

## Regulatory Conservation Measures

*Note to Reviewers: These three BDCP Other Stressors Conservation Measures have been rewritten to add certainty that the measures would occur. These conservation measures have been proposed for relocation to Section 3.5. Conditional Actions.*

**OSCM14: Increase the Harvest of Non-Native Predatory Fish to Decrease their Abundance.** The BDCP Implementing Entity will fund development of a pilot program to reduce the size and increase the bag limits on non-native predatory species in two specific locations in the Delta “hot spots.” The locations will be identified through coordination with the fish agencies and non-agency scientists familiar with several known predation “hot spots” in the Delta.

The pilot program will be proposed to the California Fish and Game Commission in 2011 and a limited exemption from current size and bag limits will be sought to allow greater catch of non-native predators at smaller sizes only in the two identified “hot spots”. The pilot program will be implemented in 2011 and will run for three years. The pilot program will include monitoring and assessments of non-native predator populations at the two identified “hot spots” to determine if reduced size and increased bag limits reduce the number of non-native predatory fish at each location and result in improved survival of covered species. The pilot program will include an education component to ensure that recreational fishermen know about the reduced size limits and increase bag limits at the two locations.

At the conclusion of the pilot program a summary analysis and report will be prepared by the BDCP implementing entity in consultation with the Department of Fish and Game that makes findings and reaches conclusions regarding the reduction of non-native predatory fish at the two locations. If the pilot program determines that non-native predator populations were reduced at the two locations then a full-scale program will be designed for “hot spots” throughout the Delta or, at the discretion of the F&GC, for the entire Delta.

The full-scale program will be proposed to the F&GC for implementation in 2014. The full-scale proposal will include the factual information that supports the conclusions of the pilot program and an estimate of the expected benefits of the full-scale program to covered species based on the conclusions of the pilot program. The F&GC has the discretion to adopt or reject the full-scale program.

In the event the F&GC decides not to adopt the full-scale program the funding anticipated for the education component will be shifted to another other stressors program identified through with the adaptive management process. In the event the adaptive management program determines that no other stressors conservation measures are available to receive the funding, the funding anticipated for education will be shifted to a habitat restoration conservation measure identified by the adaptive management program.

**Problem statement:** Despite the decline of multiple native species in the Delta over the past few years, such as delta smelt (IEP 2008a), longfin smelt (IEP 2008a), and salmon (MacFarlane et al. 2008), the abundance of non-native centrarchids such as large mouth bass have increased, possibly associated with increases in Egeria abundance (Brown 2003, Grimaldo et al. 2004). Predation by non-native centrarchids in the Delta is thought to reduce the survival rates of juvenile salmonids and splittail, although the effect of centrarchids on smelt and sturgeon in the Delta may be minor due to their use of different locations in the water column (M. Nobriga pers. comm.). Striped bass in the Delta are thought to consume juvenile salmonids primarily and may possibly consume delta and longfin smelt and splittail (M. Nobriga pers. comm.). The impact of non-native basses on juvenile sturgeon is likely small in the Delta.

1       **Hypotheses:** Relaxation of size and daily bag limits for striped bass and centrarchids is  
2       hypothesized to:

- 3       • reduce populations of adult and sub-adult striped bass and centrarchids. Humans have been  
4       extremely effective historically at harvesting fish species to very low numbers in many parts  
5       of the world;
- 6       • subsequently reduce the population of fry and juvenile striped bass and centrarchids.  
7       Relaxing size limits is expected to allow smaller fish to be harvested, potentially before they  
8       have reached a reproductive size, thereby reducing the reproductive capacity of the  
9       population;
- 10      • reduce predation mortality of Chinook salmon (ODFW 1998, Lindley & Mohr 2003, Nobriga  
11      et al. 2003, Nobriga & Feyrer 2007,2008), steelhead (ODFW 1998), delta smelt (Stevens  
12      1966, Winemiller & Rose 1992, Moyle 2002, Eisermann 2006, Nobriga and Feyrer 2007,  
13      2008), longfin smelt (Nowak et al. 2004, Eisermann 2006), Sacramento splittail (Moyle et al.  
14      2004, Eisermann 2006, Nobriga & Feyrer 2007, 2008), green sturgeon (J. Israel, pers. obs.),  
15      and white sturgeon by striped bass and centrarchids; and
- 16      • reduce competition for food with delta and longfin smelt by juvenile striped bass (Orsi &  
17      Mecum 1996, Kimmerer 2002b, M. Nobriga, pers. comm.).

18      **Monitoring and adaptive management considerations:** *[Note to reviewers: this section is a*  
19      *general summary; more detail will be provided in future iterations.]* Monitoring would consist of  
20      assessing the abundance, distribution, and size of centrarchid species before and after  
21      implementation of new regulations to determine the effectiveness of regulations. Studies would  
22      be conducted to determine size-based predation rates of centrarchids on covered fish species to  
23      determine whether relaxation of the regulations has an impact on these species.

24      If results of fish monitoring indicate that relaxation of regulations have not been sufficient to  
25      significantly reduce adverse affects of non-natives on native fish, actions would be modified to be  
26      more effective through the adaptive management process.

27      **OSCM17: Reduce Adverse Effects of Harvest on Sacramento Splittail Abundance.** The BDCP  
28      Implementing Entity will develop a study of, and draft regulations for limits on recreational and  
29      commercial splittail harvest. The study will determine the extent to which current harvest levels reduce  
30      the number of splittail in the Delta and will be performed in 2011 and 2012. The study will establish draft  
31      regulations for proposal to the California Fish and Game Commission in 2013. The draft regulations may  
32      propose a set size and daily bag limits designed to aid in the recovery of splittail. The study will utilize,  
33      among other monitoring data, existing DFG creel survey data, which contains considerable information  
34      about the number, season, and location of harvested splittail. Working with fish agencies and other fish  
35      experts, these data will be compared to life history attributes of splittail (e.g., age at reproduction, growth  
36      rates, and spatial and temporal patterns in migration and reproduction) to determine the appropriate size  
37      and daily bag limits that would be sufficient to aid in the recovery of the species.

38      The study, including a determination of appropriate size and bag limits will in consultation with CDFG  
39      propose appropriate regulations for consideration by the F&GC.

40      If the F&GC adopts the proposed regulations the Implementing Entity will propose the development of a  
41      program within the Department of Fish and Game to supplement enforcement personnel specifically  
42      focused on enforcing the splittail limits, and will work with the Department and others to secure the

1 necessary funding to implement it. The enforcement program will include an education component to  
2 ensure that fishermen know about the splittail size and bag limits in advance of active enforcement.

3 In the event the F&GC decides not to adopt the protective regulations for splittail the funding anticipated  
4 for enforcement will be shifted to another other stressors program conservation measure consistent with  
5 the adaptive managing process. In the event the adaptive management program determines that no other  
6 stressors conservation measures are available to receive the funding, the funding anticipated for  
7 enforcement will be shifted to the habitat restoration conservation measure identified by the adaptive  
8 management program.

9 **Problem statement:** There are currently no regulations on the Sacramento splittail fishery.  
10 However, the fishery may be considerable despite its poor documentation (Moyle et al. 2004).

11 **Hypotheses:** This conservation measure would establish legal limits for splittail based on known  
12 abundance and harvest rates. Although harvest is not thought to have significant effects on the  
13 population currently, this measure is expected to protect the species if harvest pressure were to  
14 increase in the future.

15 Specifically, this conservation measure is hypothesized to:

- 16 • increase the population abundance of Sacramento splittail (Moyle et al. 2004, DFG Creel  
17 Data 2007-08, USBR 2008). By reducing the number of fish being harvested, more fish can  
18 survive to reproduce.
- 19 • improve the transfer of energy through the foodweb in wetter years. Splittail are highly  
20 fecund in wetter years (Sommer et al. 1997, Feyrer et al. 2007b). It is thought that a large  
21 number of larval and juvenile splittail during these years are consumed by other organisms,  
22 thus contributing to an increase in the transfer of energy through the foodweb.
- 23 • increase predation on Corbula. Because splittail have been shown to consume Corbula  
24 (Feyrer et al. 2003), it is hypothesized that an increase in the splittail population would lead  
25 to an increased consumption of Corbula.

26 **Monitoring and adaptive management considerations:** *[Note to reviewers: this section is a*  
27 *general summary; more detail will be provided in future iterations.]* DFG would be responsible  
28 for monitoring the effectiveness of regulations in conserving Sacramento splittail while providing  
29 for a recreational fishery, and for revising regulations as needed to improve their effectiveness.  
30 The BDCP Implementing Entity would coordinate with DFG to develop and fund monitoring  
31 efforts, and to identify and support needed adjustments in regulations in future years.

32 **OSCM19: Reduce Losses of Wild Stocks of Chinook Salmon to Commercial Fishing and**  
33 **Recreational Fishing through a Mark-Select Fishery.** To reduce harvest of wild stocks of Chinook  
34 salmon, the BDCP Implementing Entity will produce a proposal by July 2011 for a full-scale mark-select  
35 fishery program that may be implemented by the California Department of Fish and Game (DF&G) and  
36 the Pacific Fishery Management Council. The proposal will be developed using lessons learned from  
37 implementation of mark-select fisheries in Washington and Oregon and marking technologies currently in  
38 existence. The full-scale programs will include all hatchery fish from hatcheries on either the Sacramento  
39 or San Joaquin river systems. The program will not be submitted to DF&G or PFMC until it has been  
40 peer reviewed by scientists holding positive and negative views of mark-select programs.

41 If DF&G and PFMC chose to adopt the full-scale program it will be funded at a level sufficient to allow  
42 its full implementation for six successive years (2012 to 2017). Implementing the program over six years

1 will allow time for four separate broods to return. During 2017 a summary report will be produced  
2 describing the program's implementation, its degree of success or failure and recommendations to  
3 improve the program regardless of its outcome.

4 The program will include a proposal for integrating differences between historic data sets using fractional  
5 marking and future data sets derived from mass marking. The purpose of this element of the proposal is  
6 to ensure that in the event a full-scale mark-select program is implemented, but not successful in  
7 improving wild salmon stocks, the mark-select program can be terminated and its data modified to  
8 conform to the historic fractional marking data. The data integration will also be capable of converting  
9 past data from fractional marking into data sets that can be used in conjunction with data from the mark-  
10 select program if DF&G and PFMC decide to continue the program at the conclusion of the sixth year.

11 In the event the DF&G and PFMC decide not to continue the mark-select program the funding anticipated  
12 to support a continuation of the program will be shifted to another other stressors program consistent with  
13 the adaptive managing process. In the event the adaptive management program determines that no other  
14 stressors conservation measures are available to receive the funding, the funding anticipated for  
15 enforcement will be shifted to the habitat restoration conservation measure identified by the adaptive  
16 management program.

17 **Problem statement:** Most hatcheries in the Central Valley are production hatcheries designed to  
18 mitigate for lost habitat from dams constructed in the middle of the twentieth century (Williams  
19 2006). However, hatchery-produced Chinook salmon and steelhead are thought to have negative  
20 effects on wild fish via competition for resources and genetic effects that can reduce the fitness of  
21 wild fish if interbreeding occurs (see ISAB 2002 for review).

22 **Hypotheses:** Although the greatest benefits of this conservation measure would be realized if a  
23 mark-selective fishery were implemented, it is expected that there would be major benefits to  
24 wild stocks of Chinook salmon of mass marking hatchery fish. Specifically, marking 100% of  
25 hatchery reared fish is hypothesized to:

- 26 • increase the knowledge base regarding Central Valley Chinook salmon (population sizes,  
27 harvest rates, success of restoration and river management programs, and other key biological  
28 parameters) for improved management (it is unknown whether current management programs  
29 primarily benefit wild fish, hatchery fish, or both, and in what proportion) (Hankin 1982,  
30 JHRC 2001, ISAB 2003, PSC-SFEC 2005, 2008a, AFS Position Paper 2009, Mohr 2009);
- 31 • increase the ability for hatcheries to track and manage the composition of wild versus  
32 hatchery origin fish in breeding programs, detect and quantify straying rates of hatchery fish,  
33 and improve broodstock management (with tagging, much improved) (ISAB 2003, AFS  
34 Position Paper 2009); and
- 35 • streamline, simplify, and reduce costs for coded wire tag, scale, otolith, and genetics  
36 sampling programs that specifically target wild or hatchery fish. Targeted fish would be  
37 easily identifiable with a visual mark leading to more efficient collection of targeted fish and  
38 reduced "bycatch" of non-targeted fish.

39 If the Fish and Game Commission and Pacific Fish Marine Counsel implement a mark-  
40 selective fishery, it is hypothesized that benefits would include:

- 41 • Reduce harvest-related mortality of wild Chinook salmon, thus contributing to the recovery  
42 of all covered Chinook salmon races (Cramer et al. in press); and

- 1 • reduce competition and genetic introgression from hatchery fish with natural fish on  
2 spawning grounds due to increased harvest of hatchery fish and the ability for managers to  
3 visually segregate hatchery reared fish from wild fish (Hankin 1982, Flagg et al. 2000,  
4 Goodman 2005, Weber & Fausch 2005, Araki et al. 2006, AFS Position Paper 2009, Mohr  
5 2009);

6 DFG has marked and tagged a constant fraction (25%) of hatchery reared fall-run fish since 2007,  
7 which been proposed to be sufficient to gain information about life history parameters (Newman  
8 et al. 2004). However, additional benefits associated with harvest reductions of wild fish and  
9 increased harvest of hatchery fish are predicted to be greatly increased with 100% marking of  
10 hatchery fish compared to 25% (Cramer et al in press.).

11 **Monitoring and adaptive management:** *[Note to reviewers: this section is a general summary;*  
12 *more detail will be provided in future iterations.]* The Fishery Agencies would be responsible for  
13 monitoring the effectiveness of a mark-select fall-run Chinook salmon fishery program for  
14 conserving wild fall-run stocks. The BDCP Implementing Entity would provide funding and  
15 ongoing review of Fishery Agencies' monitoring, progress, and other relevant reports to assess  
16 the effectiveness of the mark-select fishery for improving wild stocks of fall-run Chinook salmon.  
17 The BDCP Implementing Entity would coordinate with the Fishery Agencies to adjust mark-  
18 select strategies and funding levels through the BDCP adaptive management process as  
19 appropriate based on review of the Fishery Agencies' reports.

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