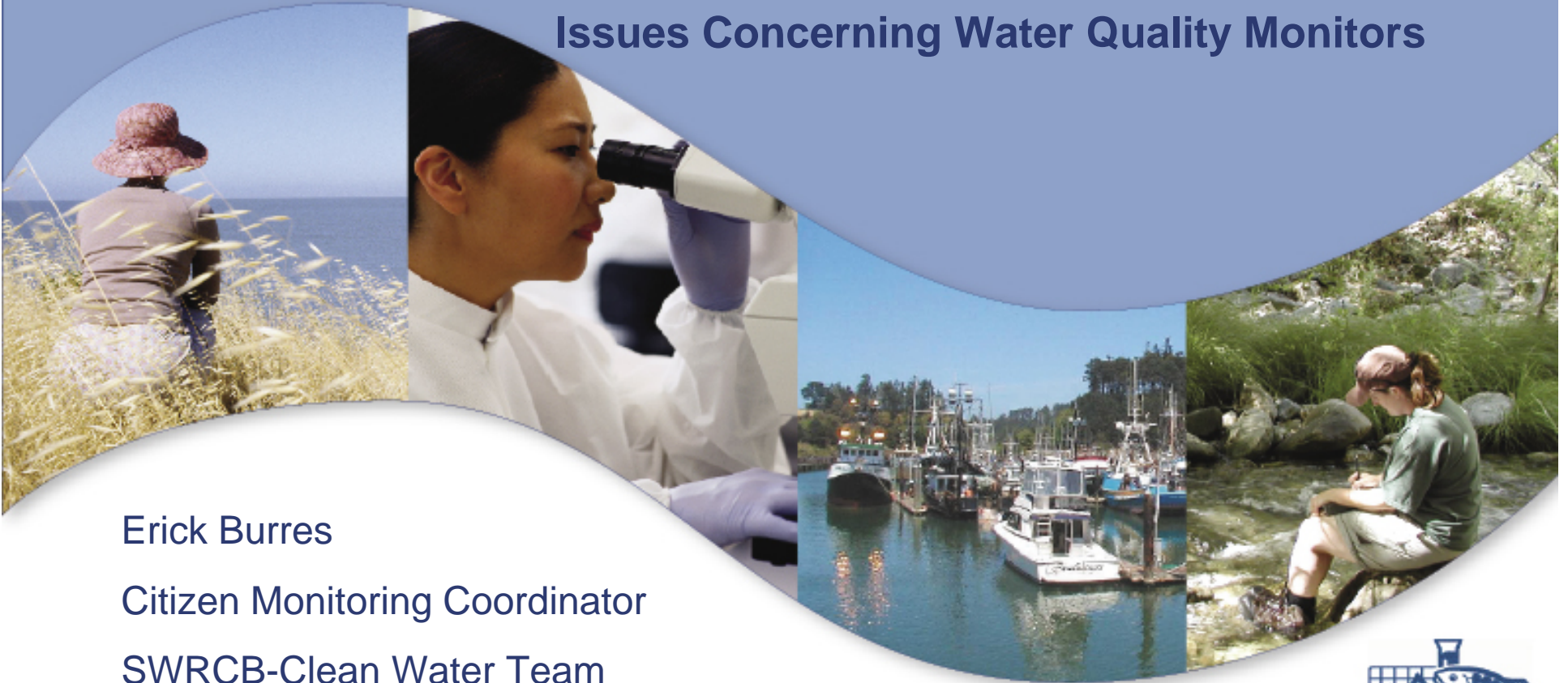


California's Surface Water Ambient Monitoring Program

Aquatic Invasive Species: Issues Concerning Water Quality Monitors



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Agenda:



This Webinar will present Aquatic Invasive Species (AIS) information for those involved with water quality monitoring activities and concentrating on freshwater.

- What are AIS?
- What harm can AIS cause?
- AIS Prevention planning (HACPP's)
- Profiles of some AIS species of interest
- Provide examples of some decontamination techniques
- Highlight useful Web-based resources



What are Aquatic Invasive Species

AIS are plants, animals or disease agents; with respect to a particular ecosystem that is not found in the ecosystem and whose presence in the environment causes economic or environmental harm or harm to human health.

Based on Invasive Species Laws and Regulations- Executive Order 13112 (Federal)

AIS are also known as, but not limited to: Exotic Species, Alien Species, Invasive Organisms, Noxious Species, Naturalized Species, and Non-indigenous Aquatic Species or Non-Native Species).



Pests

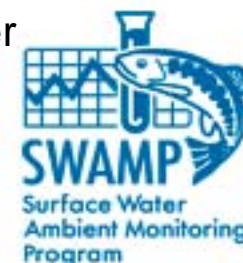
California Food and Agricultural Code 12754.5.

"**Pest**" means any of the following that is, or is liable to become, dangerous or detrimental to the agricultural or **nonagricultural environment** of the state: (a) Any insect, predatory animal, rodent, nematode, or weed. (b) Any form of terrestrial, aquatic, or aerial plant or animal, virus, fungus, bacteria, or other microorganism (except viruses, fungi, bacteria, or other microorganisms on or in living man or other living animals). (c) anything that the director, by regulation, declares to be a pest.

Code of Federal Regulation, Title 40: Protection of Environment 152.5 Pests.

An organism is declared to be a pest under circumstances that make it deleterious to man or the environment, if it is:

- (a) Any vertebrate animal other than man;
- (b) Any invertebrate animal, including but not limited to, any insect, other arthropod, nematode, or mollusk such as a slug and snail, but excluding any internal parasite of living man or other living animals;
- (c) Any plant growing where not wanted, including any moss, alga, liverwort, or other plant of any higher order, and any plant part such as a root; or
- (d) Any fungus, bacterium, virus, or other microorganism, except for those on or in living man or other living animals and those on or in processed food or processed animal feed,



Additional Regulations Affecting AIS

➤ SWRCB

- Set water quality objectives in Water Quality Control Plans
http://www.waterboards.ca.gov/plans_policies/
- 303(d) list (impaired waterbodies list) –24 waterbodies were listed in 2006 as impaired by exotic species
http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/303dlists2006/epa/r3_06_303d_regtmdls.pdf
 - The Role of Aquatic Invasive Species in State Listing of Impaired Waters and the TMDL Program *Seven Case Studies* The Environmental Law Institute® May 2008
http://www.elistore.org/reports_detail.asp?ID=11298
- Total Maximum Daily Loads (TMDL's) http://www.waterboards.ca.gov/water_issues/programs/tmdl/

➤ DFG -Prohibited species, releases, transfers

- Fish and Game Code http://www.leginfo.ca.gov/html/fgc_table_of_contents.html
- CCR Title 14 <http://www.ciwmb.ca.gov/Regulations/Title14/>

➤ DFA -Noxious weeds list <http://plants.usda.gov/java/noxious?rptType=State&statefips=06>

- **USDA Ag Library: Public Laws and Acts**-Provides information pertaining to public laws and acts for invasive species, listed with the most recent first. <http://www.invasivespeciesinfo.gov/laws/publiclaws.shtml>



AIS Impacts

The effects of invasive species can be seen in declining wildlife and plant populations, loss of economically important resources, and impacts to human health.



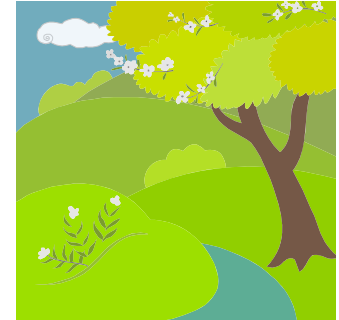
AIS Impacts: Ecological

- Over 40% of the species listed as threatened or endangered in the US (ESA) are at risk in part or due to invasive species.
- Invasive species have become the single greatest threat to NWRs, causing widespread habitat degradation, competition with native species and contributing significantly to the decline of trust species (USFWS 2001).
- Elimination or degradation of plankton by non-native bivalves (Asian clam, zebra mussel...). (Pothoven et al. 2001 and Cloern 1996)
- Zoonoses such as chytrid fungus have lead to the decline or extinction of some frog populations.
- AIS plants such as purple loosestrife and phragmites have overtaken wetlands resulting in a loose of biological diversity.
- Altered food chains such as the San Francisco Bay where over 230 AIS have been documented (USDI-USGS 2002).



AIS Impacts: Hydrology & Habitat

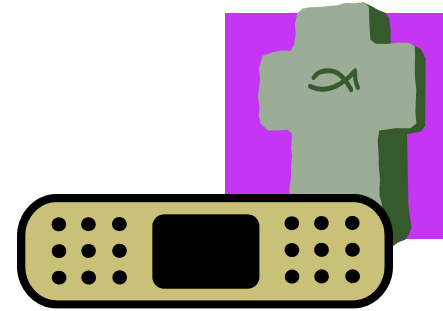
Invasive species in the watershed can have significant effects on water quality and ecosystem health due to the ways they affect bank stability and the volume and pollution levels in runoff.



- Short rooted plants promote erosion (non-native grasses, arundo..)
- Burrowing animals can cause stream banks and levees to fail (European green crab...)
- Aquatic weeds can reduce dissolved oxygen levels (ANSTF)
- Invasive plants can change nitrogen levels in the soil (Corbin and D'Antonio 2004)
- Some AIS plants have created/promoted a fire regime which can increase erosion and stream sedimentation.
- Allelochemicals can be added to the soil by invasive plants.
- Water levels of some waterbodies have been seen to be reduced by invasive species (tamarisk...).
- Localized infestations of some AIS (New Zealand mud snails, zebra mussel..) has reduced the amount of habitat available to native benthic invertebrates.
- *Didymosphenia geminata* silica stalks trap sediment which increases embeddedness.



AIS Impacts: Human Health



- West Nile virus, an invasive species transmitted by mosquitoes to wildlife, livestock and people had by the end of 2002 caused the death of over 16,000 birds and 14,000 horses. It also resulted in nearly 3,000 human encephalitis cases including 284 deaths.
- Some AIS plants such as wild parsnip and nettle causes skin lesions and rashes.
- The dinoflagellate *Pfiesteria* (CDC 1997) can cause memory loss, confusion, skin/eye irritation, respiratory irritation, and/or gastrointestinal complaints.



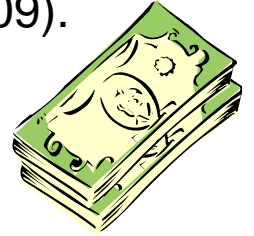
AIS Impacts- Financial

- In a recent study it was shown that total use and indirect use impacts by invasive species in the US costs \$143 billion annually (Cusak et al. 2009).

http://www.oregon.gov/OISC/docs/pdf/economics_invasive.pdf

- A previous study estimated that the associated costs in the US due to invasive species is \$137 billion annually (Pimentel et al. 2000).

<http://sgnis.org/publicat/proceed/aide/pime2003.htm>



- A study in the early 1990's reported approximately \$97 billion in damages from 79 exotic species during the period 1906-1991.

- AIS control, reduction and/or elimination programs can cost state and local communities millions and possible billions of dollars per effected waterbody.

- Aquatic invasive plants (Eurasian milfoil, water hyacinth, frogbit...) have caused serious impacts to boating ways and swimming areas.

- Drinking water infrastructure has been impacted by clogs and maintenance draw downs due to zebra and quagga mussels.

- Shipworms, *Teredo navalis*, have caused damages estimated at \$200 million/year (Cohen and Carlton 1995).

<http://www.invasivespeciesinfo.gov/aquatics/economic.shtml>



AIS Programs: Global



- **International Union for the Concern of Nature (IUCN): Invasive Species Specialist Group (ISSG)-**

Aims to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them. <http://www.issg.org/>

- **Global Invasion Species Program** is an international partnership dedicated to addressing the global threat of invasive species. <http://www.gisp.org/index.asp>



AIS Programs: North America



➤ **The 100th Meridian Initiative** is a cooperative effort between state, provincial, and federal agencies to prevent the westward spread of zebra mussels and other aquatic nuisance species in North America.

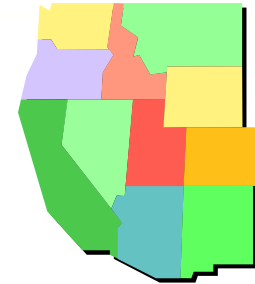
<http://www.100thmeridian.org>

➤ **Commission for Environmental Cooperation's Closing the Pathways of Aquatic Invasive Species across North America** seeks to protect North America's marine and aquatic ecosystems from the effects of aquatic invasive species. The initiative will assist the development of a North American approach to prevention and control aimed at eliminating pathways for the introduction of invasive species among the coastal and fresh waters of Canada, Mexico and the United States.

http://www.cec.org/programs_projects/conserv_biodiv/project/index.cfm?projectID=20&varlan=english



AIS Programs: Western US



- **The West Coast Ballast Outreach Project** works collaboratively with partnering organizations throughout the West Coast and Pacific Basin in the development of outreach programs and tools to manage aquatic invasive species (AIS) and ballast water issues. <http://ballast-outreach-ucsgep.ucdavis.edu/>
- **Western Regional Panel on Aquatic Nuisance Species** has the opportunity to protect its financial and ecological resources from invasive nuisance species. A rapid, coordinated response on the part of affected public and private entities from North Dakota to Guam and Alaska to Texas will ensure that the introduction, spread and impacts of aquatic nuisance species are limited. To facilitate this coordinated response, a provision calling for the formation of the Western Regional Panel on Aquatic Nuisance Species (WRP) was included in the National Invasive Species Act of 1996 (P.L. 101-636) which amended the 1990 Act. <http://www.fws.gov/answest/aboutus.htm>



AIS Programs: California



- **Invasive Species Council of California (ISSC)** represents the highest level of leadership and authority in state government regarding invasive species. The ISSC is an inter-agency council that helps to coordinate and ensure complementary, cost-efficient, environmentally sound and effective state activities regarding invasive species. <http://www.iscc.ca.gov/>
- **California Invasive Species Advisory Committee** advises the ISSC and develops recommendations. The **CISAC** will provide its advice based upon input from and cooperation with other stakeholders and existing organizations addressing invasive species issues. <http://www.iscc.ca.gov/cisac.html>
- The **Department of Fish and Game's Invasive Species Program** has a mission to reduce the negative effects of non-native invasive species on the wildlands and waterways of California. <http://www.dfg.ca.gov/invasives/>
- The **State Lands Commission's California Marine Invasive Species Program** is charged with preventing or minimizing the introduction of nonindigenous species to California Waters from commercial vessel. http://www.slc.ca.gov/Spec_Pub/MFD/Ballast_Water/Ballast_Water_Default.html



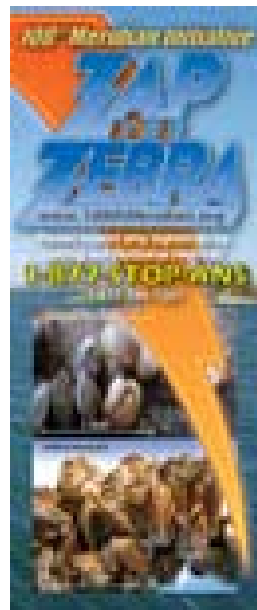
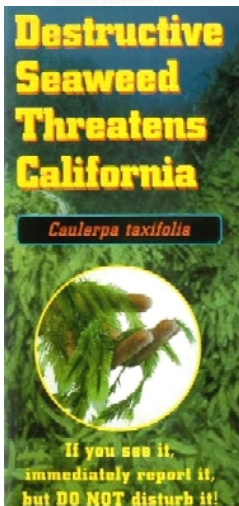
Vectors of Invasion

AIS and potential AIS species can be spread in many ways:

- Ballast
- Boats and trailers
- Wheeled vehicles
- Airplanes
- Cargo and mail
- Prices increases to agricultural and forest products due to invasive species impacts and control/elimination programs.
- Water diversions
- Aerial deposition during fire fighting actions)
- Fishing equipment (including waders..)
- Hiking boots
- Livestock
- Bait
- And more...



AIS Prevention Outreach



DON'T RELEASE A PEST
Freezing is Best!

BE A RESPONSIBLE AQUARIUM HOBBYIST!
Look INSIDE FOR: ALTERNATIVES TO DUMPING
AQUARIUM PLANTS AND PETS

DUMPING AQUARIUM PLANTS AND PETS IS ENDANGERING MARINE ECOSYSTEMS

YOU CAN HELP PREVENT FUTURE PROBLEMS

FOR MORE INFORMATION AND TO DOWNLOAD A COPY OF THIS BROCHURE GO TO:
<http://www.usc.edu/org/5/aggrant/tequidistance.html>

'thistle' ruin your day...

Bull thistle (*Cirsium vulgare*)
Scotch thistle (*Onopordum acanthium*)

Monday 2 Tuesday

California Invasive Weeds Awareness Week



STOP the spread of noxious weeds!

Weed seeds and plant parts can become lodged in tires, shoes, clothing, nets, and camping gear. They can fall out anywhere and start a new infestation.

HELP
By checking your tires, clothing, nets, and gear for these pesky hitch-hikers, and dispose of them securely in the trash.

YOU CAN HELP SAVE OUR LANDS

San Diego County Invasive Weeds 2007 Team
Honey Lake Valley NCO

Do we know which species are AIS and where are they?

Due to the predictive nature and lack of data regarding AIS, all activity in surface water should be treated with respect towards AIS so that species are not introduced from one water.

The list of known Aquatic Invasive Species continues to grow. The presence of an AIS usually does not occur until they have become established. There are several programs for reporting and querying presence information on certain AIS.

Unfortunately as of yet we cannot predict which foreign species may become AIS species but we can learn which species are AIS in other area.

Many AIS display a different ecology that within their native ranges, *Caulerpa taxifolia* and *Didymosphenia geminata* are probably the best examples of this.



AIS Maps, Queries and Reporting

- **CitSci.org** is an [invasive species mapping program](#) that allows citizens, school groups, agencies and professionals to enter invasive species observations into a global database

- **USGS NAS** - [Nonindigenous Aquatic Species](#)
Search by - State or by Major Drainage Area (using a hydrologic unit code) - HUC2, HUC6, HUC8

- **Montana State University** - [Map of New Zealand Infested Mudsnail Areas](#)

- **CA Dept. of Fish & Game: Invasive Species Program**
 - [Maps of Quagga and Zebra Mussel Infested and Undetected Areas](#)
 - [How should I report a sighting of an invasive species?](#)
 - OSPR - The [Marine Invasive Species Program](#) is a multi-agency effort to control the introduction on Non-Indigenous Species (NIS) from the ballast of ocean-going vessels. Data from the monitoring effort must be posted to the internet and updated on an annual basis.

- **USGS** - [Sighting Report Form](#)



See SWAMP AIS Webpages for links

AIS Species Profiles: Chytrid fungi



http://civr.ucr.edu/chytrid_fungus.html

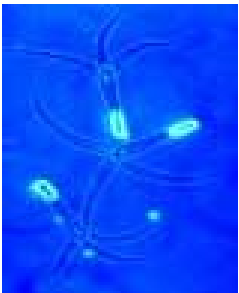


Chytrid fungi, *Batrachochytrium dendrobatidis* (Bd) travel easily in water and on damp materials, as well as on amphibians themselves. Dead and dying frogs generally have disorders of the epidermis, and often exhibit behavioral changes such as lethargy and loss of righting reflex. Chytrid zoosporangia live in the heavily keratinized stratum corneum and stratum granulosum of the frogs' pelvic patch, digits, and ventral body, and in the keratinized mouthparts of tadpoles. Associated epidermal changes included irregular cell loss, hyperkeratosis, and excessive sloughing of the skin. Infected frogs begin to die roughly 21 days post-infection, and though larvae are susceptible to infection, deaths are generally restricted to metamorphosed individuals (this is because larvae do not have much keratin).



AIS Species Profiles: Fish Diseases

- **Whirling Disease:** Whirling disease is a parasitic infection caused by the non-native microscopic parasite, *Myxobolus cerebralis*. By damaging cartilage, whirling disease can kill young fish directly, or cause infected fish to swim in an uncontrolled whirling motion. When an infected fish dies, millions of tiny indestructible Mc spores (each about the size of a red blood cell) are released to the water where they can survive in this “dormant” form for up to 30 years. Whirling disease is most infective to rainbow and cutthroat trout, but can infect all salmonid species.
- **Ceratomyxa** (possible eastern US origin) has been a major mortality of salmon in Klamath River. Clinical indications of infection include lethargy loss of body mass, darkening of the skin amongst other symptoms. Internally the infection affects entire digestive tract, liver, gall bladder, kidney, heart, gills and muscle tissue. Infection in adult Chinook/king salmon causes mortality through intestinal perforations and co-occurring bacterial infections.
- **Viral Hemorrhagic Septicemia (VHS):** VHS causes, Hemorrhaging (bleeding), bulging eyes, unusual behavior, anemia, and bloated abdomens.



<http://dnr.wi.gov/fish/vhs/vhsfacts.html>



AIS Species Profiles: Didymo

Didymo, *Didymosphenia geminata*, also known as 'rock snot' is a diatom. It can smother entire stream beds with mats as thick as eight inches and can ruin just about any river or creek.



FIGURE 18. Stalks of *D. geminata* clog a grate in a water supply canal in California (Image by Peter Pryfogle, Idaho National Laboratory).

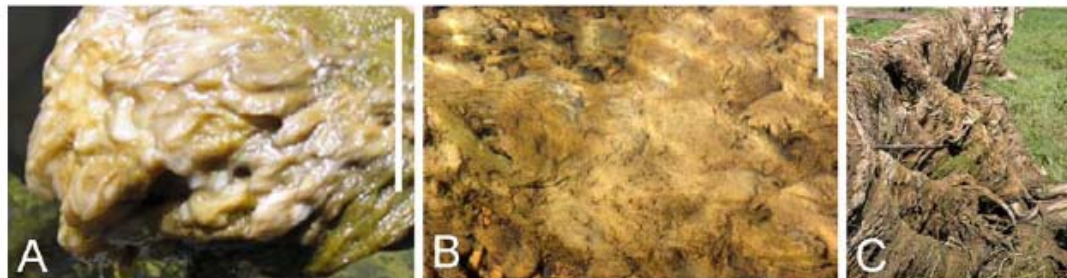


FIGURE 2. A. Stream cobble covered with *D. geminata* and stalks 5 cm thick. Scale bar equal to approximately 10 cm. B. Streambed covered with *D. geminata*. Note that rocks and cobbles are hardly visible. Scale bar equal to approx. 10 cm. C. Dried stalks on docks. (Images by Erica Shelby, Arkansas Department of Environmental Quality).



AIS Species Profiles: Terrestrial Plants

- **Perennial pepperweed**, *Lepidium latifolium*, invades wetland perimeters, riparian areas, salt marshes and other habitats. It has interfered with the regeneration of cottonwoods and willows.
- **Cheatgrass**, *Bromus tectorum*, has increased the occurrence of fires from a 60-110 year frequency to a frequency of just 3-5 years. The increase of fires is a burden on our watersheds.
- **Giant reed** (*Arundo donax*) chokes riversides and stream channels, crowds out native plants, interferes with flood control, increases fire potential, and reduces habitat for wildlife, including the Least Bell's vireo, a federally endangered bird. The long, fibrous, interconnecting root mats of giant reed form a framework for debris dams behind bridges, culverts, and other structures that lead to damage. It ignites easily and can create intense fires.



<http://www.nps.gov/plants/ALIEN/fact/le1a1.htm>
http://www.wm.edu/academic/nspaces2/qjiaflora/arundo_donax.jpg

ALS Species Profiles: Freshwater Aquatic Plants

- **Eurasian water-milfoil** (*Myriophyllum spicatum*) is a submerged, rooted perennial plant. It has long underwater stems with finely-divided leaves that float near the surface. The species often occurs in high abundance and replaces native plant species. Rapid colonization can result not only in the disruption of native plant communities but also can change the substrate, water flow patterns and invertebrate communities of an aquatic ecosystem.
- **Parrot feather** (*Myriophyllum aquaticum*) is another ornamental aquatic plant that has escaped cultivation. Infestations can alter aquatic ecosystems. It forms dense mats that shade out other native aquatic plants, inhibits water flow, and recreational activities.



AIS Species Profiles: Smooth Cordgrass



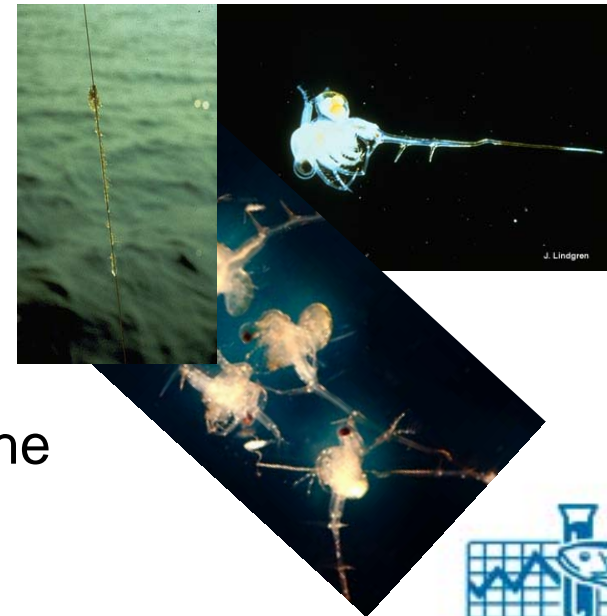
Smooth Cordgrass, *Spartina alterniflora*, transform productive mudflats and eelgrass beds into marshy areas, trapping sediments, changing the elevation of the landscape and displacing native animals and plants. Migrating shorebirds lose critical feeding areas along the Pacific Flyway.



AIS Species Profiles: *Zooplankton*



- ***Pseudodiaptomus inopinus*** one of several non-native species of marine/estuarine zooplankton. The extent and ecological effects of this invasion are unknown.
- **Spiny** and **Fish-hook water fleas** both species have high reproductive rates and can build a very large population in a short amount of time. Since water fleas primarily feed on zooplankton, scientists are worried that high populations of these two water fleas will lead to a depletion of the zooplankton population.



http://www.in.gov/dnr/files/spiny_and_fishhook_water_flea.pdf

AIS Species Profiles: New Zealand Mudsnail

The **New Zealand Mudsnail** (NZMS) often reaches densities greater than 100,000/m² in suitable habitat and has been reported to approach densities as high as 750,000/m². They have no natural predators so their rapid reproductive rate overwhelms river environments and consumes a river's productivity. The negative impact is on mayflies, stoneflies, caddis flies and some midges and from there the entire food chain.



<http://mudsnails.com/>



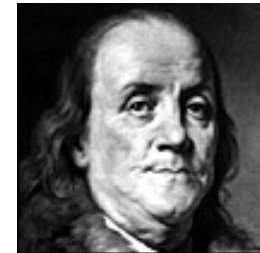
AIS Species Profiles: Eurasian Mussels and Asian Clam

- **Zebra mussels** (*Dreissena polymorpha*) and **Quagga mussels** (*Dreissena rostriformis bugensis*) are collectively known as Eurasian or Dreissenid Mussels. They are small freshwater mollusks. Quagga/Zebra mussels will upset the food chain by consuming phytoplankton that other species need to survive. They are filter feeders that consume large portions of the microscopic plants and animals that form the base of the food web. Their consumption of significant amounts of phytoplankton from the water decreases zooplankton and can cause a shift in native species and a disruption of the ecological balance of entire bodies of water. In addition, they can displace native species, further upsetting the natural food web.
- **Asian clam**, *Corbicula fluminea*, are filter feeders that remove particles from the water column. They can be found at the sediment surface or slightly buried. The ability to reproduce rapidly coupled with low tolerance of cold temperatures can produce wild swings in population sizes from year to year in northern water bodies. It has also been documented to cause problems in irrigation canals and pipes and drinking water supplies. It also alters benthic substrates and competes with native species



AIS Prevention Planning

An ounce of prevention is worth a pound of cure.



<http://www.tchd.org/benfranklin.htm>

Prevention is the First Line of Defense Against AIS

Prevention – Actions taken to prevent the introduction and spread of AIS

Control – Actions taken to reduce the spread of AIS

Exclusion – Actions taken to keep an AIS within a specific area

Eradication – Actions taken to remove an AIS



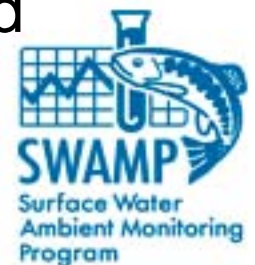
Introduction to HACCPs

HACCP Definition:

Hazard Analysis and Critical Control Point

Water Quality Monitoring Projects...

- Need to have a policy and procedure in place to deal with AIS concern.
- The procedures must be robust enough to work for a wide variety of monitoring activities.
- Need to have records indicating that the policies and procedures are being followed.
- Must verify that policies and procedure work.



HACCP Approach



- HACCP is preventive, not reactionary.
- Concentrates on the points in the process that are critical to the safety of the water.
- Stresses communication.
- Is not a zero risk system, but minimizes risk



The Seven Principles of HACCP

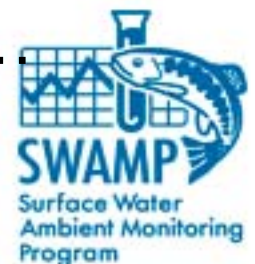
1. Conduct hazard analysis
2. Identify critical control points (CCP)
3. Establish control measures
4. Monitor each CCP
5. Establish corrective action to be taken when a problem occurs
6. Verify that the HACCP plan and Control Measures work
7. Establish a record-keeping system

This and the following HACCP slides are from Sea Grant AIS-HACCP training curricula 2004.



Potential Hazards

1. AIS Fish and Vertebrates- Exotic gobies...
2. AIS Invertebrates- Zebra mussels, New Zealand mudsnail, spiny and fish hook water fleas...
3. AIS Plants- Eurasian water milfoil, knapweed, didymo..
4. AIS Diseases- Whirling disease, heterosporis...



Step 1 General Project Information

Product/Procedure Description

Organization Info	Organization name:
	Address: City: State: Zip:
(If applicable):	Fish species:
Harvest, production, management, research, or enforcement activity:	Activity:
Method of transportation, distribution and storage of fish, gear, boats, etc.:	Methods:
(If applicable):	Intended use and consumer:

Step 2 Develop a Flow Chart

Product/Procedure Flow

List the steps involved in the research, management, enforcement, or fish production activity. Only a simple, but complete, description of the procedure is needed. It is important to include all the steps within the control of the agency or business, but use only as many steps as necessary to define your procedure.

①
②
③
④
⑤
⑥
⑦
⑧
⑨
⑩
⑪
⑫

Next Steps...
Once you have defined your procedure, determine potential hazards by completing the potential hazards worksheet.

Product/Procedure Flow	
①	Agency biologists launch their research boat on Lake Ono and conduct fish sampling using a standard trawl net at two offshore stations.
②	After those two sampling runs, boat is trailered to another lake where they sample fish with trawls. The journey between the two lakes takes approximately 2 hours.
③	Fish sampling efforts are continued on the second lake, Lake Bono, with the same type of trawl net at two different locations.
④	After the 2 sampling sessions, the boat is driven back to the original on-land secure storage facility.
⑤	
⑥	
⑦	
⑧	
⑨	

Step 3 Complete Hazard Analysis Worksheet

AIS-HACCP

Aquatic Invasive Species – Hazard Analysis and Critical Control Point

Hazard Analysis Worksheet

Critical Control Point (CCP) is a point, step or procedure at which controls can be applied and a AIS hazard can be prevented, eliminated or reduced to acceptable (critical) levels

1 Activity	2 Hazards	3	4 Justification	5 Control	6 CCP
Activity, Harvest or Aquaculture Step (from flow diagram)	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)

Work Flow Step <input type="radio"/>	Fish/Other Vert.				
	Invertebrate				
	Plant				
	Pathogens				

AIS-HACCP SAMPLE PLAN ONE
Aquatic Invasive Species – Hazard Analysis and Critical Control Point Hazard Analysis Worksheet

1 Activity	2 Hazards	3	4 Justification	5 Control	6 CCP
Activity, Harvest or Aquaculture Step (from flow diagram)	Potential AIS hazards introduced or controlled at this step (from potential hazards worksheet)	Are AIS hazards significant? (Yes/No)	Justify your decisions for column 3.	What control measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/No)

Work Flow Step <input checked="" type="radio"/>	Fish/Other Vert.				
The research boat is trailered to Lake Bono. The over-land journey takes approximately 2 hours. Once they arrive at the second lake they continue the fish sampling efforts		No	No AIS fish are in Lake Bono.		No
	Invertebrate <i>Cercopagis pengoi</i>	Yes	Adults & eggs could be on nets and other collecting equipment, the anchor and boat.	Nets, equipment, and the boat can be washed and/or treated to remove or kill the hazard.	Yes
	Plant Eurasian Watermilfoil (EWM)	No	EWM has been in Lake Bono for 8 years.		No
	Pathogens	No	AIS Pathogens not present		No

Step 4 Complete HACCP Plan Form

AIS-HACCP

Aquatic Invasive Species – Hazard Analysis and Critical Control Point

AIS-HAACP Plan Form

Critical Control Point Each row answered "yes" in column 6 on the Hazard Analysis Form Significant Hazards as determined in column 3 of the Hazard Analysis Form Limits for each control measure	1		
	2		
	3		
Monitoring Describe what is being monitored Explain how the monitoring will take place Frequency of monitoring Person or position responsible for monitoring	4		
	5		
	6		
	7		
Corrective Actions Actions taken when limits of control measures are not met Verification Method of Verification	8		
	9		
Records List what is recorded at each critical control point	10		

AIS-HACCP SAMPLE PLAN ONE

Aquatic Invasive Species – Hazard Analysis and Critical Control Point

AIS-HAACP Plan Form

Critical Control Point Each row answered "yes" in column 6 on the Hazard Analysis Form Significant Hazards as determined in column 3 of the Hazard Analysis Form Limits for each control measure	1	The research boat is trailered to a second lake. The overland journey takes approximately 2 hours. Once they arrive at the second lake they continue the fish sampling efforts at two locations	After the 2 sampling sessions, the boat is driven back to the agency's secure, on-land storage facility
	2	<i>Cercopagis pengoi</i> is present in Lake Ono. It could be transported from there to uninfested lakes.	Nets and collecting gear could have Eurasian watermilfoil attached which could be released into an un-infested lake.
	3	No live adults or resting eggs left on boats or equipment. Boats and equipment are washed with high pressure hoses, nets are tagged and only used in infested waters	No viable Eurasian watermilfoil left on boats or equipment or boats and equipment tagged and only used on EWM infested waters or dried for 10 days.
Monitoring Describe what is being monitored Explain how the monitoring will take place Frequency of monitoring Person or position responsible for monitoring	4	Presence of adult <i>C. p.</i> or eggs. Ensure that the boat and all equipment is power washed and nets tagged for use in infested waters only are not brought to Lake Ono.	Presence of EWM. Monitor that boat and all equipment have been sufficiently power washed, properly tagged, or dried for 10 days
	5	Visual inspection for adults. Visually inspect tag on nets. Visually inspect boats for any debris that could indicate power washing was not effective.	Visual inspection for EWM fragments. Visually inspect nets and equipment for appropriate tags.
	6	Each time boat and equipment are used in Lake Ono.	Each time equipment is used in EWM infested lake.
	7	Staff	Staff
Corrective Actions Actions taken when limits of control measures are not met Verification Method of Verification	8	Cease operation and secure clean AIS-free nets, boats, or equipment before proceeding	Cease operation and secure clean AIS-free nets, boats, or equipment before proceeding
	9	Records review.	Records review.
Records List what is recorded at each critical control point	10	Record washing, drying, or treatment procedures used on boats and gear. Record that nets were inspected for a tag prior to trawling.	Record washing, drying, or treatment procedures used on nets and gear. Record that nets were inspected for proper tags prior to employee leaving the storage facility at the end of the day.

HACCP Plan Implementation

- Maintain Records
 - Checklists of HACCP action done during each activity day.
 - Field staff training AIS/HACCP records

- Update HACCP
 - As new equipment is used
 - When new decontamination are used
 - When new AIS threats emerge



AIS Decontamination Introduction

Some Definitions

Hygiene- Refers to a set of practices associated with the preservation of health.

Clean- Removal of dirt, debris...

Disinfect- Cleaning an article of some or all of the pathogenic organisms which may cause disease.

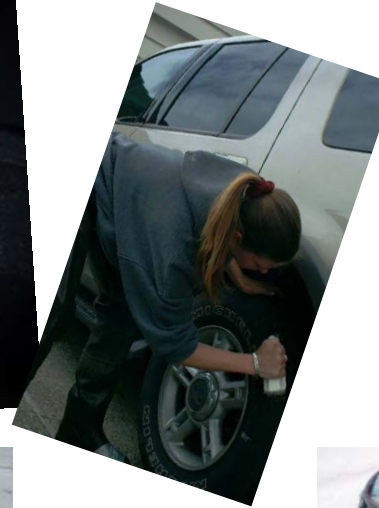
Sterilize- Using a process to effectively kill or eliminate transmissible agents (spores, bacteria, viruses...) from a surface, equipment...



Equipment for Treating and Scrubbing Gear

Rinse all mud and debris from equipment and wading gear

- Containers for scrubbing and soaking gear
- Brushes
- Weights
- Water containers
- PPE (gloves, goggles) & MSDS
- Decon. chemicals
- Dry bags can also be used for soaking gear



Equipment for Treating and Scrubbing Gear

ALWAYS remove and rinse all mud and debris from equipment and wading gear.



<http://www.usu.edu/weeds/management/prevention.html>



http://www.automedia.com/Wheel_and_Tire_Clean-Up/ccr20030501wt/1



California Center for Amphibian Disease Control



Freezing



New Zealand Mudsnail:
freeze waders and other gear
overnight (at least 6 hours).



Heating

- **Whirling Disease:** water heated to nearly boiling (200 degrees F) poured over your gear and allowed to cool.
- **NZMS:** Give your gear a **hot water bath (120 -130°F)** for at least five minutes. Not recommended for Gor-Tex ®
- **Didymo** can be killed by submersion in water heated to 140°F for 1 minute or 20 minutes at 113°F.
- For other AIS it has been recommended that using steam on an area to be treated for 3 minutes will be sufficient to kill AIS.



Chlorine

- **Chytrid Fungus:** Decontaminate all equipment using a 5% bleach solution and **soak for 2 minutes in the sterilizing solution!**
- **Whirling Disease:** Chlorine (regular household bleach) is a very effective disinfectant, and one of the few that can kill all stages of the parasite if used at the proper concentration. However, chlorine is a very strong chemical and can harm your equipment with prolonged exposure, so make sure you rinse the chlorine off your waders and other equipment after you disinfect, and dry in the shade.
 - *To kill the TAM stage*, use 1 part chlorine to 32 parts water. It must **stay in contact for about 10 seconds** to assure disinfection.
 - *To kill the mature myxospore* that may be found in the mud from an infected stream is much more difficult and hard on equipment. 50% solution (1 part chlorine to 1 part water) - dip waders into a solution of the bleach or wipe or spray on. 10% solution (1 part chlorine to 9 parts water) and **soak your equipment for 10 minutes.**

Rinse all gear free of chlorine before using.

Suggestion: Use dry chlorine.



Spraying

New Zealand Mudsnaill:

- Using copper sulfate Solution 252 mg/L (dissolve 3.785 grams of copper sulfate pentahydrate crystals (99.1% purity) for each gallon) spray for a minimum of 5 minutes
- Dissolve 7.57 grams of benzethonium chloride (97% purity) for each gallon of cleaning solution you want to make. This will achieve a concentration of 1,947 mg/L in the cleaning solution.

Didymo using 0.12% benzalkonium chloride solution 1940 mg/Liter but not for felt soles or neoprene, or soft absorbent fabric of boots. 1940 mg/Liter

Rinse all gear before using.



Quaternary Ammonia Compounds

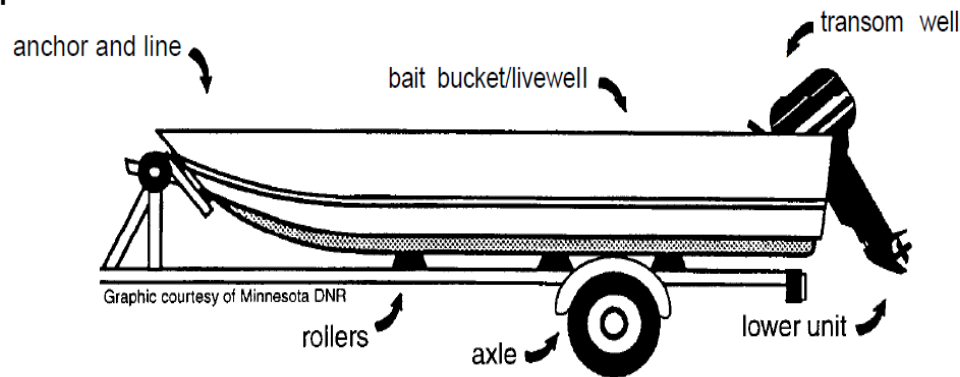
- **Chytrid fungus:** Use A 2 gallon collapsible bucket filled with 1 gallon of water should suffice for nets and stream equipment. Equipment that is non absorbent should be flooded with disinfectant solution on all surfaces and allowed to dry.
 - Dilution: 1 part Quat-128 to 1000 parts water (1 teaspoon of Quat-128 per gallon of water).
 - Soak gear in solution for 20 minutes, rinse and let dry
 - Rinse gear just before next use.
- **Whirling disease:** Quaternary ammonium compounds are also effective in killing both parasite stages. These disinfectants are commercially available for disinfecting fishing equipment (Bright Water™), for the pet/veterinary trade (Roccal-D™, Parvosol™) or for cleaning medical facilities.
- **New Zealand Mudsail:** 4.3 liquid oz of quat 256 per gallon of water for 10 minutes exposure. Rinse gear just before next use.
- **Didymo:** 1.7 liquid oz of quat 256 per gallon 1 minute exposure. Rinse gear just before next use.

Dilution Rates for Hospital Sterilization:
Quat. 128 1 oz. per gal. Vs Quat. 256- ½ oz. per gal



Boat Decontamination

- Use a professional to **apply scalding water (140°F)** to wash your boat (inside and out) and trailer, and to flush your motor, bilge and livewells, including ballast tanks or anyplace else that circulates raw water.
- **Drain ALL water from the boat**, especially the live well. Drain all water from the bilge, motor well, water-holding compartments, and water-skiing ballast tanks and bladders.
- **Completely drain all water from the motor cooling system.**
- **Thoroughly clean the boat, trailer and all equipment of mud, plants and mussels.** In addition to looking – inspect by gently running your hand along the entire surface of the equipment. Take time and carefully feel for juvenile mussels; when you locate them, it will feel like sandpaper.



Health and Safety

HAVE ON THE JOB SITE:

- MSDS (Material Safety Data Sheets)
- PPE
 - Gloves (chemical resistant)
 - Eye protection
- First aid kit
- Water for chemical agent decon. & eyewash



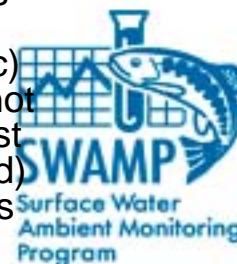
Regulation for Chemical Agents

California Food and Agricultural Code 12753. "Pesticide" includes any of the following: (a) Any spray adjuvant. (b) Any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, as defined in Section 12754.5, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever.

Code of Federal Regulations, Title 40 Protection of Environment, Part 152 *Pesticide* means any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, or intended for use as a plant regulator, defoliant, or desiccant, other than any article that: (1) Is a new animal drug under FFDCa sec. 201(w), or (2) Is an animal drug that has been determined by regulation of the Secretary of Health and Human Services not to be a new animal drug, or (3) Is an animal feed under FFDCa sec. 201(x) that bears or contains any substances described by paragraph (s) (1) or (2) of this section.

152.6 Substances excluded from regulation by FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act). Products and substances listed in this section are excluded from FIFRA regulation if they meet the specified conditions or criteria.

(a) *Liquid chemical sterilants.* A liquid chemical sterilant product is not a pesticide under section 2(u) of FIFRA if it meets all of the following criteria. Excluded products are regulated by the Food and Drug Administration (FDA). Products excluded are those meeting all of the following criteria: (1) *Composition.* The product must be in liquid form as sold or distributed. (2) *Claims.* The product must bear a sterilant claim, or a sterilant plus subordinate level disinfection claim. Products that bear antimicrobial claims solely at a level less than "sterilant" are not excluded and are jointly regulated by EPA and FDA... (c) *Human drugs.* Fungi, bacteria, viruses or other microorganisms in or on living man are not "pests" as defined in section 2(t) of FIFRA. Products intended and labeled for use against such organisms are human drugs subject to regulation by the FDA under the FFDCa.. (d) *Animal drugs.* (1) Fungi, viruses, bacteria or other microorganisms on or in living animals are not "pests" under section 2(t) of FIFRA. Products intended for use against such organisms are "animal drugs" regulated by the FDA under the FFDCa.



<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr;sid=c0657a0e9d39b15e2f9c50c2ea2cb7e;rgn=div8;view=text;node=40%3A23.0.1.1.3.1.1.4;idno=40;cc=ecfr>

Additional Regulations

SEC. 201. [21 U.S.C. 321] **CHAPTER II—DEFINITIONS** **SEC. 201.**

(g)(1) The term "drug" means (A) articles recognized in the official United States Pharmacopoeia, official Homoeopathic Pharmacopoeia of the United States, or official National Formulary, or any supplement to any of them; and (B) articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or other animals; and (C) articles (other than food) intended to affect the structure or any function of the body of man or other animals; and (D) articles intended for use as a component of any article specified in clause (A), (B), or (C). A food or dietary supplement for which a claim, subject to sections 403(r)(1)(B) and 403(r)(3) or sections 403(r)(1)(B) and 403(r)(5)(D), is made in accordance with the requirements of section 403(r) is not a drug solely because the label or the labeling contains such a claim. A food, dietary ingredient, or dietary supplement for which a truthful and not misleading statement is made in accordance with section 403(r)(6) is not a drug under clause (C) solely because the label or the labeling contains such a statement.



Do Not Use Felt Soles

Felt soles are a high risk carrier of microscopic aquatic organisms like didymo. While there are procedures for decontaminating felt soled waders, it is acknowledged that these are not practical. Cells are able to survive and remain viable in cool, damp, dark conditions for at least 40 days (Kilroy 2005). A study conducted at Montana State University on angler movement titled *Movements of Resident and Non-Resident Anglers in Montana: Implications for Transferring Whirling Disease among Drainages in the Greater Yellowstone Ecosystem* found that the average pair of wading boots sampled carried 22.10 grams of sediment. Its easy to see how felt soled wading boots can acquire AIS.

Some states and foreign countries are already banning or are considering bans on felt soles.



Other Factors to Consider

- Using equipment less prone to acquiring and transporting AIS.
- Using designated gear for dedicated waters.
- Use easy to clean equipment.
- Stop using boots with felt soles.
- Limit the number of field staff contacting surface water.



Your Questions.....?????

Surface Water Ambient Monitoring Program (SWAMP)

http://www.swrcb.ca.gov/water_issues/programs/swamp/

SWAMP AIS Webpages

http://www.swrcb.ca.gov/water_issues/programs/swamp/ais/index.shtml

Clean Water Team (CWT) – Citizen Monitoring

http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml

California Water Quality Monitoring Collaboration Network

http://www.swrcb.ca.gov/water_issues/programs/monitoring_council/collaboration_network/index.shtml

