

Report on BPC Special Project regarding the Future Study Recommendations and Peer Review of the Salmonid Fish Tagging Study (Hearn, et al., 2012)

Background

I, Josh Trotter, have been asked by John Coleman, BPC Executive Director, to compile this Executive Summary report to the Board of Directors about the results of the special project (item 2AA) authorized by the Board in its 12/13/2012 meeting.

The Board authorized the Executive Director to contract with ARCADIS US, Inc. and ECORP Consulting, Inc. to prepare two letter reports concerning the UC Davis draft report on fish tagging, which was performed under the LTMS program and released in 2012. The peer review (ARCADIS' 1st letter) was reviewed by BPC's ExCom and was forwarded on to Bill Brostoff late in 2012 for consideration by the authors of the UC Davis/USACE fish tagging study. The 2nd letter, recently received from ARCADIS, summarized the content of the peer review, and made recommendations for future fish studies relevant to the LTMS program. This letter has not been released outside of BPC and also will be summarized in this presentation.

For convenience, listed at the end of this report are the current dredging work windows in the San Francisco Bay Estuary, as well as figures of ESA-protected fish species and potential impact to those species in the proposed San Francisco Bay to Port of Stockton Dredging Project.

Special Project Completion Criteria

The contractual obligations agreed upon by ARCADIS, ECORP, and BPC are as follows: conduct a review with two perspectives: 1) a technical "peer" review and 2) a review of the peer review result and future directions the Study should take. The second perspective will be with respect to the benefits to be gained by the dredging community (e.g., widening Environmental Windows, reducing uncertainty about occurrence of fish in project sites, etc.).

Key Terminology

- The Study = the interim draft report entitled "Salmonid Smolt outmigration and distribution in the San Francisco Estuary 2010" by Hearn, et al.
- The 1st letter = ARCADIS' 1st letter to the BPC, which contains the peer review of the Salmonid study by Hearn, et al.
- The 2nd letter = ARCADIS' 2nd letter to the BPC, which contains the review of the peer review and suggestions for future directions the research on sensitive fish species should take

1st Letter – Peer Review

As stated by ARCADIS in their 1st letter: "Members of ARCADIS and ECORP conducted a peer review of the interim draft report titled "Salmonid smolt outmigration and distribution in the San Francisco Estuary 2010" dated 2010 (but released in 2012) and authored by A.R. Hearn, E.D. Chapman, A.P. Klimley, P.E. LaCivita, and W.N. Brostoff. As here applied, "peer review" connotes a process intended to be identical to that employed by the editors of most scientific journals. The ultimate goal of the

review is to assist the authors in improving the [Study], thereby enhancing its contribution to the body of scientific knowledge.” (pg. 1)

All reviewers concurred in the following general comments (as summarized by ARCADIS):

- “The overall impression is that the authors and their project team have conducted a solid study and are to be complimented on the work that was performed.
- [The Study] is very well written: remarkably few editorial/format errors were detected.
- Most of the graphics are of high quality and very informative to the reader.
- The data appear to have been carefully evaluated with respect to quality.
- The data analyses appear to be thorough and extensive.
- While many of the conclusions that are directly derived from the results appear to have merit, a number of broad conclusions appear to be weakly supported or entirely unsupported by information presented in the [Study].” (pg. 2)

One might conclude from this comments summary that ‘the fish tagging study, overall, seems well-reviewed and, apart from some errors in the conclusions, has fulfilled its objectives satisfactorily.’ However, based on the general impression of review comments, the study objectives and conclusions make it difficult to assess the value of the study, specifically in regards to the study objectives. For example:

P. Lebednik, Section 1.1: Study Objectives, “While the list of study objectives appears to be reasonable and appropriate when considered in isolation, statements made in the following paragraphs give pause to the reader. For example, the first objective is to identify “general migratory patterns of outmigrating late-fall run Chinook salmon smolts,” yet in the next paragraph it is stated that “the migration timing of wild or hatchery fish cannot be inferred.” (pp. 3-4)

Furthermore:

P. Lebednik, Section 1.1, Paragraph 2, “The second sentence identifies an apparently substantial limitation of the study before the key aspect of the study associated with the limitation is revealed. This seems backward. Also, the reader is left mystified as to what benefit of the study is, because of the statement “this study does not address the key problem.” (pp. 4)

The overall significance of the Study’s data and conclusions will be addressed in the discussion of ARCADIS 2nd letter to BPC in the following section.

URS’ comments were not received in time to be included in the Peer Review Report. However, URS’ comments in general reaffirm, and sometimes clarify, ARCADIS’ and ECORP’s comments. The entirety of verbatim comments can be found in ARCADIS’ 1st letter and are briefly reviewed below in the following section.

2nd Letter – Peer Review Discussion and Recommendations for Future Fish Studies Relevant to LTMS

As stated by ARCADIS, “the purpose of this letter is to identify key findings of the [peer review] that relate to fish protection measures associated with the Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) and to provide recommendations to BPC regarding the focus of future fish studies (specifically, tagging studies of salmonids and green sturgeon) that could facilitate LTMS regulated operations.” (p. 1)

“In general, key fish study questions relevant to the LTMS goals and policy objectives include the following:

1. What are the temporal and spatial distributions of emigrating salmonid smolts and immigrating adults for each of the sensitive species?
2. What is the transit time for these life stages through the Bay?
3. What are the temporal and spatial distributions of green sturgeon and longfin smelt in the Bay?
4. What are the probabilities of potential effects of dredging and dredged material disposal on the species?
5. What environmental factors influence immigration and emigration, and how might they influence the environmental work windows?” (p. 2)

The research questions presented in the introduction to the Study are:

1. What are the general migratory patterns of outmigrating late-fall run Chinook salmon smolts and steelhead trout smolts and to what extent does their spatial distribution coincide with the location of dredged material placement sites and dredging sites?
2. What is the exposure time of outmigrating salmonid smolts to the various dredged and dredged material placement sites throughout the San Francisco Bay Estuary?
3. What are the spatio-temporal patterns of occurrence of green sturgeon in the San Francisco Bay Estuary, especially in relation to the location of dredging operations?

“These research objectives are consistent with the first three LTMS key study questions stated above. However, while the extensive data analyses completed in the [Study] add to the body of knowledge for these species, the data presented in the [Study] are not sufficiently robust to support several of the statements made by the authors, such as:” (p. 3)

- “The results provide insight into whether or not fish migrate through the estuary in batches and are therefore most susceptible to potential adverse effects on a population level, or if they are detected over a longer time period and only some would be potentially affected.”
- “The environmental work windows may be an effective tool to protect migrating salmonids.”
- “75% of salmonids may have been at risk if dredging or dredged material placement had been permitted during their outmigration.”
- “If placement of dredged material were to occur in any of the studied placement sites, while smolts were outmigrating, many fish would be exposed to the operations” and “Many fish would be exposed multiple times...” (p. 3)

“In drawing their conclusions, the Study also fails to mention the LTMS management plan, which has been in effect since 1999 and calls for a reduction in in-Bay disposal volumes to 20% in-Bay disposal by 2013, the remainder to be used for beneficial reuse or ocean disposal (LTMS, 2001). Potentially adverse

effects from dredge material disposal to the study species, as well as other aquatic organisms in the Bay, can therefore be expected to be less than in previous years.” (p. 4)

“In the Study, acoustic tags were placed on hatchery Chinook salmon and steelhead trout, and released on two occasions, both outside the dredging windows. Movement through the Bay was tracked using receivers, which were placed at dredge and dredge placement sites, two spatial control sites, as well as on bridges. Green Sturgeon data were obtained from the California Fish Tracking Consortium database. (Hearn, et al. 2012)” (p. 4)

The next section of ARCADIS’ 2nd letter specifies the most significant data gaps, then suggests modifications to the Study or future fish tagging studies. For example:

Release Design

As noted in the [Study], the “migratory timing of wild or hatchery fish cannot be inferred from the deliberate timed release of the experimental fish from Sacramento.” Therefore the data presented in the Report do not adequately support conclusions regarding exposure times or potential risk to salmonids from dredging during their outmigration.

Study Recommendation: Capturing and tagging wild fish during outmigration would improve the validity of the application of the results to seasonal movements, as wild fish would be moving through the Bay on much more frequent occasions based on such factors as originating rivers’ flow regimes. The tracking of (wild) salmonid movement through the Bay when dredging is permitted would provide more realistic data on migration paths, exposure to dredging operations, and migration success and transit time through the dredging and disposal sites. To validly address the subject of exposure of fish to dredging operations, spatio-temporal distribution of dredging and disposal patterns combined with concurrent fish tracking data would need to be evaluated. It should be noted that potential adverse effects on the wild fish resulting from the tagging operation would need to be evaluated before such an approach could be implemented.” (p. 4)

The letter then continues with “Control Design and Use,” “Migration Pathways,” “Environmental Variables,” “Potential Exposure to Toxins,” and “Smolt Emigration Mortality,” which concludes the Study review and future study recommendations.

ARCADIS suggests that the data gaps and fish tagging study design considerations can be “best addressed through a thoughtful and coordinated study framework,” which is described in their concluding “Next Steps” section (reproduced here in full):

Next Steps

[Step] #1: Finalize Interim Draft Report

“USACE San Francisco District should facilitate finalization of the most recent report on fish tagging (Hearn, et al. 2012) as soon as possible and before additional fish tagging studies are considered. This action would solidify the results and conclusions

of the study, thus providing a firm basis for planning the details of additional related studies. The process should incorporate considerations of the [peer review].”

[Step] #2: Review and Evaluate Relevant Information

“An in-depth review should be conducted of the currently available information on and/or relevant to salmonids and green sturgeon in the Bay, with a focus on the locations and potential effects of dredging and dredged material disposal. This evaluation should focus on prioritizing those studies that are most likely to directly address relevant outstanding LTMS issues associated with the species. The [step] should consider information included in LFR (2004); however, that report is nine years out of date and its primary focus was to comprehensively identify the range of studies desired by stakeholders. Additionally, the review of dredging effects literature included in that report was very limited and a critical review of the literature was not performed. Green sturgeon were not considered in the LFR report. Accordingly, current review and evaluation of existing information are needed to facilitate planning of future fish studies. This [step] should be completed before additional studies are conducted and may be performed in parallel with [Step] #1.”

[Step] #3: Evaluate the Potential Effects of Dredging and Dredged Material Disposal

“One of the key questions identified above, namely the potential effects of dredging and dredged material disposal on sensitive species, should be addressed. This [step] would have the goal of providing a risk-based evaluation of the spatio-temporal potential effects of dredging and disposal activities at relevant sites in the Bay. In developing the plan for this evaluation, additional fish tagging studies may be identified to fill critical data gaps, such as those identified [below]. The plan for this [step] should be developed based on the results of [Steps] 1 and 2. The above recommended [steps] represent a first phase effort that can be identified based on existing knowledge. Depending on the outcomes of these studies, additional efforts may be identified if there are remaining questions to be addressed.” (p. 8)

The end of the “Next Steps” section marks the conclusion of ARCADIS’ 2nd letter to the BPC.

Conclusion

To summarize:

- The peer review of the Hearn, et al. fish tagging study suggests that, while the Study itself yielded valuable data and analysis on fish tagging itself, the Study did not address the primary concerns related to the USACE’s LTMS—specifically, the management of sensitive species with regards to dredging operations.
- Modifications to the Study and future fish tagging studies, as suggested by ARCADIS, may enable such analysis of LTMS operations to be made. However, completion of a comprehensive literature review may lead to modifications of ARCADIS’ study recommendations and/or proposals for different studies to be conducted.

- As stated in Step #3 (above), in order to expend any available funds for future field study as efficiently as possible, the comprehensive literature review included in Steps 1 and 2 should be considered the top priority. This will ensure that the topics of future study are: 1) most relevant in evaluating the current work windows and other dredging/disposal mitigation measures, 2) likely to produce definitive results that will be employed in regulatory decision-making, and 3) do not unnecessarily duplicate the existing knowledge (i.e. avoid rehashing questions already answered sufficiently in the literature).
- To minimize confusion and maximize logistical efficiency, regulators on all levels should be kept in the loop with respect to the existing knowledge pertaining to sensitive fish species, and the implications of that knowledge for work windows and other mitigation measures in the San Francisco Bay Estuary.

Finally, ARCADIS and ECORP have completed 1) a technical “peer” review of the UC Davis Interim Draft Report fish tagging study and 2) a review of the peer review result and future directions the study should take. The review considered the benefits to be gained by the dredging community (e.g., widening Environmental Windows, reducing uncertainty about occurrence of fish in project sites, etc.). The satisfactory completion of ARCADIS’ and ECORP’s contractual obligations is up to the BPC Board of Directors, though it is my opinion that their formal obligations have been completed.

References:

ARCADIS U.S. Inc. (ARCADIS) 2013. Review of Salmonid Outmigration and Green Sturgeon Distribution Report and Recommendations for Future Fish Studies Relevant to LTMS. Letter from Liesbeth Magna to John Coleman, Bay Planning Coalition. January 25.

ARCADIS U.S. Inc. (ARCADIS) 2012. Peer Review of "Salmonid smolt outmigration and distribution in the San Francisco Estuary 2010. Interim Draft Report." Letter from P.A. Lebednik to John Coleman, Bay Planning Coalition. November 14.

Hearn, A.R., Chapman, E.D., Kimley, A.P., LaCivita, P.E., and Brostoff, W.N. 2012. Juvenile Salmonid Outmigration and Green Sturgeon Distribution in the San Francisco Bay Estuary. [Dated 2010 but released in 2012]

LFR Levine-Fricke (LFR). 2004. Framework for assessment of potential effects of dredging on sensitive fish species in San Francisco Bay. Final Report. August 4.

U.S. Army Corps of Engineers (USACE) 1999. Record of decision. Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region. July.

U.S. Army Corps of Engineers (USACE) 2013. Report Synopsis for San Francisco Bay to Port of Stockton, John F. Baldwin Ship Channel Phase III, Navigational Improvement Project. Draft Report. January.

Sacramento River winter-run Chinook salmon	<i>Oncorhynchus tshawytscha</i>	FE, SE	Y	Jan-Jun	Oct-Apr	**Nov-May migrates through the northern Delta to the Sacramento River; may stray into the Central Delta.	Jan-Apr
Central California Coastal steelhead	<i>Oncorhynchus mykiss</i>	FT	Y	Nov-May	Mar-Jun	**not present	
Central Valley steelhead	<i>Oncorhynchus mykiss</i>	FT	Y	Sept-Mar	Dec-Jun	Oct-May	Nov-Jun
Green sturgeon (southern DPS)	<i>Acipenser medirostris</i>	FT	Y	Feb-Jul	Year round	**Migrates through the northern Delta to the Sacramento River; may stray into the Central Delta. Information on distribution of green sturgeon in San Joaquin River is lacking.	Year round
Delta smelt	<i>Hypomesus</i>	FT, SE	Y	Sep-Dec	Apr-Oct		Dec-Mar

Table 2 State and Federal ESA Protected Fish Species in the Project Area

Species	Status	Critical Habitat	Presence in Bay		Presence in Central Delta ²	
			Adult	Juvenile	Adult	Juvenile
<i>Ambloplites</i>			**Adults begin upstream migration in December, juveniles move to the LSC areas of Suisun Bay and the western Delta in June. Most spawning occurs in the North Delta in Cache Slough, Sacramento River, and the Sacramento River DWIC.		**Historically abundant throughout the Delta. However, due to anthropogenic alterations to the Delta, delta smelt population densities are extremely low in the central and south Delta with most of the population residing in the North Delta and they are no longer found there in the fallover and fall months.	
Longfin smelt	<i>Spirinchus thaleichthys</i>	FP, ST	N	July-Nov	Nov-Jun	**Resident in the Delta. Slightly upstream from Avista in the Cache Slough/Sacramento River region and up to Mendocino Island on the San Joaquin River.
Tidewater goby	<i>Eucyclogobius newberryi</i>	FE	Y	Considered extirpated.		

²The Stockton Deep Water Ship Channel lies in the central delta. Deepening this channel could directly impact listed fish within the San Joaquin River directly adjacent tributaries and sloughs within the central delta. However, indirect, cumulative, interdependent, and interrelated impacts could occur to listed species in the north and south delta.

Figure 1 – Table of State and Federal ESA Protected Fish Species in the Project Area (USACE, 2013)

Table 3 Potential Impacts to Listed Fish and Data and Analysis	
Potential Impact	Data and Analysis ¹
Salinity intrusion and change of X2 location	Salinity modeling (ongoing)
Entrainment	Entrainment risk assessment
Contaminate exposure and bioaccumulation	Sediment testing (DRET, toxicity, bioaccumulation)
Dissolved oxygen	Dissolved oxygen modeling (completed)
Turbidity and suspended sediment	Sediment transport analysis (STFATE)
Other water quality parameters (temperature, pH)	Existing data
Migration impediments	Sediment transport analysis and noise monitoring
Noise	Noise monitoring recently conducted in SF Bay and Stockton DWSC (completed ERDC 2012)
Food availability and quality (foodweb alterations)	Existing data
Increased susceptibility to predation	Existing data
Alterations to critical habitat	Existing data
Alterations to habitat (rearing, foraging, spawning, migration)	Existing data
¹ Data and Analysis refers to if additional data should be obtained to support the ESA findings. For some items, the USACE is gathering or has obtained the data discussed. 'Existing data' indicates that there is likely enough data available to support ESA findings.	

Figure 2 – Potential Impacts to Listed Fish and Data and Analysis (USACE, 2013)

Dredging Work Windows by Area

Site	Species	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec
		1-15	16-31	1-15	16-28	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31
SF Bay Bridge to Sherman Island	Steelhead Trout																								
	Chinook Salmon Juveniles																								
Cajonville Bridge to Colusa	Sacramento Splittail																								
	Delta Smelt																								
	Longfin Smelt																								
Pointe Streal	Chinook Salmon (Adults)																								
Suisun Bay Channel	Longfin Smelt																								
North San Pablo Bay	Sacramento Splittail (Juveniles)																								
Mapa & Petaluma Rivers, Sonoma Creek	Steelhead Trout																								
North SF Bay & San Pablo Bay	Dungeness Crab Hoop																								
Richardson Bay, North & South Bay	Pacific Herring																								
Waters of Marin County from the Golden Gate Bridge to Richmond San Rafael Bridge	Coho Salmon																								
Central SF Bay	Steelhead Trout																								
	Pacific Herring																								
Berkeley Marina to San Francisco Creek within 1 mile of coastline	California Least Tern																								
South of Highway 92 Bridge (San Mateo-Hayward)	California Least Tern																								
In Areas with Eelgrass Beds	California Least Tern																								
Baywide in Areas of Salt Marsh Habitat	California Clapper Rail																								
Baywide within 250 feet of Salt Marsh Habitat	California Clapper Rail																								
In and Adjacent to Salt Marsh Habitat	Salt Marsh Harvest Mouse																								
Within 300 feet of known roost site	California Brown Pelican																								

Figure 3 – Dredging Work Windows (USACE, 1999)