Mercury monitoring in California sport fish: past, present, and future

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Mercury (Hg) in California’s Aquatic Ecosystems

- Legacy contamination
  - Extensive gold mining in the Sierra Nevada
  - Mercury mining in the Coast Range of northern and central California
- Current contamination
  - Atmospheric deposition from combustion emissions
  - Urban and industrial sources
Mercury Monitoring

- Two programs addressing Hg bioaccumulation

  - Fish Mercury Project (FMP), funded by the California Bay-Delta Authority
  - Surface Water Ambient Monitoring Program (SWAMP), funded by the California State Water Resources Control Board
Past, Present and Future of Mercury in California

- The programs combined provide a multi-tiered approach to understanding Hg contamination
  - Historic review of sport fish mercury data
  - Extensive fish sampling over the next three years
  - Development of a long-term strategy for monitoring mercury and other pollutants in aquatic biota
Historical Data Review

- Compilation of all available data from statewide and regional sport fish monitoring efforts

- QA of incoming data sets
  - e.g., lab QA, fish length, compositing scheme

- Standardized data base
Monitoring Programs Included

- **Statewide**
  - Toxic Substances Monitoring Program
  - State Mussel Watch Program
  - Coastal Fish Contamination Program

- **Regional**
  - Regional Monitoring Program for Water Quality (SF Bay)
  - Sacramento River Watershed Program
  - Many others
Historical Data Review:

Bioaccumulation sampling sites

1969-2003
Assessing Mercury Impact

- Calculate median of Hg concentration in muscle tissue (wet weight)
- Select the species at each site with highest mercury
- Interpret concentrations using human health thresholds from OEHHA
Mercury Impact on Fish Consumption

1998–2003

Higher Risk

Lower Risk

- Best Choices: Up to 8 meals/month (0 – 0.12 ppm)
- Caution: No more than 1 meal/month (>0.12 – 0.93 ppm)
- Caution: No consumption (>0.93 ppm)
Mercury is driving the overall pattern of net pollutant impact (Hg, PCBs, chlordanes, DDTs, dieldrin)
Hg Problem is Significant

- Several species and sites exceed a 0.3 ppm threshold for human health concern
- Some exceed the threshold by 3-fold or more
- Consumption advisories driven by mercury are in effect for many water bodies in California
Mercury Concentrations 1998-2003

- Species with highest median Hg at each site are shown
- Spatial variation in watershed
- Overall spatial correlation with Hg and gold mining
- Worst hot spots are associated with mines
Little evidence of long-term change

- Sparse data set for time trends
- Largely NS trends
- White croaker decline at Sacramento R poorly understood

[Map of California with data points and graphs showing time trends for different locations.]

- Feather River at Nicolaus
- American River at Discovery Park
- Sacramento River at RM 44/Hood
- San Joaquin River at Vernalis
How to address the problem (minimize exposure)?

- Ultimate approach to protect humans and wildlife
  - Adaptive management — cleanup, restoration, and monitoring
  - Impact of cleanup may take 50-100 years or more
How to minimize human exposure?

- Interim approach for humans only
  - Monitoring
    - Identify high and low concentration areas
    - Identify high and low concentration species
  - Develop consumption advice
  - Communicate risk information to the public
  - Can have significant impact in 10 years or less
Fish Mercury Project
2005-2007

- Extensive sampling of mercury in sport fish in the Central Valley and Delta
- Small fish sampling for spatial trends and effects of restoration
- Advisory development and risk communication
- Stakeholder involvement
SWAMP Monitoring Strategy
Preliminary Vision

- Integrated monitoring
- Hybrid design for sampling locations
- Suite of different indicator taxa
- Stakeholder involvement
- Peer review
Hybrid Monitoring Design

- **Random sampling (GRTS)**
  - Provide inference about areas that have not been sampled
  - Statewide assessment
  - Advisory development

- **Targeted sampling (fixed sites)**
  - Long-term trend analysis
  - Local assessment of specific management actions
  - Advisory development
Process-oriented Elements of the Proposed Program

- **Stakeholder involvement**
  - Agency staff
    - water quality, health, resource agencies
  - Community-based Organizations
  - Fishing groups
  - Environmental groups

- **Peer review**
Stakeholder Involvement

- Data-user needs
- Goals, objectives, assessment questions
- Coordination with other monitoring
- Environmental justice
- *Risk communication* (integrated monitoring)
Peer Review

- **Internal**
  - SWAMP Roundtable

- **External**
  - Panel of national experts in bioaccumulation and/or monitoring
Preliminary Design - Sport Fish

- Primary emphasis in bioaccumulation monitoring
- Assess the fishing beneficial use
- Use "integrated" monitoring approach
- Hybrid design for sampling locations
Preliminary Design - Small Fish

- Indicate
  - Wildlife exposure
  - Spatial and temporal trends

- Targeted sampling location design
  - Critical habitats, particularly wetlands
  - Historic sites
  - Sites potentially influenced by management actions
Preliminary Design - Bird Eggs

- Indicate
  - Risks to aquatic birds
  - Regional spatial patterns
  - Long-term trends

- Targeted sampling location design
  - Regional index sites with historic time series
  - Sample in critical wildlife habitats
  - Compare to effects thresholds for development and survival