Evaluating Stressors in the San Francisco Estuary using Biomarkers

Charge to Panel Document

BACKGROUND

In 2007, the Interagency Ecological Program (IEP) convened a Task Force to evaluate the appropriate use of biomarkers to assess contaminant effects on the four declining fish species (collectively known as the POD species) in the San Francisco Estuary. The report that resulted from the Task Force (Anderson et al 2007) emphasized that in order to interpret stressor effects, addressing these questions must take into consideration geographic, seasonal, and temporal variability of the fish populations, understanding the organismal properties, life stages, and sensitivities. Furthermore, it is essential that interpretation incorporates physicochemical and anthropogenic influences - including fate and transport of contaminants, bioavailability, routes and timing of exposure (water, sediment, and food), chemical properties, and concentrations.

Much research has been conducted over the six years since this workshop was held. Current interest extends beyond the POD species to include additional listed species (e.g., green and white sturgeon and various salmonids), and other species of interest (e.g., inland silversides and Sacramento splittail). Biomarkers continue to be an important integrative tool.

Staff from several agencies are working through the IEP Contaminants Work Team (CWT) to assess what has been learned since 2007, what progress has been made in the state of knowledge, and, if the technology is ripe, how to use and interpret biomarkers in the San Francisco Estuary. The Work Team has prepared a background document that presents background information, provides a conceptual model, summarizes recent and ongoing studies, and poses questions for discussion by a Science Advisory Panel.

SCIENCE ADVISORY PANEL CHARGE

Using the material presented, namely the background document, the reference documents, and the presentations from the public workshop, the Science Advisory Panel (Panel) will respond to the questions posed in the background document as well as:

1. Assess the potential application of biomarkers for evaluating stressors and/or adverse effects on San Francisco Estuary fishes;
2. Identify biomarkers that should be focused on in future San Francisco Estuary research; and,
3. Identify data gaps and develop a research framework to guide the role and application of biomarkers within the Bay-Delta ecosystem.

QUESTIONS FOR THE PANEL

The Planning Committee has prepared a background document that frames each of the questions below by providing relevant information related to each question. The questions have been excerpted from the background document for presentation here.

Ecosystem Monitoring:

- How can biomarkers help us understand the relative health of organisms and the natural variability in these measured conditions?
- What is the relative importance of biomarkers on individual organisms and population health?
- How can current biomarker systems be used strategically to determine whether anthropogenic, physicochemical, and/or biological influences are causing significant stress in SFE species?
- What is the relative importance of these stressors to individual and population-level impacts, and thus ecosystem functioning?
- How can baselines, references or controls be established for field-based assessments?
- How can spatio-temporal variability be incorporated into biomarker data analyses?
- What are the relevant pros and cons that we need to be aware, or cautious, of?

Additional Questions:

- What specific information on health condition should be obtained to support biomarker assessments and monitoring? Consider contaminant transport and fate, bioavailability, and bioaccumulation, in conjunction with physicochemical and biological influences.
- What are the current benefits and limitations of the use of single versus multi-biomarker approaches?
- What is the suitability of current biomarkers and/or novel approaches such as genomics, proteomics and metabolomics, to monitoring population health?
- How can biomarker systems be used to assess effects of these stressors, and their interactions within 1) field populations? 2) laboratory studies? and 3) *in-situ/ex-situ* exposures?
- How best can field and laboratory based studies be integrated, from a biomarker perspective?
- How do non-lethal vs. lethal sampling limit the use of biomarker assessments?
- Should multiple species or a single species be selected as a model for biomarker investigations? Which species and why?
- How can AOPs or associations with higher levels of biological organization be integrated into the Delta monitoring approaches?
- How best can we integrate life histories, and specific life stages into planned studies?
- What additional information should be collected to aid interpretation of biomarker data?
- What analytical approaches would likely be most useful for interpreting biomarker data and understanding its environmental relevance?
- How do we extrapolate biomarker findings to fundamental fitness parameters such as survival, growth, and reproduction?

WORKSHOP DATES AND SCHEDULE

WORKSHOP DATES: October 24 and 25, 2013

LOCATION: UCD ALUMNI Center

SCHEDULE:

Day 1 Morning: The Panel convenes at UC Davis and hears presentations and engages in discussion with presenters and audience.

Day 1 Afternoon: The Panel convenes at UC Davis to continue with presentations and the session concludes following additional questions and discussion with the audience and Panel.

Day 2 Morning: Panel convenes at UC Davis to begin synthesizing review with the goal of developing a peer review outline.

Day 2 Early Afternoon: Panel reports out initial findings, asks final questions, and has final discussion with audiences.

Oct/Nov. (5 weeks): The Panel continues their review of the material and responses to questions. The Panel will communicate via email and phone as needed.

December (first week): The Panel releases report.

PANEL REVIEW MATERIAL

Anderson S.L., et al. (2007) Biomarkers and the pelagic organism decline: conclusions of the POD Biomarker Tast Force, Fort Mason, San Francisco, August 29-30, 2007.

Connon, R. E., et. al (2013) Evaluating Stressors in the San Francisco Estuary and Suisun Bay Using Biomarkers. Background Document for Biomarkers Workshop

Hamers, T., et al (2013) Expert Opinion on Toxicity Profiling – Report from a NORMAN Expert Group Meeting. Integrated Environmental Assessment and Management. SETAC.

Teh et al. (2012) ANNUAL REPORT: (August 2011 – May 2012): Fall Low Salinity Habitat (FLaSH) Fish Health Study: Contrasts in Health Indices, Growth and Reproductive Fitness of Delta Smelt Rearing in the Low Salinity Zone and Cache Slough Regions.

PANEL MEMBERSHIP

The Independent Science Advisory Panel consists of the following distinguished scientists:

- Tracy Collier, Panel Chair, Delta Science Program Independent Science Program
- Nancy Denslow, University of Florida
- Evan Gallagher, University of Washington
- Dave Lattier, US EPA
- Mitch Kostick, US EPA

Panel members were screened for conflict of interest and bias to ensure a balanced and objective review.

PLANNING COMMITTEE:

Richard E. Connon, University of California, Davis
Marjorie Brooks, Southern Illinois University
Cameron Irvine, CH2M HILL
Swee Teh, University of California, Davis
Josh Israel, US Bureau of Reclamation
Tim Mussen, Sacramento Regional County Sanitation District
Anke Muller-Solger, IEP and Delta Stewardship Council
Kurt Ohlinger, Sacramento Regional County Sanitation District
Chris Foe, Central Valley Regional Water Quality Control Board
David Ostrach, Ostrach Consulting
Julie Garcia, California Department of Fish and Wildlife
Jason Roeh, California Department of Fish and Wildlife
Joe Domagalski, US Geological Service
Stephanie Fong, State and Federal Contractors Water Agency
Allen Barnes, University of California, Davis
Carol Atkins, California Department of Fish and Wildlife