



Indian River Lagoon



Mercury in Sentinel Fish from Coastal Regions of the Greater Everglades

David W. Evans¹, Colleen Rochelle², and Derek Tremain³

¹NOAA, Center for Coastal Fisheries and Habitat Research, Beaufort, NC, USA

²JHT, Inc., supporting NOAA, Center for Coastal Fisheries and Habitat Research, Beaufort, NC, USA

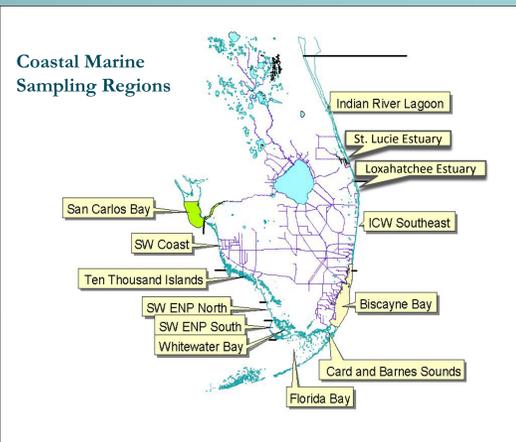
³Florida Fish and Wildlife Conservation Commission, Melbourne, FL, USA



Florida Bay mangroves

BACKGROUND

Monitoring the mercury concentrations in fish is a cost-effective means to assess environmental changes in potential human and wildlife exposure of this persistent, bioaccumulative toxicant. Fish consumption advisories are now widespread in both freshwater and coastal marine environments of the Greater Everglades. We have developed a three year database as well as a historical database of mercury concentrations in sentinel fish species to establish a baseline against which to gauge the impacts of hydrological and ecological changes accompanying restoration activities. The goal is to ensure that CERP does not worsen the existing mercury problem in South Florida to the point that risks to humans or wildlife outweigh restoration benefits.



Three or more sub-stations were sampled within each regions for spatial variability.

Sampling Design

- ❖ 13 coastal marine regions containing at least 3 sampling sites each
- ❖ 2 target species per region
- ❖ 20 fish from each region each year
- ❖ Annual sampling over three years

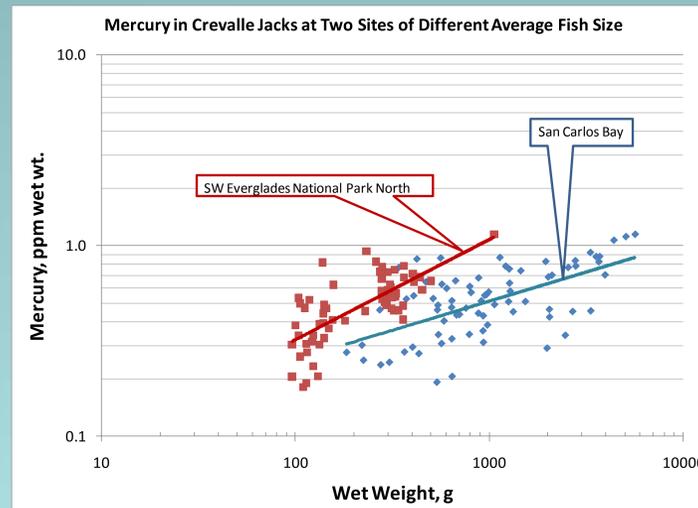


Gray Snapper (*Lutjanus griseus*)

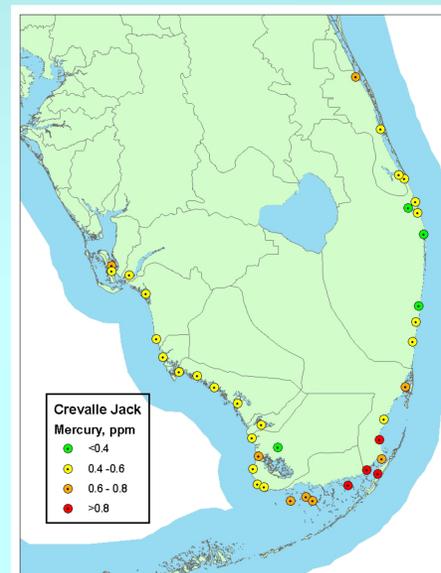
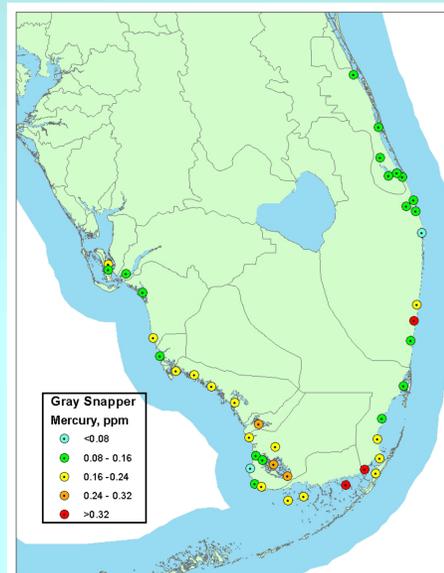


Creville Jack (*Caranx hippos*)

SPATIAL PATTERNS



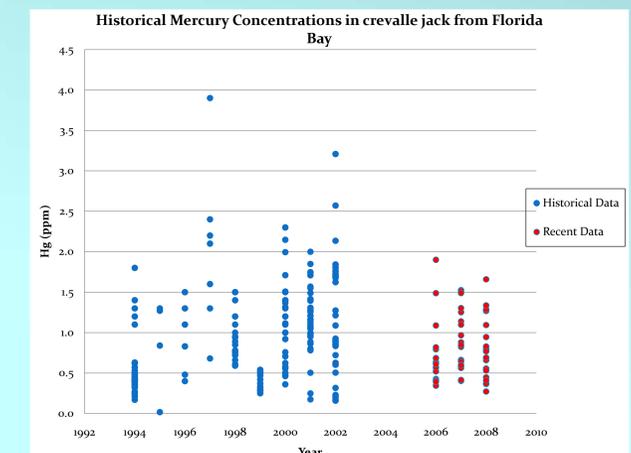
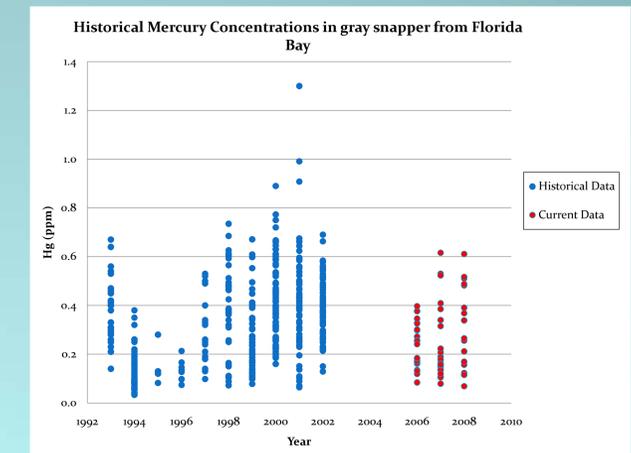
Mercury concentrations increase in creville jack as their size increases as is common for predatory fish. If in comparing average mercury concentrations among regions, average size also differs, then false conclusions about which site has fish with higher mercury concentration can occur. The above figure shows such a case. San Carlos Bay has many fish larger than any sampled in SW Everglades National Park South. The average mercury concentration in the San Carlos Bay fish was higher (0.548 vs. 0.515 µg/g (ppm), when concentrations are clearly lower as shown above. Statistical normalization for size (ANCOVA) could be used to reduce variability. We found, however, that such adjustments provided little improvement in revealing spatial patterns of high mercury concentrations. We therefore report only raw, unadjusted data.



EPA's criterion for mercury in seafood to protect human health is $<0.3 \mu\text{g/g}$ (ppm). Highest mercury concentrations in coastal marine regions were found along the extreme southeast tip of Florida, from Florida Bay through Biscayne Bay. They frequently exceed the EPA criterion. The southwest coast between Whitewater Bay to Ten Thousand Islands tended toward higher mercury concentrations than the Atlantic coast. These sites of high mercury concentrations in these two game fish seemed to be associated with estuaries with restricted flushing which did not dilute methylmercury as much as in high freshwater flow systems. In addition, calcareous sediments in more southern estuaries would not bind inorganic mercury strongly, leaving it freer to be methylated. Evidence of mercury methylation within eastern Florida Bay's sediments is reported elsewhere by Darren Rumbold, for example.

TEMPORAL PATTERNS

Adequate historical data on mercury concentrations exists for only two regions, Florida Bay and Indian River Lagoon. Florida Bay has the better historical record. For gray snapper in Florida Bay, an apparent concentration minimum occurred in the period 1995-6. Maximum concentrations seemed to occur in the period 1998-2002, with slightly lower concentrations more recently. These variations cannot be attributed to CERP activities such as the C-111 spreader canal which await implementation. Year-to-year variations must therefore depend on variations in the natural phenomena that determine methylmercury production and bioaccumulation in the Florida Bay foodweb. Creville jack show a similar, but less annually variable pattern, perhaps because the greater mobility of this species averages mercury concentrations over greater areas.



Conclusions:

- Prior to the implementation of most CERP projects, mercury concentrations in two species of sentinel fish exist in some regions of the Greater Everglades at levels exceeding criteria to protect human and wildlife health.
- Mercury concentrations vary substantially across and within regions, with areas of restricted water flushing seeming to have highest concentrations.
- Altered water flow accompanying CERP is likely to change mercury bioaccumulation. Hotspots, with limited water flushing, are likely to experience reduced mercury bioaccumulation if increased water input accompanies CERP. Diversion of water from well flushed areas (e.g. St. Lucie estuary) may increase mercury bioaccumulation through increased water residence time.