# Results of a Wildlife Toxicology Workshop held by Smithsonian Institution: Identification & Prioritization of Problem Statements

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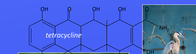


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## Abstract

### Background/Question/Methods

On March 13-15, 2007 nearly 50 scientists and administrators from the US and Canada participated in a Smithsonian sponsored Wildlife Toxicology Workshop. Invitees were from academic, government, conservation and private organizations and were selected to represent the diverse disciplines that encompass wildlife toxicology. The workshop addressed scientific and policy issues, strengths and weaknesses of current research strategies, interdisciplinary and science-based approaches in the study of complex contaminant issues, mechanisms for disseminating data to policy-makers, and the development of a partner network to meet the challenges facing wildlife toxicology over the next decade. Prior to the meeting, participants were asked to submit issues deemed to be of highest concern which shaped four thematic groups for discussion: Wildlife Toxicology in Education, Risk Assessment, Multiple Stressors/Complex Mixtures, and Sub-Lethal to Population-Level Effects.

### Results/Conclusions

From these discussion groups, 18 problem statements were developed and prioritized outlining the most important issues to address now and into the future. Along with each problem statement participants developed potential solutions and action steps geared to move each issue forward. The workshop served as a stepping-stone for action in the field of wildlife toxicology. These problem statements and the resulting action items are presented to the inter-disciplinary wildlife toxicology community for adoption, and future work and action items in these areas are encouraged. For example, it was found that ecologists would be essential in addressing the implications of sublethal or lethal effects of contaminants on wildlife at the population, community and ecosystem scales. The workshop outcome looks to generate conversation and collaboration that will lead to the development of innovative research, future mechanisms for funding, workshops, working groups, and listserves within the wildlife toxicology community.

## Methods

### Breakout Groups

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Prior to the meeting, participants were asked to submit issues they deemed to be of highest concern than shaped four thematic areas for discussions:

- Wildlife Toxicology in Education
- Risk Assessment
- Multiple Stressors/Complex Mixtures
- Sub-lethal and Population-Level Effects

DAY 1: Participants were provided with an overview of how the four themes were derived, and how each would be discussed. This overview was followed by a series of presentations related to the thematic areas given by various workshop participants.

DAY 2: Four revolving working groups convened to address the four thematic areas. Working groups rotated through different sessions throughout Day 2 to address specific objectives established for each session. Within each theme, problem statements describing gaps in scientific knowledge and regulatory concerns were developed, solutions were considered, and next steps were determined to facilitate interdisciplinary, science-based approaches to studying and understanding complex contaminants issues in wildlife.

DAY 3: Participants reconvened for a plenary session to review prioritization results. Each facilitator of the themed sessions summarized the issues identified and the action items for each theme, and participants volunteered to work on action items of interest to each of them.

## Results

| Priority | Theme | Problem Statement |
|---|---|---|
| 1 | Population-Level and Sub-Lethal Effects | There are few methods to translate measurable sub-lethal toxicological endpoints in individuals to correlated apical endpoints |
| 2 | Multiple Stressors/ Complex Mixtures | Wildlife are exposed to natural and anthropogenic stressors that interact synergistically or act as agonists or antagonists. The relative contributions of multiple stressors on wildlife health are difficult to quantify. |
| 3 | Education | Our existing education system and communication mechanisms are inadequate for raising awareness about the harmful effects of pollutants on wildlife health. Much of this stems from a public misconception about how scientific and regulatory processes work concerning wildlife and contaminants. |
| 4 | Education | There is inadequate and declining political and financial support for studying and understanding the problems caused by environmental pollutants on wildlife health. A need exists to better inform decision makers on these issues. |
| 5 | Risk Assessment | Risk assessments do not consider sufficient data at different levels of biological organization (e.g., residues, physiology, pathology, behavior). Because of this, a risk assessment may not address all adverse effects. As a result, acceptable levels of contaminants in the environment may be set too high to adequately protect species and long-term impacts may not be identified. |
| 6 | Risk Assessment | There is lack of post-decisional, post-assessment monitoring and verification of risk assessment conclusions. Verification of models used in risk assessment is rarely performed. |
| 7 | Risk Assessment | Because basic biological information (especially for rare species) and normal responses/baselines are not known, ground-truthing of risk assessment models is difficult. |
| 8 | Risk Assessment | Toxicity extrapolation is necessary because we can't test every species. However, this process is not adaptive and surrogates might not represent the full range of sensitivity; therefore not all species are adequately protected without model verification. |
| 9 | Multiple Stressors/ Complex Mixtures | Few diagnostic tools to understand and characterize the effects of multiple stressors for new chemicals/mixtures, and for a wide variety of species, exist or are widely accessible. Improved ability to extrapolate from what can be scientifically measured, to information that is useful for regulatory decisions is needed. |
| 10 | Multiple Stressors/ Complex Mixtures | It is difficult to understand the ecological impacts of multiple stressors at the population, community and ecosystem levels. |
| 11 | Risk Assessment | Improvement of risk assessment in international/developing countries is needed. |
| 12 | Risk Assessment | Regulatory frameworks need to be revised to address data gaps and incorporate scientific advancements, new endpoints, indirect effects, spatial issues, and methods to introduce new surrogates. |
| 13 | Risk Assessment | Indirect effects are not adequately considered as part of the risk assessment to effectively protect a species. |
| 14 | Multiple Stressors/ Complex Mixtures | More mechanistic data are needed to characterize how chemicals interact with each other, and/or with cellular/ molecular targets, to alter their individual effects on animals. |
| 15 | Population-Level and Sub-Lethal Effects | There are demonstrated population declines due to contaminants in the environment; however there is currently no regulatory response (i.e., the workshop participants stated that EPA does not have a wildlife toxicology program—see disclaimer). |
| 16 | Risk Assessment | Lack of consideration for spatial distribution and site-specific attributes coupled with an incomplete knowledge of fate and transport mechanisms and organism movements in the environment does not allow for adequate predictions of risk. |
| 17 | Multiple Stressors/ Complex Mixtures | A regulatory mechanism to comprehensively evaluate and manage complex mixtures and multiple stressors does not exist. Multiple agencies have regulatory authority for different chemicals and there is no integration. Additionally, the necessary science to inform the regulatory process often does not exist even if a regulatory mechanism were available to address mixtures. |
| 18 | Population-Level and Sub-Lethal Effects | Little information exists to fully understand the adverse consequences of sub-lethal effects, from exposure to contaminants, on individuals and populations. |

## Action Items

| Complete/In Progress | Overarching Action Items |
|---|---|
| ✔ | Establishment of an e-mail Listserve |
| ✔ | Develop a portal compiling existing databases relevant to wildlife toxicology<br>Develop a paragraph describing the purpose of the initiative and provide examples of databases that would be linked<br>Submit citations of relevant databases to include |
| | Encourage the submission of comments to the Docket to address regulatory issues |

| Complete/ In Progress | Education |
|---|---|
| | Develop acurriculum for a professional certificate program in wildlife toxicology for professionals and post-baccalaureates. |
| | Approach the Howard Hughes Medical Institute (HHMI) about sponsoring Science Education Fellows (undergraduate fellowships) to develop one-hour modules for schools on wildlife toxicology |
| ✔ | Present findings of the workshop to other professional organizations and interested groups:<br>Wildlife Society's Wildlife Toxicology Working Group<br>Association of Zoos & Aquariums' Education Liasons<br>Ecological Society of America<br>Socieity for Conservation Biology<br>Society of Toxicology<br>Society of Environmental Toxicology and Chemistry |
| ✔ | Form an Interagency group to develop a PowerPoint presentation and key talking points for educating other organizations on the wildlife toxicology community's needs. |
| | Develop an online toxicology course for chemistry students. |
| ✔ | Compile an inventory of existing wildlife toxicology education resources (e.g., websites, curricula, State departments of natural resources). |
| | Develop a strategic research plan for the National Science and Technology Council (NSTC) Joint Subcommittee on Ocean Science and Technology. |
| | Based on the outcome of the conference to refine the Citizen Science Toolkit (e.g., Backyard Bird Project) held June 20–23, 2007 and sponsored by the Cornell Laboratory of Ornithology in Ithaca, NY, work to develop a local project through the Backyard Bird Project. |
| ✔ | Develop an exhibit on wildlife toxicology. |
| | Author a book for middle school children on coral reefs with a wildlife toxicology component. |
| ✔ | Develop tools to promote awareness of wildlife toxicology, including:<br>Compile existing documents and multi-media materials to promote their availability<br>Create a Smithsonian exhibit<br>Create a cable/media special (e.g., CSI Wildlife) |
| | Prepare a briefing and host a reception for Congressional staffers on wildlife toxicology. |
| | Convene an NGO symposium on wildlife toxicology to encourage organizations to act on the issue. Potential NGOs include: The Nature Conservancy, National Audubon Society, World Wildlife Fund, Wildlife Management Institute, National Wildlife Fund, Environmental Defense Center, Wildlife Conservation Society, Conservation International, American Bird Conservancy, Natural Resources Defense Council, Sierra Club, and Defenders of Wildlife. |
| ✔ | Identify upcoming relevant meetings and discuss the outcome of the workshop (e.g., SETAC could sponsor a session). |

| Complete/ In Progress | Risk Assessment |
|---|---|
| | Make better use of existing information, including human health data and published literature, and establish a bibliography. |
| ✔ | Address why there is a need for additional animal models. |
| | Catalog the suite of available endpoints, protocols, and methods for these endpoints. |
| | Create a list of known endpoints that are biologically/diagnostically relevant. This list can then be used to determine which endpoints are missing. |
| | Promote incorporating residues in target tissues as part of standard toxicity testing and update guidance accordingly. |
| | Develop a centralized catalogue of species that includes basic biological information relevant to wildlife toxicologists, including: Birds in Agricultural Areas Database; North American Breeding Bird Survey; Birds of North America Online (http://bna.birds.cornell.edu/BNA/); NatureServe; Fish and Wildlife Service databases; and State Agencies' databases (e.g., Massachusetts' BioMap project: http://www.mass.gov/dfwele/dfw/nhesp/nhbiomap.htm). |
| | Identify data needs for incident reporting as part of the Avian Incident Monitoring System. |
| | Expand the International Union of Pure and Applied Chemistry's (IUPAC) training modules to include other chemicals. |
| ✔ | Develop international monographs. |
| | Provide periodic comment on public risk assessment documents to promote these concepts. Improvements to the regulatory and guidance process are iterative. Start with qualitative discussions, and then move to development protocols and guidance. |
| | Develop a list of research topics/projects for land grant university students. |
| | Create a subcommittee to address spatial effects. |
| | Identify data needs for incident monitoring. |

| Complete/ In Progress | Population and Sub-Lethal Effects |
|---|---|
| | Work to establish an empirical data set that allows for relating residue levels and measurement endpoints to apical effects. |
| | Write an op-ed piece regarding language in FIFRA 6(A)(2). |

| Complete/ In Progress | Multiple Stressors/Complex Mixtures |
|---|---|
| | Develop an inventory of chemicals associated with particular spatially explicit wildlife habitats (resident and transient) during the lifespan of an organism.<br>Review Pesticide Action Network's work on pesticides; EPA's Toxic Release Inventory trends; USGS performed analyses for 23 parks and 52 Important Bird Areas (IBAs). |
| | Organize a workshop on mixtures. |
| | Improve knowledge transfer from the human health world. |
| | Educate the scientific community and how the regulatory process works, identify regulatory data gaps, and provide an overview on which chemicals are adequately managed and under which statute. |
| | Hold a SETAC session where an NGO could educate the scientific community on how the regulatory process works, identify regulatory data gaps, and provide an overview on which chemicals are adequately managed and under which statute to highlight regulatory disconnects. |

## Further Action:

1. Develop a consortium of federal, non-governmental and academic partners that will provide leadership in meeting the decadal challenges in wildlife toxicology.
2. Disseminate scientific knowledge that will inform policy-makers in the areas of contaminants, wildlife health and biodiversity.
3. Refine strategies, action steps and timelines to facilitate interdisciplinary, science-based approaches to studying and understanding complex contaminants issues.
4. Invite the larger community interested in wildlife toxicology to join the listserve to improve communication between scientists.
5. Enlist members of the wider wildlife toxicology community to participate in completing action items.