

## **GROUP DISCUSSION (Submersed Plant Research Priorities)**

### **State Agency Perspectives on Needs in Chemical Control Research:**

1. T&E species issues – lack of non-target effects data.
2. Risk assessment – invasive species threat to T&E species or aquatic habitat vs. the management risk.
3. Lack of large-scale management options (cost-effectiveness and selectivity).
4. Lack of tools for managing macrophytes in high-flow environments.
5. Public perception of the negative impacts of chemicals.

### **Role of researchers –**

- conveying information on chemical use to the public. We often have a breadth of experience (outside of the lake or state of interest) that can added to the ongoing discussion.
- involvement in registration issues, local disputes or high profile aquatic sites, and when policies are being formulated.

### **Potential needs or topics that our group identified:**

#### **Toxicology Issues**

1. Improved data development for non-target organisms and non-target plant species with an emphasis on developing strategies to address T&E species issues.
2. Specific toxicity concerns for the potential toxicity of formulated and end products (e.g surfactants) as well as some mixtures.
3. Documentation on a regional basis of the real world field exposures to various herbicide applications and relation of these exposures to current toxicity data. Use patterns, weed control objectives and specific concerns can vary dramatically on a regional basis.
4. Due to high plant specificity and potency, newly registered compounds such as enzyme-specific inhibitors, may cause greater concern for T&E plant species and potential for impacts on emergent species following submersed applications.
5. There is little information regarding toxicological impacts and impact on efficacy for Adjuvants and Formulations.
  - a. Can quantifiable differences for submersed plant control be documented?
  - b. Do they present different toxicity issues to non-target organisms?

#### **Efficacy and Selectivity Needs -**

1. Generation of susceptibility data for key native plants, comparable to the databsase for hydrilla and EWM. Cooperation with regional entities to identify the key submersed and emergent species for evaluation.
2. Identify and support registration of new herbicides that target different enzymes or sites of action

- a. Will require developing the capability to rapidly screen both native and submersed species.
- b. Will require developing the capability to effectively screen a wide variety of compounds

### **Risk Assessment, Public Education, Guidelines for Resistance Management.**

1. Develop methods to conduct a Risk Assessment or to develop a Risk Assessment Model for aquatics that evaluates the impacts of the invasive species, management alternatives, or a no action alternative. Risk assessments are well accepted in the field of toxicology and they form the basis of the EPA herbicide registration process.
2. Improve Invasive Plant Management Education Strategies:
  - a. Review what is working and what is not working
  - b. How do you educate the misinformed and informed public?
3. Develop resistance management guidelines for existing and new chemical tools. –
  - a. Information for managers on how to use or rotate tools to prevent resistance development
  - b. Very different for a CA or WA eradication strategy vs. managing large waterbodies in FL.

### **Challenges Associated with Managing Plants in High-Flow Environments**

1. Address labeling for currently registered products to determine if language changes can include rivers or high-flow environments.
  - a. If not, what studies would be necessary to support this action?
2. Significant irrigation concerns limit products outside of copper and acrolein.
  - a. Encourage companies to develop crop tolerance information.
  - b. Develop application techniques and efficacy data for use in high-flow environments.
3. Screening programs for new product development should emphasize those products that can be used in spot treatments or highly dynamic waters.
4. Evaluate formulations or application techniques that will increase exposure time and improve efficacy.

### **Algal Research –**

1. Harmful algal blooms are becoming a significant issue, and aquatic plant managers should become involved in this issue.
  - a. Encourage industry to develop selective algaecides to replace copper or other broad-spectrum compounds.

- b. Evaluate impacts of certain cyanobacteria on submersed macrophyte growth
  - i. Toxin production or allelopathy
  - ii. Light or resource competition

#### **Enhanced Microbial Degradation –**

1. Evaluate environmental conditions that favor enhanced degradation of products such as fluridone, endothall, and 2,4-D, as this may provide some insight into the new chemistries as well.
  - a. Enhanced degradation could pose a threat to eradication programs.

#### **Basic Research on Herbicide Tolerance (Physiologists)**

1. Mechanisms of herbicide tolerance for species such as Cabomba, Variable Milfoil, and Hygrophila? By learning how these plants tolerate herbicides, we may be able to use this information to our future advantage.

#### **Large-scale management or whole-lake manipulations – (Ecologists)**

1. How do you adequately assess aquatic vegetation in a cost-effective and standardized manner? This would be the case for both managed and non-managed systems.
  2. Need improved methods for both detecting the impacts of management on natives and invasives, as well as methods for detecting impacts of invasives on natives.
  3. Our group conceded that replication of lakes is not possible and we need to work towards a weight of evidence model versus replication.
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Chris: T&E Species as a model for non-target effects. Questions on impacts to amphibians. Fluridone - sea-water challenge on salmonids.

- West Coast - non-target concerns related to salmonids and true non-targets
- Other areas of country – concerns more related to rare or endangered plant species.
- Listed species – sea water challenge test. Smoltification. Weight of evidence. Risk of not controlling invasives.
- Traditional risk assessment – invasive species. Should we bring risk assessment into the control or no control options. Action or No Action.
- T&E species - concerns on older chemistries related to non-target organisms.  
concerns on new chemistries related to non-target plants.

Field exposures related to realistic use patterns and realistic exposures. Need to better relate this toxicity information.

- Adjuvants and surfactants or formulated product – are there toxicity concerns ?  
Glyphosate Roundup study (significant impact on aquatic communities).
- How to better inform public on the issues (both chemical toxicity and invasive plant control strategies).

CHALLENGE – How do you develop a national strategy given the different objectives and problems in different regions of the country.

Tyler - Develop a suite of non-target species for evaluation on a regional basis.

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**What benefit would additional work in these areas provide to managers?**

Additional research in these areas would facilitate management decisions, help address concerns about non-target effects, and increase the effectiveness of control strategies by

reducing delays in implementation associated with multi-jurisdictional approvals and litigation.

**What are the obstacles to accomplishing this work?**

Funding, a lack of consensus about objectives and concerns, and lack of interest or mandate on the part of scientists to reach out to the general public are the greatest obstacles to effectively dealing with invasive aquatic plants and associated concerns.

**What suggestions would help overcome these obstacles?**

Funding and education of the public are the greatest needs. Whereas the former is a given in all research forums, the latter is frequently overlooked or not emphasized sufficiently. As scientists, we can no longer view our jobs as ending with publication in the peer-reviewed literature, but will have to participate in facilitating public understanding of the issues and available information. To this end, we need to embrace citizen science and actively participate in educating and training the general public (including K-12) so that they can assist with data collection and monitoring, and gain a better understanding of management issues. A well-informed public and electorate (local or national) is our best hope for effectively controlling the spread of exotics.

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Development of new tools and proper screening techniques.

Need to improve methods to disseminate information on invasive and management alternatives to the “dumb public” and informed public.

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**Adjuvants and Formulations:**

What is the Benefit: Data to demonstrate adjuvant or formulation provides a tangible difference.

What are the obstacles : Funding and lack of Federal regulation.

Adjuvants are understudied in submersed plant control.

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Management philosophies:

Are we managing for the right reasons. We often manage because of the law.

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**Invasive Plant Management: Chemical Control, Herbicide Technology and Non-target Effects** – Kurt Getsinger, Chair

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My comments primarily come from within the context of issues surrounding use of chemical controls within habitats occupied by endangered species, specifically salmon in the Pacific Northwest. Constraints (real or potential) on the use of aquatic herbicides come from three primary fronts: the conservative approach to assessing hazard employed by resource management/regulatory agencies responsible for protecting endangered species; the attentive public that is well-meaning, but frequently not well informed; and advocacy groups focused on reducing/eliminating use of chemicals in the environment. While all may have the best interests of the resource at heart, constraints on the use of appropriate and effective control strategies may interfere with or impede control efforts and therefore, conservation efforts. As such, it is difficult to maintain an effective “tool box” within Integrated Pest Management strategies. Should constraints be realized through litigation, science is frequently a bystander.

Efforts to address environmental concerns (including human health) are complicated by requests to prove a negative, i.e., chemical use will not adversely affect particular organisms directly or indirectly through chemical induced changes in their environment. The number of studies and resulting data are never sufficient (or ever going to be) to address the myriad of potential questions or concerns. Additionally, sources of available data may be perceived as biased based on affiliation (employment or funding source). Even within agencies, mandates, missions and agendas may conflict, leaving the attentive public confused, opening avenues for litigation by advocacy groups, and influencing funding decisions. This may lead to inaction allowing the invasive aquatic plant problem to get worse, and making control more difficult, expensive, and requiring greater use of chemicals.

Besides concerns associated with chemical control, a general lack of knowledge of the affected wetland systems themselves and scientific justification for control targets (management vs eradication) further complicate implementation of effective control strategies. In some cases, concerns over non-target effects are focused on another invasive aquatic species because of the potential benefits of the latter to species of concern (e.g., exotic eelgrass or smooth cordgrass and salmonids in the Pacific Northwest). Such concerns have in some cases (at least temporarily) outweighed protection of affected habitats (e.g., tidal mudflats). Although within a regulatory framework, a “weight of evidence” approach is frequently taken, such an approach is often difficult within the conservative mandates of conservation legislation (e.g., ESA) or litigation. Given funding realities, the best we can hope for is to be able to provide timely information that can be used in the decision-making process with the hope that a “weight of evidence” approach will be embraced.

### **What areas have been overlooked or understudied?**

My research has focused on the efficacy of control strategies and non-target effects of herbicides (active ingredients, formulated products, and tank mixes [end products]) on salmonids. The latter is particularly important in the Pacific Northwest (including northern California) where many runs of salmon are ESA listed. Most toxicity data are for active ingredients. However, our studies (and those of others) indicate that adjuvants can dictate the toxicity of formulated products and resulting tank mixes. This is complicated from a regulatory standpoint because active ingredients and adjuvants (e.g., surfactants) are regulated under different legislative authorities (FIRFA vs TSCA). Recent rulings by the 9<sup>th</sup> Circuit Court of Appeals complicate matters further by involving the Clean Water Act as well. Irrespective of federal regulations, states can incorporate data on “other ingredients” as part of their permitting processes (e.g., California and Washington). The European Union and member states have already moved in this direction. The availability of data on non-target toxicity will continue to control the permitting process.

Equally important are assessments of exposure in the field without which hazard assessments (and risk assessments) are not possible. Characterization of exposure (temporal and spatial) is critical and often effects data are collected in the laboratory

without a good understanding of exposure. Exposure characterizations should guide effects studies in the laboratory or the field.

We need to ensure that monitoring data are collected to verify the effectiveness of control strategies and address concerns about non-target effects. These efforts need to be well designed so that the most essential data are collected and collected properly.

We also need to scientifically determine targets for control when eradication is not the goal. This may be more relevant to “aquatic weeds” vs invasives. Managers are frequently faced with balancing user needs, e.g., boating vs fish habitat. What should be the spatial coverage and distribution of aquatic plants to provide for boating, fishing, and habitat for aquatic species other than game fish?

And finally, we need to facilitate the dissemination of this information to the general public (at least to the attentive public) and get the public directly involved. In Washington State, we are actively investigating the potential role(s) of citizen science (including K-12) in natural resource conservation.