1) Selenium in Sturgeon Muscle Plugs

Oversight Group: Selenium Strategy Team
Proposed by: Jay Davis, SFEI

Funding requested for 2014: $23,000

Introduction and Background

In April 2014 the RMP formed a Selenium Strategy Team to evaluate information needs that can be addressed by the Program in the next several years. The charge given to the Team by the RMP Steering Committee was to focus on low-cost, near-term monitoring elements that could provide information that provides high value in support of policy development and decision-making. A TMDL for the North Bay is in development by the Regional Water Board, with a staff report in preparation.

The TMDL will establish a target concentration in white sturgeon muscle tissue as the basis for evaluating impairment. White sturgeon is a bottom-feeding species that is considered to be at substantial risk for selenium exposure in the Bay (Beckon and Mauer 2008). White sturgeon are particularly at risk because their diet consists primarily of the overbite clam (*Potamocorbula amurensis*), which are selenium-rich relative to other prey (Stewart et al. 2004). Other increased risk factors for sturgeon include their longevity (they can live over 100 years), their year-round resident status, and long egg maturation times (several years) (Beckon and Mauer 2008). Green sturgeon are also considered to be vulnerable to selenium but their exposure could be limited. Adults and sub-adults spend a large portion of their lives in coastal marine waters outside of the estuary, and are only briefly exposed to high selenium diet during their infrequent spawning migrations through the Bay. In addition, green sturgeon are a threatened species and fishing for them is prohibited.

White sturgeon have been routinely sampled (in 1997, 2000, 2003, 2006, 2009, and 2014) by the RMP sport fish monitoring element since 1997. However, the number of fish collected in each round of sampling has been small (12 fish per round), and the collections are currently being performed on a five year cycle. The upper end of the distribution of concentrations measured in North Bay sturgeon exceed the target under consideration for the TMDL, but this determination is based on a relatively small number of samples. Identifying a means to obtain a larger number of white sturgeon muscle samples on a more frequent basis has been identified as a high priority by the Selenium Strategy Team, both to obtain a more precise understanding of impairment and to track inter-annual trends.

In the 2009 RMP sport fish sampling, an effort began to establish a nonlethal and efficient method of collecting sturgeon muscle through the use of plugs. Concentrations in plugs were found to correlate well with concentrations in muscle fillets for the 12 fish sampled. Another round of evaluation of this correlation will occur with the 12 sturgeon to be collected in the 2014 sport fish monitoring (note these fish are separate from the fish to be sampled in this proposal). This correlation is opening the door to an opportunity to obtain a larger number of sturgeon muscle samples, non-lethally, through a collaboration with a California Department of

Fish and Wildlife annual tagging program that is tracking population trends (DuBois and Harris 2013; more information at http://www.dfg.ca.gov/delta/data/sturgeon/bibliography.asp).

This proposal is requesting funds to perform collaborative plug sampling in 2014. Performing this work in 2014 may result in the data being incorporated in the TMDL staff report that is currently in preparation.

Study Objective and Applicable RMP Management Questions:

This objective of this study is to obtain a relatively large number of sturgeon muscle samples (30 white sturgeon and, if possible, 10 green sturgeon) both to obtain a more precise understanding of impairment and to begin to track inter-annual trends.

Selenium Strategy questions addressed:

2. Are the beneficial uses of San Francisco Bay impaired by selenium?
4. How do selenium concentrations and loadings change over time?

RMP Management Questions addressed:

1. Are chemical concentrations in the Estuary at levels of potential concern and are associated impacts likely?
   B. What potential for impacts on humans and aquatic life exists due to contaminants in the Estuary ecosystem?
4. Have the concentrations, masses, and associated impacts of contaminants in the Estuary increased or decreased?
   B. What are the effects of management actions on the potential for adverse impacts on humans and aquatic life due to Bay contamination?

Study Approach

The study would be performed in collaboration with CDFW and USGS. SFEI staff would plan the study, train CDFW staff and perform sampling, manage the data, and write a brief technical report. USGS (Robin Stewart and her team) would perform analysis of selenium and stable isotopes of C, N, and S in the plugs. The stable isotopes provide information on diet and habitat use by the sturgeon. The sampling would occur during the course of the CDFW survey in August through October.

Thirty white sturgeon plugs will be collected and analyzed. Another 30 will be collected and archived in case additional samples are needed. Up to ten green sturgeon plugs, if possible, will be collected and analyzed.

Tasks and Budget

- Planning: decide on methods, coordination
  - SFEI: $600 (1 day)
- Training and field work
  - SFEI: $2500 (4 days)
- Sample processing (including archiving)

    - USGS: $500
- Analysis
    - Selenium
        - USGS: $6,600 (40 samples @ $165)
    - Isotopes
        - USGS/UCD: $2,000 (40 samples @ $50)
- Data management and QA
    - SFEI: $7505
- Reporting - short technical report to document methods and results, plot data with past data
    - SFEI: $2500 (4 days)

Total Cost: $23,000 (rounded up from $22,205)

Deliverables and Timeline

Draft technical report	Feb 2015
Final technical report	Mar 2015

References

Beckon, W. and T. Mauer. 2008. Species at Risk from Selenium Exposure in San Francisco Estuary. Final report to the USEPA. US Department of the Interior, Fish and Wildlife Service. http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/northsfbayselenium/Species_at_risk_FINAL.pdf

DuBois, J. and M.D. Harris. 2013. 2013 Field Season Summary for the Adult Sturgeon Population Study. http://www.dfg.ca.gov/delta/data/sturgeon/bibliography.asp

Stewart, R.A., S. Luoma, C. Schlekat, M. Doblin, and K. Hieb. 2004. Food web pathway determines how selenium affects aquatic ecosystems: a San Francisco Bay case study. Environ. Sci. Technol. 38. 4519-4526.