Data Analysis of the Levels of Human Toxins in Fish within the Salt & Verde Rivers

Santa Fe, NM
November 16, 2011
Background Information

- Located 20 miles East of Phoenix
  - Scottsdale, AZ
- Population of 9,500+ Enrolled Members:
  - Akimel O’Odham (Pima)
  - Xalychidom Piipaash (Maricopa)
- Bound on all sides
- Diverse ecosystem
- Innovative tribal commercial development
Community Location
Environmental Protection & Natural Resources

- Administration
  - Manager
  - Supervisors
  - Technical Support

- Air Quality Program (AQP)

- Brownfields Program

- CARP Program

- Environmental Programs & Policy Development (EPPD)
  - Pesticides & Hazardous Substances
  - Recycling
  - Solid Waste

- Land Use Compliance (LUC)
  - Archaeology
  - Enforcement & Compliance
  - National Environmental Policy Act (NEPA)
  - Stormwater

- Range Management Program (RMP)

- Water Quality Program (WQP)
  - Ground & Surface Water
  - Wetland Program
Water Quality Issues

- Surface Water
- Ground Water
- Wetlands
Grants & Additional Funding

- CWA §319 Base
- CWA §319 Competitive
- CWA §106
- Wetland Development Program
- SRP-MIC
Project Background
4 Sampling Sites

- “The Beach”
- “The Wall”
- Pond #1
- Pond #2
“The Beach”

- Verde River
- Between Pole 1 and 2
- Beach-like area with a large eddy
“The Wall”

- Salt River
- Above Granite Reef Dam
- High Potential for Variability in
  Fish Species
Pond #1

- Salt River
- Directly below flood gates of dam
- Water extremely turbid
- High algal growth
- Depth only 3-8ft
Pond #2

- Salt River
- Downstream of Granite Reef Dam near Bush Highway
- Flows received through drainage pipe
Sampling Methods
Fish Species Harvested
Fish Tissue Processing

- Fish were weighed individually
- Fish were measured
- Fish were visually inspected for lesions
- Photographed
- Scales were removed and fish filleted (skin & no skin)
- Subsamples wrapped in foil and weighed
Composite Scale

Fish Species

Large
- Skin
- Skinless

Small
- Skin
- Skinless
## Toxins Analyzed

<table>
<thead>
<tr>
<th>Carcinogens</th>
<th>Non-carcinogens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Inorganic Arsenic</strong></td>
<td>Alpha/Beta-BHC</td>
</tr>
<tr>
<td>Aldrin</td>
<td>Selenium</td>
</tr>
<tr>
<td><strong>Gamma-BHC (Lindane)</strong></td>
<td>Cadmium</td>
</tr>
<tr>
<td>Chlordane</td>
<td>Methylmercury</td>
</tr>
<tr>
<td><strong>DDD/DDE/DDT</strong></td>
<td>Tributyltin</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>Endosulfan sulfate</td>
</tr>
<tr>
<td>Heptachlor/epoxide</td>
<td>Endosulfan I+II</td>
</tr>
<tr>
<td>Hexachlorobenzene</td>
<td>Endrin/aldehyde/ketone</td>
</tr>
<tr>
<td>Toxaphene</td>
<td>Mirex</td>
</tr>
<tr>
<td>PCBs (total)</td>
<td>Methoxychlor</td>
</tr>
<tr>
<td>PAHs</td>
<td><strong>Chlorpyrifos</strong></td>
</tr>
<tr>
<td>2,3,7,8-TCDD (dioxin)</td>
<td></td>
</tr>
<tr>
<td><strong>TEQs</strong>*</td>
<td></td>
</tr>
</tbody>
</table>

*Estimated Total Toxicity Equivalency Quotient based on substituted dioxins and furans.

**RED** – Detected in all fish species

**GREEN** – Detected in some fish species
Formula

Generation of the Maximum Monthly Fish Consumption Limit, $CR_m$ (meals/month)

Non-carcinogenic Effects:

$$CR = \sum (\frac{RfD_m}{C_m}) \times BW$$

$$m=1$$

$$CR_m = \frac{(CR \times T)}{MS}$$

$$CR = RL \times BW / \sum (C_m + CSF_m)$$

$$m=1$$

Carcinogenic Effects:

$$CR = RL \times BW / \sum (C_m + CSF_m)$$

$$m=1$$

$$CR_m = \frac{(CR \times T)}{MS}$$

where:

- CR = maximum allowable fish consumption rate (g/kg)
- RfD = Oral Reference Dose (mg/kg-d)
- BW = consumer body weight (70 kg)
- C = concentration of a human toxin in fish tissue (mg/kg)
- T = time average period (1 month = 30.44 d)
- MS = meal size of uncooked fish fillet (0.227 kg/meal)
- RL = maximum acceptable life risk level (10^-5)
- CSF = Cancer Slope Factor (10^-5)
- CR_m = Cancer Slope Factor ((mg/kg-d)^-1)
# Maximum Monthly Fish Consumption Limit ($CR_m$)

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>$CR_m$*</th>
<th>Toxin Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Catfish</td>
<td>4.01 (4)</td>
<td>Methylmercury</td>
</tr>
<tr>
<td>Glass Carp</td>
<td>6.06 (6)</td>
<td>Methylmercury</td>
</tr>
<tr>
<td>Largemouth Bass</td>
<td>3.83 (4)</td>
<td>Methylmercury</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>8.47 (8)</td>
<td>As + (DDD+DDE+DDT)</td>
</tr>
<tr>
<td>Sunfish</td>
<td>8.27 (8)</td>
<td>As + (DDD+DDE+DDT)</td>
</tr>
<tr>
<td>Bluegill</td>
<td>8.43 (8)</td>
<td>As + (DDD+DDE+DDT)</td>
</tr>
</tbody>
</table>

*Associated with a consumer body weight of 70 kg (154 lbs) and a meal size of 0.227 kg (8 oz) of uncooked fish fillet.
Results

- Maximum Monthly Fish Consumption Limits for a selected set of fish species harvested from the Community’s surface bodies were generated using the approach and assumptions recommended by USEPA. The results of these will be used to issue Fish Consumption Advisories for Community Members in the near future.

- The bio-accumulation of methylmercury by Channel Catfish and Largemouth Bass harvested from the Community’s surface water bodies was found to be up to 5 times lower than the corresponding results of a Roosevelt Lake Study conducted by the State of Arizona.

- Within a fish species, it appears that larger/older fish generally tends to accumulate a higher level of human toxins that smaller/younger fish.

- Within a fish species, tissue samples with intact skin generally tend to accumulate a higher level of human toxins than skinless sample.

- Instead of testing an entire spectrum of human toxins, inorganic arsenic, methylmercury, and DDD+DDE+DDT can be used as indicator toxins when conducting future risk assessment on bio-accumulation of human toxins in fish from the Community’s surface water bodies.
Next Steps

- Fish Consumption Advisories
- Outreach
Water Quality Website

Water Quality Program

What We Do
The Water Quality Program (WQP) has overall responsibility for ensuring the waters within the Community are in compliance with water quality standards, which were updated for the SRPMIC during this year. The program enforces SRPMIC and federal regulations to protect water quality.

The WQP collects and analyzes monitoring data to ensure the quality and safety of surface and groundwater. This data is used to create annual reports, which inform the Community of the surface and groundwater quality. Additionally, the WQP performs educational outreach to other departments, Community schools, and Community members to increase awareness of the importance of environmental stewardship and the Community’s watershed. In addition to protecting the Community’s surface and groundwater, the WQP manages the Community’s wetlands to mitigate nonpoint source issues.

Document development plays an integral part of ensuring the water quality is improved, protected, and maintained. These documents may also provide a tool to share data with the Community and federal government. The WQP develops and updates documents to reflect current federal standards and guidelines as well as consideration of any SRPOMIC cultural practices. Most documents are revised every 2-5 years, or as needed.
Map & Outreach Form

Water Quality Sites Map

This map below contains the Water Quality sites currently on the Salt River Pima-Maricopa Indian Community.

Environmental Education and Outreach Program

Who We Are

The WQF is dedicated to educating the community about its program responsibilities, nonpoint source pollution, and its impact. Because the protection of the community's water resources must be a joint effort, the program believes that changes in awareness and understanding of the water quality issues are important in maintaining and improving water quality.

Outreach Program – Request Form

Fields marked with an * are required

* Last Name: __________________________  * First Name: __________________________

* Phone: __________________________

Email Address: __________________________

Organization: __________________________

Number of People in Group: __________________________

- [ ] Tour of Verde and Salt River
- [ ] Tour of Wetlands
- [ ] General Presentation
- [ ] Other

Additional Notes: __________________________
Contact Information

EPNR Hotline (480) 362-7500
www.SaltRiverEnvironmental.org