone and the project proposal has received support from Mike McCorkle, President of the Southern California Trawler's Association.
    - Any east-west traffic that navigates SBMC's lease area will also be able to safely navigate SBSR's proposed lease area.
    - SBMC's lease area is minimally marked, and even so there have been no navigation problems there.
- **Public access:** The public will have the same access to SBSR's lease area as they do to SBMC's lease area. VERY FEW boats are ever out there, as there is no commercial fishing or sportfishing activity there. I know this from personal experience, having been at the proposed lease area more than 50 times since applying for the lease.
- **Bethnic habitat:** The bethnic habitat is identical to that at SBMC's lease area. As my bottom survey and the USGS survey have shown, the entire area is shallow sloping sand and mud with no structure or growth of any kind. There isn't a more ideal place for an offshore shellfish aquaculture operation along the Santa Barbara coast.
- **Water quality:** The water quality at the proposed lease is very good and will only be improved by the bi-valve animals which filter the water. Impact on phytoplankton levels is not a concern. When SBMC wanted to reconfigure its lease, UCSB Professor of Marine Science, David A Siegel, PhD., said phytoplankton reduction levels in the SB Channel due to his operation would be unmeasurable by any technique he knows of. It is therefore safe to assume that SBSR would also not have any significant impact.

Performing an EIR will cost an enormous amount of money and add at least another year of delay to the project. The cost and associated delay of performing and EIR will likely make the entire project unfinanceable and unattractive to further pursue. CDFW should

not unnecessarily put such an onerous, and potentially insurmountable, requirement on a startup business.

Public Resource Code and Fish and Game Code in Statutory Policy:

Public Resources Code declares it in the public interest to expand aquaculture activity[1], as does Fish and Game Code in statutory policy that encourages development of commercial aquaculture[2].

I don't think anyone could reasonably argue that FGC's and CDFW's handling of this project has been in any way encouraging.

Summary:

1) FGC still does not have a process for handling state water bottom lease applications. FGC was aware of that when they received SBSR's lease application, and yet has not remedied the situation, nearly two years later.
2) CDFW never produced a reimbursement agreement and never did its part to support the agreed upon path for creating the SBSR initial study.
3) SBSR expressed its concern over the lack of CDFW progress on multiple occasions throughout the project.
4) SBSR has relied on CDFW's direction and guidance for how to complete its initial study, but CDFW's handling of this project has been discouraging, distressing, highly unsupportive, and has effectively made it impossible for SBSR to finish its initial study.
5) SBSR does not believe that CDFW's recommendation for an EIR is consistent with CEQA Statutes and Guidelines. The cost and associated delay to the project that performing an EIR will introduce could likely make the entire project unfinanceable and unattractive to pursue any further. CDFW should not unnecessarily put such an onerous, and potentially insurmountable, requirement on a startup business. An EIR requirement would put the project and the family-wage jobs at stake in peril.
6) CDFW/FGC's handling of this situation has been highly discouraging to SBSR's efforts to develop a commercial aquaculture business that with will create family-wage jobs, increase environmentally friendly, sustainable seafood production in California, and reduce California's reliance on foreign seafood imports, and it is not consistent with Public Resources Code, or Fish and Game Code, requirements to encourage the development of commercial aquaculture.

[1] The Aquaculture Development Act (Pub. Resources Code, § 826.).
[2] Fish and Game Code, § 1700.

After nearly two years, it remains unclear to me how anything will be different going forward. What can be done to do to rectify this situation and encourage the development of this commercial aquaculture opportunity?

Sincerely,

David T. Willett
President and CEO
Santa Barbara Sea Ranch, Inc.

ec: Sophie Fox, District Representative, Office of Senator Hannah-Beth Jackson
Sophie.Fox@sen.ca.gov
Michelle Sevilla, Field Representative, Office of Assemblymember Monique Limón
Michelle.Sevilla@asm.ca.gov
California Fish and Game Commission
Rachel Ballenti, Deputy Executive Director
Rachel.BallantiBuck@fgc.ca.gov
Susan Ashcraft, Marine Advisor
Susan.Ashcraft@fgc.ca.gov
California Department of Fish and Wildlife
Stafford Lehr, Deputy Director, Wildlife and Fisheries Division
Stafford.Lehr@wildlife.ca.gov
Randy Lovell, Statewide Aquaculture Coordinator
Randy.Lovell@wildlife.ca.gov
Craig Shuman, Regional Manager, Marine Region
Craig.Shuman@wildlife.ca.gov
Kirsten Ramey, Environmental Program Manager, Marine Region
Kirsten.Ramey@wildlife.ca.gov

From: afa@mcn.org <afa@mcn.org>
Sent: Tuesday, February 25, 2020 02:02 PM
To: Office of the Secretary CNRA; FGC; Wildlife DIRECTOR; Cornman, Ari@FGC
Cc: info@tortoise.com; mbernstein@spcala.com; jloda@biologicaldiversity.org; cfox@projectcoyote.org; jeno@peta.org; gemmav@peta.org; swells@aldf.org; cdillard@aldf.org
Subject: CORONAVIRUS & LIVE ANIMAL FOOD MARKETS - CHINA & THE USA

CORONAVIRUS AND THE LIVE ANIMAL FOOD MARKETS - CHINA & THE U.S.

These godawful markets should be closed down permanently, worldwide. Legislation is in order, both state and federal. And perhaps a few lawsuits. Here in California, more than 30 necropsies on the market frogs & turtles since the mid 1990's have shown them ALL to be diseased and/or parasitized, with documented cases of E. coli, salmonella and pasturella (all potentially fatal in humans), plus giardia, blood parasites, even one case of malaria. A few years ago I was seeing whole, frozen armadillos in the Oakland & San Francisco markets, notorious carriers of the leprosy bacillus. Nor should we forget the S.F. case in which a coatimundi had boiling water poured down his/her throat for a half-hour, to get the adrenaline flowing for a gourmet feast (Google the story in the S.F. EXAMINER, if in doubt.) Where are the local Health Departments, pray? Must "culture," "tradition," racial politics and PROFITS always trump the environment, animal welfare and the public health? So it seems. Twenty-five years and counting.....

Ugh and onward,

Eric Mills, coordinator
ACTION FOR ANIMALS
Oakland

https://gcc01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.theguardian.com%2Fenvironment%2F2020%2Ffeb%2F25%2Fcoronavirus-closures-reveal-vast-scale-of-chinas-secretive-wildlife-farm-industry&data=02%7C01%7Cfgc%40fgc.ca.gov%7C822eaf256b8b4c7e1dc408d7ba3e58c6%7C4b633c25efbf40069f1507442ba7aa0b%7C0%7C1%7C637182649251684781&sdata=OOZDr72f3HExabQPkyDZoqPtRd3aEzBNXgF7LPCg%2B74%3D&reserved=0

From: C p [redacted]
Sent: Friday, February 28, 2020 3:24 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Petition #2019-012

Dear FGC

I found out about Petition #2019-012 recently and I would like to see the petition claims and agenda. I have group of fishermen who believe that pump is the Eco friendly way of catching clams and would like to submit our opinion on that petition.

Thank you

Sincerely

Jerry Hong

From: kathy Lynch <lynch@lynchlobby.com>
Sent: Thursday, March 26, 2020 08:45 PM
To: Senator Bob Wieckowski <senator.wieckowski@senate.ca.gov>
Cc: Rachel Wagoner <Rachel.Wagoner@gov.ca.gov>; Senator Brian Dahle <senator.dahle@sen.ca.gov>; Senator Mike McGuire <senator.mcguire@senate.ca.gov>; Senator Bill Monning <senator.monning@senate.ca.gov>; Senator Henry Stern <senator.stern@senate.ca.gov>; Joanne Roy <Joanne.Roy@sen.ca.gov>; Emilye Reeb <Emilye.Reeb@sen.ca.gov>; Dennis O'Connor <Dennis.OConnor@sen.ca.gov>; Todd Moffitt (todd.moffitt@sen.ca.gov) <todd.moffitt@sen.ca.gov>; Senator Toni Atkins <senator.atkins@senate.ca.gov>; Millie Yan (Millie.Yan@dof.ca.gov) <Millie.Yan@dof.ca.gov>; OAL Reference Attorney <OALReferenceAttorney@oal.ca.gov>; Wildlife DIRECTOR <DIRECTOR@wildlife.ca.gov>; FGC <FGC@fgc.ca.gov>; kathy Lynch <lynch@lynchlobby.com>
Subject: OSCC Letter re DFW Service Based Budgeting and Strategic Vision Plan

Attached please find a letter from the Outdoor Sportsmen's Coalition of California re Department of Fish and Wildlife Statewide Department of Fish and Wildlife Service Based Budgeting (SBB) and Strategic Vision Plan, Item 3600, Issue 12, March 5, 2020 Agenda.

Lynch & Associates

1127 11th Street, Suite 610

Sacramento, CA 95814

Tel: (916) 443-0202

Fax: (916-443-7353

Cell: (916) 838-6600

E-mail: lynch@lynchlobby.com

permanently delete the original e-mail message, and any attached file(s), and all electronic or paper copies.

From: kathy Lynch <lynch@lynchlobby.com>
Sent: Thursday, March 26, 2020 08:51 PM
To: Senator Bob Wieckowski <senator.wieckowski@senate.ca.gov>
Cc: Rachel Wagoner <Rachel.Wagoner@gov.ca.gov>; Senator Brian Dahle <senator.dahle@sen.ca.gov>; Senator Mike McGuire <senator.mcguire@senate.ca.gov>; Senator Bill Monning <senator.monning@senate.ca.gov>; Senator Henry Stern <senator.stern@senate.ca.gov>; Joanne Roy <Joanne.Roy@sen.ca.gov>; Emilye Reeb <Emilye.Reeb@sen.ca.gov>; Dennis O'Connor <Dennis.OConnor@sen.ca.gov>; Todd Moffitt (todd.moffitt@sen.ca.gov) <todd.moffitt@sen.ca.gov>; Senator Toni Atkins <senator.atkins@senate.ca.gov>; Millie Yan (Millie.Yan@dof.ca.gov) <Millie.Yan@dof.ca.gov>; OAL Reference Attorney <OALReferenceAttorney@oal.ca.gov>; Wildlife DIRECTOR <DIRECTOR@wildlife.ca.gov>; FGC <FGC@fgc.ca.gov>; kathy Lynch <lynch@lynchlobby.com>
Subject: CSL Letter re DFW Service Based Budgeting and Strategic Vision Plan

Attached please find a letter from the California Sportsman's Lobby re Department of Fish and Wildlife Statewide Department of Fish and Wildlife Service Based Budgeting (SBB) and Strategic Vision Plan, Item 3600, Issue 12, March 5, 2020 Agenda.

Lynch & Associates

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Sacramento, CA 95814

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Cell: (916) 838-6600

E-mail: lynch@lynchlobby.com

From: kathy Lynch <lynch@lynchlobby.com>
Sent: Thursday, March 26, 2020 09:02 PM
To: Asm. Richard Bloom <assemblymember.bloom@assembly.ca.gov>
Cc: Rachel Wagoner <Rachel.Wagoner@gov.ca.gov>; Asm. Vince Fong <assemblymember.fong@assembly.ca.gov>; Asm. Cristina Garcia <assemblymember.garcia@assembly.ca.gov>; Asm. Kevin Mullin <assemblymember.mullin@assembly.ca.gov>; Asm. Jim Patterson <assemblymember.patterson@assembly.ca.gov>; Asm. Eloise Reyes <assemblymember.reyes@assembly.ca.gov>; Asm. Luz Rivas <assemblymember.rivas@assembly.ca.gov>; Susan.Chan@asm.ca.gov <Susan.Chan@asm.ca.gov>; Kirstin Kolpitcke <Kirstin.Kolpitcke@asm.ca.gov>; Lawrence Lingbloom <Lawrence.Lingbloom@asm.ca.gov>; Catherine Freeman <Catherine.Freeman@asm.ca.gov>; Calvin Rusch <Calvin.Rusch@asm.ca.gov>; Asm. Anthony Rendon <assemblymember.rendon@assembly.ca.gov>; Millie Yan (Millie.Yan@dof.ca.gov) <Millie.Yan@dof.ca.gov>; OAL Reference Attorney <OALReferenceAttorney@oal.ca.gov>; Wildlife DIRECTOR <DIRECTOR@wildlife.ca.gov>; FGC <FGC@fgc.ca.gov>; kathy Lynch <lynch@lynchlobby.com>
Subject: OSCC Letter re DFW Service Based Budgeting and Strategic Vision Plan

Attached please find a letter from the Outdoor Sportsmen's Coalition of California re Department of Fish and Wildlife Statewide Department of Fish and Wildlife Service Based Budgeting (SBB) and Strategic Vision Plan, Item 3600, Issue 3, March 4, 2020 Agenda.

Lynch & Associates

1127 11th Street, Suite 610

Sacramento, CA 95814

Tel: (916) 443-0202

Fax: (916-443-7353

Cell: (916) 838-6600

E-mail: lynch@lynchlobby.com

Dedicated to Preserving Your Rights To Hunt and Fish In the State of California

March 24, 2020

The Honorable Bob Wieckowski, Chair
Senate Budget & Fiscal Review Subcommittee #2
on Resources, Environmental Protection,
Energy, and Transportation
California State Senate
State Capitol Building
Sacramento, CA 95814

Position: Support

Location: Senate Budget & Fiscal Review Subcommittee #2

Re: Department of Fish and Wildlife Strategic Vision Plan and Service Based Budgeting (SBB), Item 3600, Issue 12

Dear Senator Wieckowski and Committee Members:

The Outdoor Sportsmen's Coalition of California is a nonprofit organization of sportsman's clubs and individuals dedicated to preserving outdoor recreation in California. Our principal activities are to monitor legislation that might negatively impact hunting, fishing and other recreation, and to oppose unwise changes in laws and regulations relating to these activities.

The Outdoor Sportsmen's Coalition of California (OSCC) promotes the conservation enhancement, scientific management, and wise use of all our natural resources; OSCC seeks to end activities needlessly destructive to natural resources; OSCC endeavors to educate and encourage the public generally, and the youth specifically, to an understanding of the advantages and importance of the conservation and enhancement of our natural resources.

OSCC works to enhance outdoor opportunities for all citizens. With several thousand members located throughout California, we stay in contact with our membership via newsletters and the internet so they can be involved as they see fit.

We want to notify you of the support of OSCC for Governor Newsom's budget proposal to provide the Department of Fish and Wildlife (DFW) $38.9 million in 2020-21 and $42.3 million in 2020-21 and ongoing.

DFW's mission is to manage California's diverse fish, wildlife, and plant resources for their ecological value and for their use and enjoyment by the public. This includes habitat protection and maintenance in a sufficient amount and quality to protect the survival of all species and natural communities. DFW is also responsible for the diversified use of fish and wildlife, including recreational, commercial, scientific, and educational uses.

In order to fulfill its mission effectively, the legislature enacted a statute in 2010 to require the Natural Resources Agency to develop a strategic vision for DFW to improve and enhance the department's capacity

and effectiveness in fulfilling its public trust responsibilities for protecting and managing the state's fish and wildlife.

The legislature enacted legislation in 2018 that required DFW to contract with an independent entity to conduct a comprehensive Service Based Budgeting (SBB) review to identify the tasks needed to accomplish the department's mission to help with planning for future budget needs based on staff time needed to complete such tasks.

It is strongly urged that the legislature refrain from enacting new policy changes to the Fish and Game Code for DFW to implement until the department can complete the tasks mandated by the 2010 and 2018 enactments.

Adding or modifying any programmatic requirements or revenue streams until the strategic vision and SBB independent review projects are completed and fully implemented is premature.

To do otherwise would be to create a constantly changing fiscal landscape that would make it difficult, if not impossible, for the strategic vision and SBB review process to remain current. Thus it would hinder any ability to complete the statutorily mandated projects as the endpoint would be constantly moving.

The Governor's budget proposal provides funding for all of the above, and thus it is supported by OSCC.

Should you have any questions, please contact our legislative advocate, Kathryn Lynch, at (916) 443-0202 or lynch@lynchlobby.com.

Sincerely,

Randall S. Walker, President
Outdoor Sportsmen's Coalition of California

cc: The Honorable Gavin Newsom, Governor
Ms. Rachel Wagoner, Deputy Legislative Secretary, Governor's Office
Senate Budget and Fiscal Review Subcommittee #2 on Resources, Environmental Protection, Energy, and Transportation (Senator Bob Wieckowski, Chair; Senators Brian Dahle, Mike McGuire, Bill Monning, and Henry Stern)
Ms. Joanne Roy, Consultant, Senate Budget and Fiscal Review Subcommittee #2
Ms. Emilye Reeb, Consultant, Senate Republican Caucus
Mr. Dennis O'Connor, Chief Consultant, Senate Natural Resources and Water Committee
Mr. Todd Moffitt, Consultant, Senate Republican Caucus
The Honorable Toni Atkins, President Pro Tempore, California State Senate
Ms. Millie Yan, Department of Finance
Office of Administrative Law Mr. Charlton Bonham, Director, Department of Fish and Wildlife
Ms. Melissa Miller-Henson, Executive Director, Fish and Game Commission
Ms. Kathryn Lynch, Legislative Advocate
Outdoor Sportsmen's Coalition of California

Senate Budget and Fiscal Review—Holly J. Mitchell, Chair
SUBCOMMITTEE NO. 2 **Agenda**

Senator Bob Wieckowski, Chair
Senator Brian Dahle
Senator Mike McGuire
Senator William W. Monning
Senator Henry I. Stern

Thursday, March 5, 2020
9:30 a.m. or upon adjournment of session
State Capitol - Room 112

Consultant: Joanne Roy

Item **Department** **Page**

VOTE-ONLY CALENDAR

ISSUES FOR DISCUSSION

Pursuant to the Americans with Disabilities Act, individuals who, because of a disability, need special assistance to attend or participate in a Senate Committee hearing, or in connection with other Senate services, may request assistance at the Senate Rules Committee, 1020 N Street, Suite 255 or by calling (916) 651-1505. Requests should be made one week in advance whenever possible.

VOTE-ONLY CALENDAR

3600 DEPARTMENT OF FISH AND WILDLIFE (DFW)

Issue 1: Camp Fire Assistance Act of 2019 Implementation (AB 430)

Governor's Proposal. Requests $275,000 (General Fund) GF and one position in 2020-21 and $220,000 ongoing thereafter to support increased workload in the Environmental Review and Permitting program associated with AB 430 (Gallagher), Chapter 745, Statutes of 2019.

AB 430 expedites the process to build housing projects in Butte County and surrounding areas to facilitate the relocation of the Camp Fire victims. AB 430, which is in effect until January 1, 2026, eliminates the need for local governments to issue a conditional use permit for housing development applications. Projects that meet specified criteria can be approved by the local agencies through a ministerial approval process. The 2018 Camp Fire destroyed 18,804 structures and displaced over 50,000 people.

Staff Recommendation. Approve as budgeted.

Issue 2: Freshwater and Estuarine Harmful Algal Bloom (HAB) Program

Governor's Proposal. Requests $214,000 GF and one position in 2020-21, $202,000 ongoing thereafter, to address the workload addressing HABs and protecting water quality and public health pursuant to AB 834 (Quirk), Chapter 354, Statutes of 2019.

Background. HABs are colonies of algae and cyanobacteria that produce toxins harmful, and even fatal, to people, fish, shellfish, marine mammals, and birds. Toxic blooms have appeared to have increased in recent years and impact humans through drinking water, recreational water use, and contaminated or dietary supplements.

AB 834 requires the development of a Freshwater and Estuarine HAB Program to do the following:

1) Coordinate on incident response and incident notifications to state and local decision makers and the public;
2) Conduct field assessments and monitoring to evaluate HAB extent, status, and trends;
3) Determine regions, watersheds, or waterbodies experiencing or at risk of experiencing HABs to prioritize assessment, monitoring, remediation, and risk management;
4) Conduct applied research and develop decision-support tools; and,
5) Provide outreach and education and maintain a centralized website for HAB information and data.

Staff Recommendation. Approve as budgeted.

Issue 3: New Streamlined Temporary Permit and Temporary Change Order Water Permitting for Groundwater Sustainability Implementation (AB 658)

Governor's Proposal. Requests $1.119 million GF in 2020-21 and five positions, $1.059 million ongoing thereafter to fund implementation of AB 658 (Arambula), Chapter 678, Statutes of 2019.

AB 658 encourages groundwater recharge projects during high-flow events by creating a temporary five-year permit and a temporary five-year change order for Groundwater Sustainability Agencies and local agencies. AB 658 expands the number of allowable applicants and projects that may apply for the new streamlined permits. With new Sustainable Groundwater Management Act (SGMA) requirements and the need for groundwater storage to serve as a reservoir under increasing use of conjunctive water management regimes, AB 658 is intended to increase the submission rate for project applications that divert surface water for groundwater storage.

Staff Recommendation. Approve as budgeted.

Issue 4: Proposed Water Transfers from Groundwater Basins Underlying Desert Lands (SB 307)

Governor's Proposal. Requests $420,000 GF and two positions in 2020-21, $400,000 ongoing thereafter to implement SB 307 (Roth), Chapter 169, Statutes of 2019.

SB 307 requires the Fish and Wildlife Commission, in consultation with DFW, to evaluate proposal transfers of water from groundwater basins underlying desert lands near state and federally protected lands in San Bernardino County's Mojave Desert for impacts on natural and cultural resources.

The transfer of water would be prohibited if DFW was to find that the water transfer would have an adverse impact on natural or cultural resources, including groundwater resources or habitat on those state or federal lands.

SB 307 responds to a proposed project, the Cadiz Valley Water Conservation, Recovery, and Storage Project, which would pump and transport water from an aquifer under the Mojave Desert to Southern California and raises concerns about harm to the Mojave Desert's environmental and cultural resources. Given Southern California's population growth and increasing strain on groundwater resources outside of the basins managed under SGMA, DFW anticipates future groundwater transfer project proposals for California's inland deserts, requiring ongoing workload.

Staff Recommendation. Approve as budgeted.

Issue 5: Various Minor Projects

Governor's Proposal. Requests $400,000 in reimbursement authority for several projects related to the eradication of nutria. The projects, located in the Imperial Wildlife Area (Imperial County), Hernandez Lake Wildlife Area (Alpine County), and Woodbridge Ecological Reserve (San Joaquin County), are to be grant-funded by the Sacramento-San Joaquin Delta Conservancy and $480,000 in Federal Trust Fund authority.

Staff Recommendation. Approve as budgeted.

3860 DEPARTMENT OF WATER RESOURCES (DWR)

Issue 6: DWR Charge Fund Program Implementation (AB 1054)

Governor's Proposal. Requests 11 new positions for the start-up and ongoing operations of the DWR Charge Fund program pursuant to AB 1054 (Holden), Chapter 79, Statutes of 2019. This includes re-purposing the collection of existing bond charges on California's electric investor-owned utilities' (IOUs) ratepayers from the Electric Power Fund program to the Charge Fund program, issuance of bonds, and compliance with regulatory and financial orders and agreements.

AB 1054 enacted a broad set of reforms and programs related to the prevention and remediation of utility-caused wildfires in California and established the Wildfire Fund. The purpose of the Wildfire Fund is to provide a source of money to pay or reimburse eligible claims arising from a covered wildfire, which is a wildfire ignited by a participating IOU company's equipment or infrastructure, within that IOU's service territory. The Wildfire Fund is capitalized through a combination of payments from participating IOU companies, and monthly surcharges on ratepayers' power bills. These monthly charges are administered through the DWR Charge Fund.

To initiate activities related to the implementation of the DWR Charge Fund, AB 1054 includes a $9 million loan from the GF in 2019-20. The $9 million loan will be repaid upon issuance of bonds, likely occurring in fall 2020. In addition, AB 1054 includes a $2 billion loan to the Wildfire fund, to be repaid with proceeds from future DWR issuance of bonds.

Staff Recommendation. Approve as budgeted.

Issue 7: Federal Emergency Management Agency (FEMA) Grant Reimbursement

Governor's Proposal. Requests $36.25 million in Reimbursement Authority ($3.25 million in 2020-21 and $8.25 million ongoing) in order to receive two FEMA grants, one for hazard mitigation efforts and the other related to high hazard dams.

Grant funding will be allocated by California Governor's Office of Emergency Services (Cal OES) and FEMA for two purposes: (1) Post Hazard Mitigation Grant for post fire watershed and alluvial fan flood hazard mapping, instrumentation, and coordination platform application, and (2) High Hazard Potential Dams grants (first round will be for technical, planning, design, and other pre-construction activities).

Background. ***Federal funding for natural disasters.*** Upon a Presidential Disaster Declaration, FEMA provides grant funding for plans and projects that reduce the effects of natural disasters through their Hazard Mitigation Grant Program (HMGP). The purpose of HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The funds are administered through the California Governor's Office of Emergency Services (Cal OES) through its Post Hazard Mitigation Grant Program.

Staff Recommendation. Approve as budgeted.

Issue 8: Flood Management Support

Governor's Proposal. Requests $835,000 GF in 2020-21 and $791,000 ongoing to support three positions to address the resource needs for large flood and multi-benefit projects.

Background. ***Division of Flood Management (DFM).*** DWR, through its DFM, has a significant role in flood control and management to safeguard life and property. DWR fulfills this mission by supervising design, construction, operation and maintenance of more than 1,200 jurisdictional dams; encouraging preventative floodplain management practices; maintaining and operating Sacramento Valley flood control facilities; cooperating in flood control planning and facility development; and providing flood advisory information. DWR works with local and federal agencies to build and maintain a robust flood system of levees and bypasses.

Staff Comments. The request asserts that "large projects essential to addressing these significant flood risks require additional project management and environmental support beyond what is currently available. The lack of resources is impacting the timeliness of these projects and the result is a risk of stranded investments and lengthy delays in work."

Funding this request would enable DWR to have the necessary resources to support large flood projects that are required to maintain the state's flood system, protect developing communities, and increase flood system functionality to achieve both flood protection and environmental goals.d

Staff Recommendation. Approve as budgeted.

Issue 9: Perris Dam Remediation Plan

Governor's Proposal. Requests $5 million Proposition 84 to support 7.2 existing positions and fund development, rehabilitation, acquisition, and restoration related to providing public access to recreation and fish and wildlife enhancement resources at Perris Dam, a State Water Project (SWP) facility. This project will also be supported by approximately $9.8 million in SWP funds for 2020-21.

The Perris Dam and Reservoir are located in San Bernardino County. It is a terminal SWP Reservoir and provides key water supply and delivery benefits. The Lake Perris State Recreation Area is a popular and highly visited recreational facility with over one million visitors annually. This state park unit provides recreational opportunities including boating, swimming, and other water-based recreation in an area significantly deprived of other such resources.

Staff Recommendation. Approve as budgeted.

Issue 10: Public Affairs Office Staffing

Governor's Proposal. Requests six new positions across five sections in the Public Affairs Office to meet the increasing demand for public information and reduce the need for overtime and contractors. DWR has seen a significant increase in public and media interest in DWR operations, specifically the SWP.

The Public Affairs Office has approximately 3,600 employees statewide and is comprised of three branches: Communications and Outreach, Creative Services, and Administrative.

Staff Recommendation. Approve as budgeted.

Issue 11: Transmission Operator – Compliance Support

Governor's Proposal. Requests 23 new permanent positions, funded by SWP funds, to support in registering and becoming functionally compliant as a Transmission Operator (TO) by September 2020, as mandated by the North American Electric Reliability Corporation (NERC) and the Western Electricity Coordination Council, to maintain participation in the Bulk Electric System and deregulated electrical market. Failure to do so will result in significant fines and jeopardize SWP's ability to operate.

The TO role was previously performed by Pacific Gas & Electric (PG&E) for DWR. In December 2018, PG&E declined to serve this function for DWR. In order to serve this role, DWR needs additional staffing for operations at both a primary and backup transmission desks, operation of a new backup center, ongoing system maintenance and support of new technology systems in both centers, and the supporting activities with compliance requirements of evidence, audits, and reports as identified by NERC.

This request supports SWP by maintaining a reliable operating condition for delivering water and continue as a utility participating in the deregulated electrical market operating under mandated requirement to operate by September 2020.

Staff Recommendation. Approve as budgeted.

ISSUES FOR DISCUSSION

3600 DEPARTMENT OF FISH AND WILDLIFE (DFW)

Issue 12: Update on the Service Based Budgeting (SBB) Project

SBB is a budgeting approach that identifies the tasks needed to accomplish DFW's mission. This review will help inform future budgets based on staff time needed to complete these tasks. The SBB approach is task-based, labor-focused, and organized by DFW's services to the public.

The SBB project is governed by a team of DFW executive leaders and is a collaborative effort of managers and employees across the department working alongside independent consultants. The SBB project is a long-term effort running through 2021, when the SBB Review Report is due to the Legislature.

SB 854 (Committee on Budget and Fiscal Review), Chapter 51, Statutes of 2018, required DFW to contract with an independent entity to conduct a comprehensive SBB review, and provided $2 million for this project. In addition to contract funds, this appropriation included funding for DFW staff to participate and help implement SBB. SB 854 required the SBB review to include an analysis of existing fund sources, program costs and how these align to meet statutory mandates. DFW entered into a contract with Deloitte, Inc. in November 2018. Toward the end of the contract negotiations, it became apparent that the 2018 Budget Act funding would be sufficient to complete the first of two phases of the SBB review and that additional funding would be needed in 2019-20 to complete the project.

The project began in earnest in January 2019. The first phase of the project includes: (1) established a project work plan; (2) built out a complete catalog of DFW tasks; (3) developed a stakeholder engagement plan to keep all parties informed of progress, including the Administration, the Legislature and the public; (3) compared existing resources to the level needed to fully carry out statutory mandates; and (4) provided for development of an information technology tool for future budget planning.

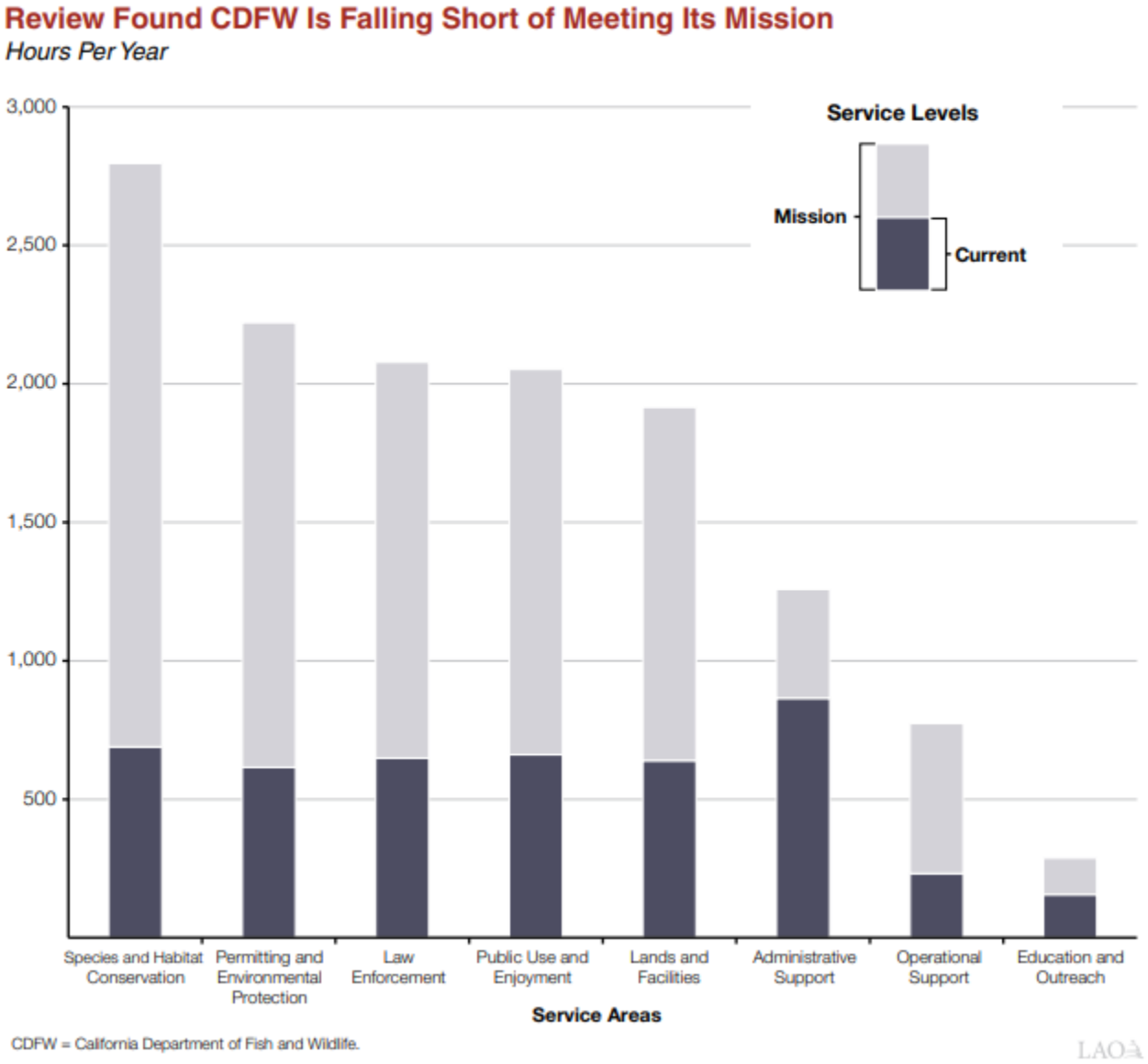
Additional funding of $2 million Environmental License Plate Fund one-time was provided in 2019-20 to fund the completion of the SBB review, SBB tracking system, training for staff on using the SBB tool for ongoing budgeting needs, continued stakeholder engagement, and final legislative report due January 15, 2021.

The review is intended to provide more clarity regarding the following:

- The core activities that DFW undertakes.
- The existing gap between the department's "mission" level of service (defined as the service standards and essential activities required for the department to meet its mission and statutory requirements) and its current levels.
- Instances where DFW may be conducting activities outside its mission and statutory requirements.
- Detailed estimates for the costs and staffing that would be necessary to meet mission service levels.
- An analysis of DFW's existing revenue structure and activities supported by those fund sources including instances where different funding sources or revenue structures might be allowable or more appropriate.

According to the Legislative Analyst's Office (LAO), the Legislature has provided $4 million in one-time GF to provide this detailed review of the department's activities and budget. DFW is currently in the middle of the SBB process. Specifically, it has accomplished two of the tasks described – defining current and mission service levels and their relative gap in terms of staffing levels – but has not yet determined what it would cost to fully achieve its mission or analyzed its revenue sources and comparative distribution of funding.

According to the LAO, while DFW has not yet completed the SBB review, its initial analysis has identified significant gaps between its existing levels of service and those it has determined would be necessary to fulfill its mission and meet all of its statutory responsibilities. The figure below by LAO displays these results, showing the difference between the number of staff hours currently being dedicated in each of dedicated in each of DFW's eight areas of service compared to the number of hours the department has determined would be needed to meet its mission.



As shown in the figure above, in most areas, DFW has determined that current service levels are less than one-third of mission levels. The largest shortfall – both proportionally and in terms of total staff hours – is in species and habitat conservation, the service area the department has determined requires the most comparative workload. Specifically, DFW staff currently spend about 690,000 hours per year

on activities in that service area, compared to the 2.8 million hours the department estimates would be needed to meet its mission. The second largest gap is in the permitting and environmental protection service area – falling short of meeting mission service levels by about 1.6 million hours annually.

Issue 13: Advancing Biodiversity Protection, Operational Modernization, and Regulatory Efficiencies (BCP) and Habitat Conservation Fund Transfer Sunset to Advance Biodiversity Protection (Trailer Bill Language (TBL))

Governor's Proposal. Requests $38.9 million GF in 2020-21 and 58 positions, $42.3 million in 2020-21 and ongoing. This includes: (1) $20 million one-time GF in 2020-21 to support operational efficiency investments, and (2) an $18.9 million ongoing GF shift from the Habitat Conservation Fund (HCF) to DFW for activities that support ecosystem-based management and biodiversity conservation, and (3) $23.4 million ongoing starting in 2021-22 to permanently extend the limited-term funding that was first provided in the 2018 Budget Act, to allow DFW to continue critical programs.

The Governor's proposal includes TBL to change the sunset date of HCF from 2030 to 2020. This proposed amendment would implement the shift of $18.9 million from the Wildlife Conservation Board's HCF and undo the recent statutory reauthorization of funding for HCF.

Background. ***DFW mission.*** The mission of DFW is to manage California's diverse fish, wildlife, and plant resources for their ecological value and for their use and enjoyment by the public. This includes habitat protection and maintenance in a sufficient amount and quality to protect the survival of all species and natural communities. DFW is also responsible for the diversified use of fish and wildlife, including recreational, commercial, scientific, and educational uses.

Fish and Game Preservation Fund (FGPF). The FGPF was established in 1909 as a repository for all funds collected under the Fish and Game Code and any other law relating to the protection and preservation of birds, mammals, fish, reptiles, and amphibians in California. These revenues are generated from the sale of licenses for hunting, recreational and commercial fishing, and numerous special permits. Over time, the Legislature has created various subaccounts within FGPF, which have specified permit fees generating revenue for projects benefitting those species. For example, the taking of migratory waterfowl in California requires a state duck stamp validation in addition to a general hunting license. Revenues from the duck stamps are deposited into the Duck Stamp Account within FGPF to be used for waterfowl protection and habitat restoration. There are currently 29 dedicated subaccounts with in the fund. The department issues more than 500 different types of hunting and fishing licenses and permits.

Revenues from licenses, fees, and permits that are not directed by statute to a dedicated account are accounted for in what is known as the non-dedicated FGPF. This is the largest repository for department revenues, including sales of general fishing and hunting licenses and permits. Approximately 75 - 80 percent of total FGPF revenues are deposited into the non-dedicated account, with the remainder going to the various 29 dedicated subaccounts. There is a running deficit in the non-dedicated FGPF.

Structural imbalance within FGPF. In recent years, expenditures have exceeded revenues in the non-dedicated account of the FGPF, with the gap reaching over $20 million annually beginning 2014-15. Some of the causes of the FGPF's structural imbalance that the department has identified include: fund shifts (particularly GF), lifting of prior spending restrictions (e.g. vehicles, furloughs), increased need for federal funds, increased responsibilities, decreasing revenues from user groups, and cost of business increases (e.g. employee compensation).

Prior attempts to address funding challenges and operational capacity and effectiveness. AB 2376 (Huffman), Chapter 424, Statutes of 2010, required CNRA to convene a committee to develop a strategic vision for DFW in order to improve and enhance their capacity and effectiveness in fulfilling their public

trust responsibilities for protecting and managing the state's fish and wildlife. As part of the project, a blue ribbon citizen commission and a stakeholder advisory group supported the executive committee in developing a strategic vision report in 2012.

The Budget Act of 2017 required DFW to reconvene the 2012 stakeholder group and provide a report to the Legislature regarding implementation of the 2012 recommendations as well as undergo a zero-based budget evaluation. The Budget Act of 2018 directed DFW to complete a "service-based budget" (SBB) review process. The 2018 Budget Act also provided DFW $23.4 million (GF and Tire Recycling Management Fund) annually for three years and $6.6 million GF ongoing to support FGPF's structural imbalance.

DFW is currently undergoing the SBB review process. The SBB review process is intended to create data transparency to analyze DFW's ability to meet service levels required to achieve its mission, statutory requirements, and public/stakeholder expectations. This exercise, upon completion, is intended to help identify DFW's greatest areas of need as well as identify the service standards required. This process is currently underway at DFW.

The Governor's proposal. According to DFW, the preliminary results of the SBB review process confirm that the species and habitat conservation program area and the permitting and environmental protection program area face service level shortfalls. According to DFW, the incremental funding in this proposal allows them to better protect species; enhance, maintain, and restore quality habitat; and reduce obstacles to restoration projects. DFW intends to spend the funds in this proposal as follows:

1) *New Ongoing Proposals*
    a. *Protect endangered species:* 31 positions and $10.75 million to conduct work to implement and enforced compliance with the California Endangered Species Act (CESA), including reviewing positions to list new species as threatened or endangered, processing and monitoring CESA-related regulatory permits, and developing and implementing plans to help CESA-listed species recover.
    b. *Increase awareness about biodiversity and climate change:* Seven positions and $1.9 million to conduct climate-risk assessments on DFW lands. Develop and disseminate education and outreach materials about the state's biodiversity and climate change risks.
    c. *Improve permitting process for restoration projects:* 15 positions and $3.4 million to direct additional staff resources to consult with restoration project proponents and process environmental permits to expedite timelines and enable permitting for larger scale projects.
    d. *Administration and facilities:* Five positions and $2.8 million to provide administrative support and office space proportional to new staff and activities included in the overall proposal.
2) *New one-time proposals*
    a. *New aircraft:* $6 million to purchase a new aircraft to aerially monitor wildlife.
    b. *Fish hatchery equipment:* $6.5 million to purchase equipment to upgrade hatchery operations, including egg sorters and fish stocking vehicles.
    c. *Equipment and water conveyance projects at state wetlands:* $7.5 million to undertake projects to improve water conveyance, including upgrading canals, levees, and water pumps, and installing solar panels. Purchase new heavy equipment for maintenance including tractors, graders, and excavators.

Source of funding for this proposal: Habitat Conservation Fund (HCF). The funding sources for this

proposal is a mix of GF dollars and $18.9 million that is being redirected from HCF.

Proposition 117, passed by voters in 1990, established HCF. The proposition required an annual transfer of $30 million GF into the fund until the year 2020 and specified how the moneys were to be expended for acquiring, restoring, and enhancing habitat necessary to protect wildlife and plant populations, especially deer, mountain lions, rare, endangered, threatened or fully protected species, wetlands, riparian and aqua it habitat. The Budget Act of 2019 extended the HCF 2020 sunset date to 2030.

LAO Comments. ***LAO finds that ongoing funding addresses some service gaps, but Legislature could prioritize other activities.*** DFW has identified a significant deficit in existing service levels, with the largest gaps in the areas of: (1) species and habitat conservation; and, (2) permitting and environmental protection. Most of the Governor's proposal for new ongoing funding are targeted in these categories, suggesting they would help the department be better positioned to carry out its mission. As such, the LAO finds that the proposed use of the new $18.9 million seems well-targeted for addressing existing deficiencies in DFW services.

The LAO finds that the proposal has merit, however, the funding for the ongoing activities would be shifted from other state conservation programs. The LAO recommends the Legislature adopt the one-time $20 million funding proposal because the resources will be used to make certain department operations and maintenance activities more efficient. The LAO further recommends the Legislature weigh the relative trade-offs of the ongoing $19 million shift from HCF proposal with its other conservation and GF priorities. Lastly, the LAO recommends deferring action on the third component of the Governor's proposal — to extend funding scheduled to expire in 2021-22 — until next year, when a more in-depth analysis of DFW's budget will be available.

Staff Comments. DFW works on a broad range of activities such as habitat protection, law enforcement, promotion of hunting and fishing opportunities, and management of wildlife areas and ecological reserves. Costs to deliver these programs have increased considerably over the years, resulting in a structural deficit within the FGPF of about $20 million annually. Given the the lack of information on how to address the structural deficit, DFW is undergoing the SBB exercise in order to better inform the Legislature on funding decisions. The SBB review is still underway. Even without completing the SBB review, based on its preliminary results, it is clear that DFW needs additional funding.

While the funding needs at DFW is clear, a question arises as to whether it is appropriate and prudent to redirect $18.9 million from the Wildlife Conservation Board (WCB) to DFW for a similar purpose, and whether there would be a net benefit to DFW and the WCB's mission. The funds being redirected would otherwise be going to WCB for a variety of habitat restoration projects.

Staff Recommendation. Hold open.

Issue 14: Statewide Bobcat Management (AB 1254)

Governor's Proposal. Requests $2.742 million GF in 2020-21 and $2.389 million in 2021-22, to fund staffing, field equipment, and vehicles to design and implement a statewide monitoring plan to assess bobcat populations. DFW also requests three positions and $566,000 GF in 2022-23 and ongoing to develop a bobcat management plan and implement the state bobcat management program pursuant to AB 1254 (Kamlager-Dove), Chapter 766, Statutes of 2019.

Background. ***AB 1254.*** AB 1254 prohibits the hunting of bobcats, effective January 1, 2020. The prohibition will remain in place until DFW completes a bobcat management plan and the California Fish and Game Commission authorizes the reopening of bobcat hunting seasons, no earlier than January 1, 2025. Upon appropriation by the Legislature, DFW is required to develop a bobcat management plan, including a statewide bobcat population estimate based on best available science, an assessment of the overall health of the population, a comprehensive strategy to manage bobcat populations and their habitats, an investigation of effective non-lethal strategies to prevent bobcat predation on livestock, and recommendations for regulatory and statutory changes needed to implement the plan. AB 1254 requires DFW to submit the management plan to the Commission by January 1, 2024.

Bobcats. Native to North America, bobcats (*lynx rufus)* are about double the size of domestic cats and weigh up to 40 pounds for an adult male. Bobcats may live up to 15 years in the wild. Bobcat fur can be highly valued, and trapping of bobcats for their fur has resulted in the takes of up to thousands of bobcats annually in the past. They are known to inhabit every county, except San Francisco. However, the carrying capacity of each county and within each county varies widely. They can adapt to many types of habitat but avoid urban and exurban lands, and generally avoid humans.

DFW and Bobcats. Because bobcats are non-game species, DFW does not have dedicated resources to manage this wildlife. DFW has studied and managed bobcats in the past, as funding allowed. For example, in 2014, DFW initiated "The Eastern Sierra Nevada Bobcat Study," using a combination of capture-mark-recapture, remote cameras, and genetic techniques in order to obtain more precise information about current bobcat and mesocarnivore populations and their prey base.

Staff Recommendation. Approve as budgeted.

3600 DEPARTMENT OF FISH AND WILDLIFE (DFW)
3540 CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION (CALFIRE)
3790 DEPARTMENT OF PARKS AND RECREATION (PARKS)

Issue 15: Law Enforcement Use of Deadly Force: Policy and Training Update (AB 392/SB230)

Governor's Proposal. Requests $3.2 million GF and six positions in 2020-21 and $1.8 million ongoing thereafter to implement the training and policy components related to law enforcement use of deadly force pursuant to AB 392 (Weber), Chapter 170, Statutes of 2019, and SB 230 (Caballero), Chapter 285, Statutes of 2019. More specifically, this request includes:

- DFW requests two positions, $833,000 in 2020-21, and $419,000 in 2021–22 and ongoing, including funding for one mobile training simulator and a vehicle to transport the simulator.

- CalFire requests two positions, $1.689 million in 2020-21, and $884,000 in 2021-22 and ongoing. CalFire's request includes one-time funding of $750,000 in 2020-21 for the acquisition of one live fire training simulator.

- Parks requests two positions, $619,000 in 2020-21, and $419,000 in 2021-22 and ongoing, including funding to purchase one mobile training simulator and a vehicle to transport the simulator.

Background. SB 230 and AB 392 are a legislative package that seeks to reduce police use of force by mandating all law enforcement agencies to maintain a public policy on use of force. By January 1, 2021, specified law enforcement agencies are required to maintain a policy that provides guidelines on the use of force, utilization of de-escalation techniques, crisis intervention tactics, other alternatives to the use of force, the application of deadly force, and factors for evaluating and reviewing all peace officers in California for the purpose of raising the level of competence. The legislation requires Peace Officer Standards and Training (POST) to augment its academy and ongoing law enforcement training to incorporate the subject areas identified in the legislation, which requires a collaborative effort between law enforcement agencies to revised POST basics and ongoing training. The legislation implementation is intended to result in improved training, transparency, and better outcomes for both law enforcement officers and the individuals who encounter them under adversarial circumstances.

DFW employs 466 sworn wildlife officers that are fully authorized peace officers and have law enforcement jurisdiction throughout the state and 200 miles out to sea. Wildlife officers have the authority to enforce all laws of the state, including poaching and pollution laws, laws related to violent crime, domestic violence, stolen vehicles, drug crimes, etc., and are federally deputized to enforce federal laws related to interstate wildlife trafficking. DFW's. Law Enforcement Division has a use of force policy in place for its wildlife officers, requires training on that policy, and has an extensive reporting/review requirement. DFW's use of force policies are required to be posted publicly, which was not mandated prior to passage of SB 230.

CalFire employs approximately 180 peace officers who are responsible for enforcing laws related to CalFire's forest and fire protection mission, and enforcement duties delegated to the Office of the State Fire Marshal. These law enforcement activities require statewide jurisdiction and are not pursued by other state or local law enforcement agencies as they fall solely within CalFire's jurisdiction to enforce. All of CalFire's peace officers are authorized to carry a firearm on a regular basis. CalFire will be

required to update its use of force standards to meet the requirements of AB 392/SB 230.

Parks employs approximately 540 rangers and lifeguards, all of whom are peace officers. Although the definition of "law enforcement agencies" as stated in the enacted legislation do not include Parks explicitly, the requirements of the legislation applies to Parks as it employs law enforcement officers. To fulfill the requirements, Parks intends to utilize a traveling simulator throughout the state.

Staff Recommendation. Approve as budgeted.

3600 DEPARTMENT OF FISH AND WILDLIFE (DFW)
3860 DEPARTMENT OF WATER RESOURCES (DWR)
3940 STATE WATER RESOURCES CONTROL BOARD (SWRCB)
3480 DEPARTMENT OF CONSERVATION (DOC)

Issue 16: Technical Budgeting Adjustments: (a) Budget Change Proposal (BCP): Stream Gaging Plan Implementation (SB 19); (b) BCP: Central Valley Flood Protection Board: Continuation of Existing Staff; and, (c) BCP: Flood Planning Resourcing

(a) BCP for DFW, DWR, SWRCB, and DOC: Stream Gaging Plan Implementation (SB 19).

Governor's Proposal. Requests $1.575 million ($1.175 million GF and $400,000 Water Rights Fund) over two years to implement SB 19 (Dodd), Chapter 361, Statutes of 2019, which requires the development of a plan to deploy a network of stream gages.

Background. DFW and SWRCB are heavily dependent on streamflow monitoring data from the network of gages maintained by United States Geological Survey (USGS) and DWR. DFW programs rely on monitoring data from these gages to inform hydrology and water temperature for instream flow study planning, implementation, and analysis.

Historically, the stream gaging network in California was operated by USGS and DWR, with various other federal, state, and local agencies, as well as private entities, operating gages on a smaller scale. The majority of permanent telemetered gages installed by USGS and DWR in California are used for water supply and flood forecasting and to monitor compliance, with flow or water quality requirements, downstream of dams or diversions. Currently, USGS operates approximately 8,000 stream gages nationwide, with over 500 gages in California. Likewise, DWR has expanded its gage network and operates approximately 200 gages throughout the state, reflecting the need and demand for real-time reliable streamflow data.

However, due to loss of funding in state and federal stream monitoring programs, the stream gage network has contracted considerably in the past two decades. Since 1990, more than 600 USGS stream gages, with continuous records of more than 30 years, have been discontinued in the US and additional gages are slated to be discontinued. Likewise, California's stream gaging network has experienced a similar contraction. Some of these discontinued sites represent the only real-time streamflow information in a watershed, and many sites had lengthy periods of record prior to removal. As California learned in the recent drought, the decommissioning of gages and lack of gages in priority watersheds result in important data gaps that hamper effective management of water resources, which forces state agencies to spend extra resources on field investigations and other less accurate means to obtain the needed data or to forgo timely and effective action because the data is unavailable. The existing gage network is insufficient to address key management needs (water supply management, flood management, water quality management, and ecosystem management).

LAO Comments. The positions requested are not newly established positions. This request includes an additional $34,000 in 2020-21 compared to the subsequent year.

(b) BCP for DWR: Central Valley Flood Protection Board: Continuation of Existing Staff

Governor's Proposal. Requests $4.01 million GF in 2020-21, and $3.688 million for 2021-22 and 2022-23 to support 19 existing positions within CVFPB. While CVFPB is an independent entity, its budget is contained within DWR, and it receives some staff and administrative support from the department.

Background. ***The State Plan on Flood Control (SPFC).*** The SPFC is the state-federal flood protection system in the Central Valley. SPFC includes over 1,600 miles of levees, over 1,300 miles of designated floodways, and approximately 18,000 parcels of land held in fee, easement, or other agreements. Although many SPFC components were locally or federally constructed, in the 1950s, the state committed to the federal government that it would oversee the SPFC system and maintain it pursuant to federal standards. For most segments of SPFC levees, the state has developed formal agreements with local governments (primarily local reclamation districts) to handle regular operations and maintenance responsibilities.

CVFPC oversees the SPFC facilities. The CVFPB is an independent state agency and the lead authority for flood control in the Central Valley. CVFPB is responsible for permitting and enforcing encroachments and operation and maintenance of all SPFC facilities. CVFPB collaborate with local authorities and stakeholders to ensure an integrated flood control system. CVFPB also manages real estate and easements necessary for flood control. CVFPB's activities include: (1) collaborating with local agencies to improve SPFC flood protection structures; (2) issuing permits for work on SPFC levees and facilities; and (3) ensuring that levees are maintained up to required standards, including ensuring that levee encroachments such as pipes or docks either meet code requirements and receive permits or are removed.

Funding for CVFPB. The permitting, inspection, and enforcement programs have been historically funded by GF appropriations. In addition to GF, the CVFPB has relied on the Disaster Preparedness and Flood Prevention Bond Act (Proposition 1E) funds allocated in 2012 to fulfill its statutory mandates. Those bond funds were fully expended by the end of 2017-18. The 2018 Budget Act included $1.4 million annually for two years for CVFPB to support ten existing permanent positions in order to continue to exercise its regulatory oversight authority over SPFC and its implementation of the Central Valley Flood Protection Plan.

CVFPB has the authority to levy finds and charge fees for inspection related activities, but was unable to utilize its authority due to incomplete real estate records and limited inspection and enforcement staff. The 2017 Budget Act provided provided CVFPB with an annual appropriation of $2.2 million, one existing position for three years, and nine new permanent positions for CVFPB's operating costs and to determine the nature and extent of its real estate rights and encroachments within the SPFC.

In July 2019, CVFPB began collecting fees for permitting and inspections with the intent of recovery 75-100 percent of the costs of these programs. However, there are approximately 21,000 outstanding permits, which would take time before those existing permits can generate sufficient fee revenue to sustain existing staffing.

LAO Comments. The positions requested are not newly established positions. This request includes an additional $322,000 in 2020-21 compared to subsequent years.

Staff Comments. According to CVFPB, without this funding, it will not be able to continue to fund at

least half of its 47 positions, all of which implement critical statutory programs. In 2017, as part of the approval of a budget request for additional staffing, the Legislature required CVFPB to explore creating revenue streams including charging fees for permits, collecting fines from illegal encroachments, increasing rent and royalty revenue from the Sacramento-San Joaquin Drainage District properties and exploring the feasibility of reviving CVFPB's assessment authority. As reported earlier this year, CVFPB has made significant progress, but revenue generating programs are not mature enough yet to support any CVFPB operations, requiring limited-term GF support. Allowing CVFPB to continue its existing level of oversight of the SPFC facilities is an important component of state efforts to maintain flood protection and public safety.

(c) BCP for DWR: Flood Planning Resourcing.

Governor's Proposal. Requests $2.283 million GF one-time and $2.089 million ongoing thereafter to support programs responsible for planning and project implementation within the Central Valley. Funding will support mandated updates to the Central Valley Flood Protection Plan and implementation of the Conservation Strategy.

Background. ***Central Valley Flood Protection Plan (CVFPP).*** The CVFPP is California's strategic blueprint to improve flood risk management in the Central Valley. The first plan was adopted in 2012 and is updated every five years. The last update to the plan was in 2017. The plan lays out strategies to:

- Prioritize the state's investment in flood management over the next three decades
- Promote multi-benefit projects
- Integrate and improve ecosystem functions associated with flood risk reduction projects.

The 2012 CVFPP was built on the foundation of Central Valley flood risk management efforts dating back to 1850. In 2006, DWR consolidated and coordinated its various flood risk management programs under the FloodSAFE California Initiative, which incorporated emergency preparedness, flood operations, flood risk reduction and ecosystem restoration projects, flood project maintenance, and comprehensive, systemwide assessment and planning to deliver improved flood protection as quickly and efficiently as possible.

The CVFPP was prepared in coordination with local flood management agencies, the Central Valley Flood Control Board, US Army Corps of Engineers, FEMA, and the Bureau of Reclamation. It was supported by data, analyses, and findings from related FloodSAFE efforts. These included the SPFC Descriptive Document, the Flood Control System Status Report, and the CVFPP Final Program environmental impact report, being prepared in parallel with the CVFPP and documented in interim products and reference documents. Th 2012 CVFPP focused on improving integrated flood management and flood risk reduction for areas protected by facilities of the SPFC. While the CVFPP focuses on the areas protected by SPFC facilities, the flood emergency response and operations and management of facilities in tributary watersheds that influence SPFC-protected areas were also considered.

CVFPP Conservation Strategy. The 2016 CVFPP Conservation Strategy is a non-regulatory document that provides measurable ecological objectives and long-term approaches for improving riverine and floodplain ecosystems through multi-benefit projects that include ecosystem restoration and improvements, and operations, maintenance, repair rehabilitation, and replacement. The Conservation Strategy provides a wealth of data and information necessary to support the 2017 CVFPP Update development by guiding the integration and improvement of ecosystem functions associated with flood-risk-reduction actions and providing the basis for recommending conservation actions for the SPFC. The

Conservation Strategy's measurable ecological objectives will guide and support monitoring and tracking of contributions to the CVFPP's supporting goal of promoting ecosystem functions over time.

Funding for the DFM. Since 2006, the most significant source of funding for DFM has been bond funds. In 2006, Proposition 1E was passed, authorizing $4.09 billion in general obligation bonds to rebuild and repair California's most vulnerable flood control structures, to protect homes and prevent loss of life from flood-related disasters, and to protect drinking water systems. In the same year, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Act (Proposition 84), allocated an additional $800 million for flood control projects. DFM anticipates having committed or spent most bond funds by the end of 2018-19. Proposition 1E funds are no longer available after 2019-20.

LAO Comments. The positions requested are not newly established positions. This request includes an additional $194,000 in 2020-21 compared to subsequent years.

Staff Comments. Significant investment is needed to maintain California's aged flood system, protect developing communities, and increase flood system functionality to achieve both flood and environmental protection. DFM seeks to manage floods in a manner that addresses both flood protection and environmental enhancement and restoration. This request will fund staff to work on the 2022 CVFPP updates and Conservation Strategy.

Staff Recommendation for (a), (b), and (c):

(a) *Stream Gaging Plan Implementation.* Approve $1.541 million ($1.141 GF and $400,000 Water Rights Fund) over two years.

(b) *Central Valley Flood Protection Board: Continuation of Existing Staffing.* Approve $3.688 million GF in 2020-21, and $3.688 million for 2021-22 and 2022-23.

(c) *Flood Planning Resourcing.* Approve $2.089 million GF one-time and $2.089 million ongoing thereafter.

3860 DEPARTMENT OF WATER RESOURCES (DWR)

Issue 17: Hydrometeorology and Surface Water Observations

Governor's Proposal. Requests $6 million GF ongoing and 11 positions (six existing and five new) to bolster surface water monitoring through reactivation or upgrade of existing monitoring stations, and installation of new stations to address prioritized known information gaps.

Background. ***DWR uses weather stations and stream gages to collect hydrologic data.*** DWR maintains over 250 remote weather stations and supporting the operations and maintenance of more than 20 stream gages that provide critical information for flood emergency response and water supply forecasting.

Funding for weather station operation and maintenance have been unstable. Funding for station maintenance, repair, and upgrades are done on an ad hoc basis. This has resulted in a patchwork network of different equipment of different ages and reliability. Some equipment currently in the field comes from manufacturers that are no longer in business. Under current resourcing, the decline in data quality and availability from the network of observing stations will continue and accelerate as equipment ages and maintenance is continued to be deferred. In addition to station design, programming, and maintenance, work is needed to secure and maintain permits with relevant federal and state agencies, and coordinate activities with local agency partners.

Staff Comments. With the requested resources, DWR proposes to bolster surface water monitoring through reactivation or upgrade of existing monitoring stations, and installation of new stations to address prioritized known information gaps. Having good hydrologic data can help inform climate adaptation strategies and how water is managed in California.

Staff Recommendation. Approve as budgeted.

Issue 18: (a) New River Improvement Project and (b) for Tijuana River Project

Governor's Proposals. (a) New River Improvement Project. Requests $18 million GF and $10 million Proposition 68 funds to support the New River Improvement Project and address solid waste and pollution exposure challenges in the City of Calexico, which supports health, recreation, and economic benefits in the area.

Background on New River Improvement Project. ***The New River is polluted by domestic, agricultural, and industrial waste.*** The New River is a cross-border, trans boundary river that flows from Mexicali, Baja California, Mexico, into the City of Calexico in California and on to the Salton Sea. The New River is severely polluted by discharges of waste from domestic, agricultural and industrial sources in Mexico and the Imperial Valley. New River pollution threatens public health, prevents supporting healthy ecosystems for wildlife and other biological resources in the New River, and contributes to water quality problems of the Salton Sea. Also, New River pollution hinders economic development in Imperial County. Based on the most recent available data, the following water quality problems are evident in the New River on the US side of the US-Mexico International Boundary: pathogens, low dissolved oxygen, toxicity, trash, selenium, sediment/silt, chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, polychlorinated biphenyls (PCBs), hexaclorobenzene (HCB), nutrients, and mercury.

Prior efforts to remediate the New River's water quality and promote recreational opportunities. AB 1079 (V. Manuel Perez), Chapter 382, Statutes of 2009, established a Technical Advisory Committee (TAC) to prepare a strategic plan to study, monitor, remediate, and enhance the New River's water quality to protect human health, and to develop a river parkway suitable for public use and enjoyment.

The New River TAC solicited advice from consultants, academics, and agency experts. The TAC developed a comprehensive set of recommendations to address the New River problems through the Strategic Plan, which was published in 2011 and updated in 2016. The New River Strategic Plan contemplates additional benefits and includes additional green space in the community.

The New River Improvement Project. The New River Improvement Project is a component of the New River Strategic Plan and provides a critical first step to developing the River Parkway specified in the Strategic Plan. The New River Improvement Project will divert the polluted water away from the city, reducing risks of exposure to potentially harmful pollutants, and will replace the riverbed treated water to facilitate ecosystem and health benefits. The Governor's Budget proposes $28 million for DWR, in coordination with the California Environmental Protection Agency and the Salton Sea Authority, to prioritize funding investments in a trash screen, piping and pump back system, and the construction of additional aeration structure components, and will engage in continued conversations with local partners, including the City of Calexico, Imperial County, and the Imperial Irrigation District.

LAO Comments. ***Approve funding for New River Project.*** Because the proposed projects would address serious public health issues in the City of Calexico and the Administration has a plan for how the investments would be maintained in future years by local stakeholders, the LAO recommends approving the Governor's proposal to provide $28 million for the New River Improvement Project.

(b) Tijuana River Project. Requests $35 million GF one-time for the construction, operation, and maintenance of a series of pollution capture devices and infrastructure projects on the US side of the Tijuana River Valley that supports health and environmental benefits and address pollution issues affecting the Tijuana River.

Background on the Tijuana River Project. ***The Tijuana River is polluted by raw sewage, waste tires, and industrial waste.*** The Tijuana River stretches roughly 120 miles and is sourced from two main tributaries, one originating in the Laguna Mountains (US) and one originating above the Abelardo L. Rodriguez Dam (Mexico).

Raw sewage and waste flowing from the City of Tijuana and its surrounding areas flow into California along the Tijuana River. Despite cross-border cleanup efforts, this remains a recurring problem and is a main source of pollution in the area. This pollution threatens public and ecosystem health in the Tijuana River Valley. The river's waste discharges generally consist of waste tires, residential and industrial waste, as well as some hazardous waste, building materials, and sediment, all of which contribute to contaminated stormwater runoff that flows into the Tijuana River National Estuarine Research Reserve among other ecological, recreational, and economic resources.

Waste discharges into the Tijuana River often result in beach closures along the City of San Diego's coastline, extending as far north as the City of Coronado.

Efforts to address pollution in the Tijuana River. CalEPA and the San Diego Regional Water Quality Control Board, together with local, regional, and state agencies and non-governmental organizations, are working to address long-standing pollution issues affecting the Tijuana River, the Tijuana River Valley, and its residents.

SB 507 (Hueso), Chapter 542, Statutes of 2017, dedicated funding to the County of San Diego to study and identify solutions designed to remedy Tijuana River pollution. This study, known as the County of San Diego's SB 507 "Needs and Opportunities Assessment," is currently underway and identifies 26 potential solutions in the San Diego area and along the US side of the Tijuana River Valley. This study is expected to be completed by spring of 2020.

The 2019 Budget Act provided $15 million to the Coastal Conservancy for Tijuana River Border Pollution Control projects. Also, SB 690 (Hueso), Chapter 381, Statutes of 2019, requires the conservancy to prioritize those projects identified in the SB 507 Study when expending any funds to address trans boundary flows and pollution in the Tijuana River Valley.

LAO Comments. ***Withhold approval of funding for Tijuana River projects until the state has plan for funding ongoing costs.*** The LAO recommends the Legislature withhold action on approving the $35 million for the Tijuana River series of projects until it has more certainty about how ongoing costs to operate and maintain the projects will be funded in future years. The LAO believes the proposed projects have merit and address important needs in the region. Because of this, the LAO believes the state should ensure the projects will continue to function as intended beyond the two years for which maintenance funding is proposed. The LAO recommends that the Legislature require that the Administration present a plan for how operations and maintenance for the Tijuana River projects will be funded in future years. Approving funding to construct the projects without a plan for which entities will assume the significant costs of operating and maintaining them on an ongoing basis runs the risk of them falling into neglect and failing to function effectively in the future. This could place future pressure on the state to fund ongoing costs to protect its substantial investment. If the Administration believes there is a significant

chance that the state will need to assume the $6.5 million in annual costs to maintain these projects, the Legislature should incorporate that costs into its decision of whether or not to construct these projects now. If the Administration is able to submit the aforementioned plan within the coming months, this would still allow the Legislature to consider approving funding for the Tijuana River projects as part of the 2020-21 budget.

Staff Recommendation. (a) Approve as budgeted the BCP for the New River Improvement Project and (b) Hold open the BCP for the Tijuana River Project.

Issue 19: Sustainable Groundwater Management Program (SGMP)

Governor's Proposal. Requests $39.6 million GF in 2020-21, $11.2 million in 2021-22, and $16.3 million ongoing thereafter to fund 37 new positions to do the following: (1) establish the regulations for how a Groundwater Sustainability Plan (GSP) must be prepared and assess the GSP's likelihood of achieving sustainability, and (2) assist local entities prepare and implement GSPs that will bring groundwater levels back into balance through technical and planning support. This request includes $30 million GF one-time local assistance grants to support economic mitigation planning and/or implementation projects across critically overdrafted basins.

Background. ***Sustainable Groundwater Management Act (SGMA).*** In 2014, amidst a major drought, SGMA was signed into law establishing a new structure for managing California's groundwater resources at the local level by local agencies. SGMA provides a framework for long-term sustainable groundwater management across the state. SGMA requires the formation of Groundwater Sustainability Agencies (GSAs) to form in high- and medium-priority basins by June 30, 2017. The GSAs have until 2022 (in critically overdrafted basins until 2020) to develop, prepare, and begin implementation of GSPs. GSAs will have until 2040 to achieve groundwater sustainability.

DWR's role in SGMA implementation. DWR has a regulatory role as well as an assistance role in SGMA implementation. DWR established the SGMP in 2015 to fulfill these dual roles.

Regulatory role. DWR has to develop regulations governing how a GSP must be prepared and its likelihood of achieving sustainability. DWR's regulatory responsibilities include prioritizing basins, developing and implementing regulations, and evaluating basin sustainability. DWR has met its regulatory responsibilities to date.

Assistance role. DWR helps local agencies prepare and implement their GSPs through technical, planning, and financial support. This includes providing facilitation support, direct technical support, data, information, and funding.

DWR provides local agencies with technical assistance. DWR began its Facilitation Support Services Program in 2015 to assist local agencies from GSAs. Through this engagement with the local agencies it was clear there was a demand for DWR to initiate a number of technical assistance projects to assist with data gaps. Starting in 2017-18, SGMP received an appropriation that allowed DWR to expand its assistance efforts to include new technical assistance projects with an emphasis on data collection and dissemination.

Local agencies continue to need technical assistance. According to DWR, the level of assistance needed by GSAs and their stakeholders has exceeded expectations. DWR initially estimated approximately 200 GSAs would form; however, there are nearly 270 GSAs. In addition, the level of assistance requested by GSAs has continually increased over the last two years. SGMP began in January 2015 and the first few years of this program were heavily focused on the regulatory requirements as there were aggressive legislative deadlines to meet. The primary assistance functions were outreach efforts associated with the development of the two regulations DWR prepared.

In 2018-19, DWR further expanded its technical assistance offerings with temporary Proposition 68 funding. Even as the number of assistance projects and programs expanded, DWR anticipated being able to ramp down as more GSAs submitted their GSPs for DWR evaluation. It was assumed a GSA would need less support after completion of its GSP. However, as the basins are wrapping up their GSPs, they

are finding their technical and planning assistance needs will not subside. They are recognizing they have data gaps that will need to be filled between now and the submittal of their five-year update and into their 10-year update, and potentially beyond.

LAO Comments. ***Approve $9.6 million increase for DWR's implementation activities.*** The LAO recommends the Legislature approve the Governor's proposal to provide DWR with additional staff and funding to implement SGMA. Enhancing DWR's efforts to support GSAs will increase the chances that local agencies will achieve statewide groundwater sustainability goals. Moreover, helping to ensure greater local compliance with the act's requirements will lessen the odds that the state has to assume what likely would be significant costs to take over management of non compliant basins.

Approve $30 million for implementation of grants, but add language directing use of funds. To help support critically overdrafted basins in their efforts to begin bringing their groundwater use into balance, the LAO recommends approving the Governor's proposal to provide $30 million in one-time GF. However, the LAO recommends the Legislature include provisional language in the budget bill that places parameters around how these funds can — and cannot — be used. For example, the LAO recommends requiring that the funds be used on projects that focus on public benefits (such as for studies of strategies to assist vulnerable communities that may lose drinking water from dry wells) rather than private benefits (such as to compensate individual farmers who will have to reduce their dependence on groundwater pumping). Moreover, the LAO recommends these funds be focused on local efforts needed to implement GSPs (such as to collect additional data necessary to follow the plans) rather than projects intended to address regional economic impacts that are outside DWR's scope of responsibility for assisting with SGMA implementation (such as responding to potential changes in the local labor market).

Staff Comments. This proposal builds on existing resources, some of which are set to expire in the current year. The increasing workload and costs associated with evaluating the GSPs appear justified. While there are no concerns with the requested resources associated with continuing SGMA implementation, it is unclear how the requested $30 million for local assistance grants will be used to minimize economic impacts of SGMA implementation.

Safe and Affordable Drinking Water. Last year, SB 200 (Monning), Chapter 120, Statutes of 2019, established the Safe and Affordable Drinking Water Fund (SADWF) to help water systems provide an adequate and affordable supply of safe drinking water in both the near and long term.

Stakeholders have raised concern that SGMA is being implemented in a manner that ignores the needs of providing safe and affordable drinking water in low-income communities of color. They state that many draft GSPs released to date do not account for impacts on local communities dependent on groundwater, which includes a significant majority of small communities in the San Joaquin Valley and that "some Central Valley GSPs have established minimum thresholds — or failure points — that, if reached, would allow up to 85 percent of domestic wells to go dry or be impacted. Other draft GSPs propose allowable groundwater quality contamination to exceed safe drinking water standards by as much as 20 percent, which is illegal under the state's water quality statutes. Even worse, some GSPs ignore water quality impacts entirely. Some Groundwater Sustainability Agencies insinuate that any negative impacts to water quantity or quality caused by GSPs can be ameliorated but he [SADWF]…" A question arises as to how SGMA implementation can address groundwater issues without exacerbating safe and affordable drinking water problems in the same groundwater basins.

Staff Recommendation. Hold open.

Issue 20: Systemwide Flood Improvement Projects

Governor's Proposal. Requests $96 million one-time from bond funds to implement multi-benefit flood improvement projects. Specifically: (1) $68 million Proposition 68 and (2) $28 million Proposition 1.

Background. ***The State Plan of Flood Control (SPFC).*** The SPFC is the state-federal flood protection system in the Central Valley. SPFC includes over 1,600 miles of levees, over 1,300 miles of designated floodways, and approximately 18,000 parcels of land held in fee, easement, or other agreements.

DWR is responsible for many large flood control structures throughout the SPFC. These structures include weirs, pumping plants, and outfall gates that are integral to the flood control system. In many cases, they were constructed by locals pre-project, transferred to the state during project turnover from the US Army Corps of Engineers (USACE), and then operated and maintained by DWR since. As the structures age, some components lose functionality and require repair, replacement, or rehabilitation.

SPFC system needs. USACE identified thousands of non-compliant encroachments and/or deficient maintenance and operations of facilities within the SPFC. An estimated 90 percent of the state's project levees no longer qualify for the federal Levee Rehabilitation Program. When a state project levee loses this status, it is no longer eligible for federal contribution funding for rehabilitation to return a levee to it pre-flood status. Instead, those rehabilitation costs and any associated liability due to loss of life/property falls on the state and/or local flood agency.

State is financially liable for the loss of f life or property if SPFC facilities fail. In the 2003 *Paterno* decision, the California Supreme Court found the state liable from the 1986 Linda Levee collapse in Yuba County. The levee failure killed two people and destroyed or damaged about 3,000 homes. The Court opined, "when a public entity operates a flood management system built by someone else, it accepts liability as if it had planned and built the system itself." The state settled with property owners for $500 million. Since the 2005 settlement, the state has invested billions of dollars in improving the levees and other SPFC facilities.

Staff Comments. Funding this request is intended to help provide flood risk reduction, ecosystem restoration, and water supply reliability to urban and non-urban areas of Solano, Sutter, Yolo, Colusa, San Joaquin, and Sacramento counties.

Staff Recommendation. Approve as budgeted.

Issue 21: Urban Flood Risk Reduction – American River Common Features Project

Governor's Proposal. Requests $46 million GF one-time to support the state cost-share requirement of a critical flood risk reduction project that is being implemented by USACE. This request includes provisional language for a three-year encumbrance period.

Background. ***The American River Common Features 2016 (ARCF 2016) Project.*** The ARCF 2016 Project is part of the Urban Flood Risk Reduction program. These priority projects were part of USACE feasibility studies and included in the Central Valley Flood Protection Plan (CVFPP) adopted in 2012 and updated in 2017.

The ARCF 2016 Project consists of the construction of levee improvement measures that address seepage, stability, erosion, and overtopping concerns identified for the East levee of the Sacramento River downstream of the American River to Freeport (Pocket Area), East levee of the Natomas East Main Drainage Canal, Arcade Creek, and Magpie Creek, as well as erosion control measures along the American River, and widening of the Sacramento Weir and Bypass to deliver more flood flows into the Yolo Bypass.

The ARCF 2016 Project makes a significant reduction in the overall identified flood risk in the Central Valley.

Federal funding for ARCF 2016. The ARCF 2016 project received $1.565 billion in federal appropriations through the Bipartisan Budget Act of 2018 (BBA 2018). The BBA 2018 appropriation fully funded the federal cost share as well as required the project to be implemented in five years versus the originally planned 10-year implementation timeframe. To leverage this federal funding and take advantage of the accelerated schedule, the state is responsible for providing $570 million of funding of both cost-share payments to USACE and funds for acquisition of real estate and relocation of utilities.

This proposal requests a total of $46 million GF that will leverage over $158 million of federal funding over the next year.

Staff Recommendation. Approve as budgeted.

From: Marina Sebastiano [redacted]
Sent: Wednesday, April 1, 2020 09:17 AM
To: FGC <FGC@fgc.ca.gov>; sheila@bos.lacounty.gov <sheila@bos.lacounty.gov>; landtrust@ballona.org <landtrust@ballona.org>; Wildlife DIRECTOR <DIRECTOR@wildlife.ca.gov>
Subject: Support for Petition #2017-009 – Parking in Ballona Wetlands

Dear CA Fish and Game Commission,

In 2003, the people of California paid $139 million to acquire the land that is now the Ballona Wetlands Ecological Reserve. When the ecological reserve designation was granted by the Fish and Game Commission in 2005, a special regulation was added to allow existing parking by commercial restaurants and shops across the street, and by employees of Los Angeles County, to continue. At that time, the CA Department of Fish and Wildlife promised to evaluate the compatibility of that parking in the restoration plans for the site, but that promise was not kept.

It is now up to the Fish and Game Commission to exercise its authority and compel non-reserve related parking to relocate, such that more land can be restored to native wildlife habitat. The Department of Fish and Wildlife is free to formalize agreements with various County agencies regarding parking that is directly related to the operation and management of the ecological reserve. Parking for commercial interests within the ecological reserve is highly inappropriate, as is parking for County employees who do not perform operation or maintenance activities for the reserve.

Please protect the natural resources of California, as your mission mandates, by ending this special interest parking exception for the Ballona Wetlands Ecological Reserve.

Sincerely,

Marina Sebastiano

[redacted]