

DIGEST



Providing current information on monitoring and controlling the spread of harmful nonindigenous species.

Clinton Issues Executive Order to Combat Invasive Species

by Andy Solomon, Tim Ahern, and Matt Stout

In February President Clinton signed Executive Order No. 13112 to coordinate the federal strategy addressing the growing environmental and economic threats of nonnative invasive species (NIS). President Clinton's budget for fiscal year 2000 proposes an increase of more than \$28.8 million to combat invasive species. This includes new funding for combating NIS and introduced pathogens, as well as accelerating research on habitat restoration and biologically-based integrated pest management tactics.

The Executive Order (EO) signals an expanded effort to combat invasive species and directs federal agencies to use their authorities to control, monitor, and prevent the introduction of NIS, and to restore native species where possible. The purpose of the EO is to ensure coordination between federal agencies and strengthen their ability to partner with state and other organizations. The EO establishes the Federal Interagency Invasive Species Council, co-chaired by the secretaries of the Interior, Agriculture, and Commerce, and includes the departments of State, Treasury, Defense, Transportation, and the Environmental

Protection Agency. The Council has seven specific duties:

- overseeing implementation of the EO;
- supporting field-level planning;
- identifying international recommendations;
- creating National Environmental Policy Act guidance;
- establishing an impact-monitoring network;
- developing a Web-based information network, and;
- preparing a National Invasive Species Management Plan.

The Council will create an invasive species Management Plan that is due by July 2000. The Secretary of the Interior will establish an advisory committee to provide information and advice to the Council, including recommended plans and actions at the local, state, regional, and ecosystem-based levels to achieve the goals of the Management Plan. The Council will act in cooperation with states, tribes, scientific and agricultural organizations, conservation groups, and other stakeholders at the state and local levels. The Management Plan will include detailed goals, objectives, and measures of success, and will identify needed personnel and other resources. The Management Plan will be updated every

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The CALFED Nonnative Invasive Species Program

by Kim Webb

The CALFED Bay-Delta Program is a cooperative state and federal program established to develop long-term solutions to the many problems affecting California's San Francisco Bay and Sacramento/San Joaquin Delta system (see map). Building on the 1994 Bay-Delta Accord, state and federal agencies have come together to develop and implement a long-term, comprehensive plan that will rehabilitate the ecological health and improve water management for beneficial uses of the Bay-Delta system.

The Ecosystem Restoration Program (ERP) is the principal program designed to rehabilitate the ecological health of the Bay-Delta ecosystem. The ERP represents one of the most ambitious and comprehensive ecosystem restoration projects ever undertaken in the United States. The goal of the ERP is to restore or mimic ecological processes and to increase and improve aquatic and terrestrial habitats to support stable, self-sustaining populations of diverse and valuable species.

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Michigan's Volunteer Zebra Mussel Monitoring Program

by Carol Swinehart and Mike Klepinger

Volunteers can play a key role in monitoring lakes for new infestations of zebra mussels (*Dreissena polymorpha*). Because Michigan has more than 10,000 inland lakes larger than five acres, resource managers can monitor only a few lakes and collect a limited number of samples. Citizen participation in sampling and monitoring has greatly increased the number of lakes surveyed, providing early detection of zebra mussel populations and saving valuable time and resources. This early warning allows lake managers and citizen groups to post signs at boat launches and develop volunteer programs for boat inspections and cleanings. Volunteer monitoring began in the spring of 1993 as a joint effort between the Michigan Department of Natural Resources, the Michigan Lake and Stream Associations, Inc., and the Michigan Sea Grant College Program.

At least 100 of Michigan's inland lakes are now infested with zebra mussels. Over the past five years, Michigan Sea Grant has received 360 reports of zebra mussels on 186 lakes. Volunteers were involved in monitoring 39 lakes last year. Nine — or one-quarter — of the 36 new infestations reported in Michigan during 1998 were found by volunteers participating in Michigan Sea Grant's Zebra Mussel Monitoring Program. The other infestation reports came from various sources when property owners and resource managers found adult zebra mussels on boats, docks, dams, water pumps, and other equipment.

Resource managers consider some of Michigan's lakes to be at greater risk of infestation than others. Large inland lakes with public access, high numbers of transient recreational boating activity, and those near infested waters are particularly vulnerable. Zebra mussels can contaminate lakes when boaters and anglers unknowingly transport the clinging veligers (larvae) from infested waters via boats, trailers, and fishing equipment. Monitoring was designed to verify predictions of the dispersal mechanisms, direction, and rate of spread of zebra mussels from the Great Lakes to Michigan's inland waters.

The citizen monitoring program provides training and equipment for individuals, public officials, teachers, lakefront-owner groups, and industrial-site managers to collect plankton samples. The plankton samples, which may contain microscopic veligers, are sent to a laboratory where biologists determine whether the water is infested. During the past three years, volunteers have been trained for veliger sampling through Sea Grant's award-winning instructional video. An accompanying illustrated handbook assists monitors in preparing samples while aboard their vessels. Both the video and the handbook are included in the sampling kits that Michigan Sea Grant has distributed on long-term loan throughout the state.

For more information about citizen lake monitoring and zebra mussels, visit Michigan Sea Grant's Web site at <http://www.msue.msu.edu/seagrant/sgezmsans.html>. Michigan Sea Grant is a cooperative program of Michigan State University and the University of Michigan in Great Lakes and marine research, education, and outreach. 

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CORRECTION

The article "SERC Lanuches National Ballast Water Information Clearinghouse" (Volume 3, No. 1) was modified by the Editor, unintentionally changing the meaning of several passages:

1. The abbreviation of the National Ballast Survey should be NABS not NBS, to avoid potential for confusion with the previous National Biological Service (NBS).
2. Discussion of "Contamination" (p. 3, last sentence of paragraph two) was not included in original submission and may appear out of context.
3. The original article did not state that ballast water exchange "...will result in fewer invasions" (p.3, last column). Instead, it suggested there is some support for this hypothesis, which needs to be tested. The authors do not wish to pre-judge the effectiveness of ballast exchange in reducing invasion rates. Rather, they intended to point out (a) the limits of our current understanding about invasion processes and (b) the need to measure invasion rate as an appropriate response variable for management actions.

The original article is available at SERC's website (<http://www.serc.si.edu/invasions/ballast.htm>)

Potential Overland Zebra Mussel Threat to Oklahoma Lakes

by Everett E. Laney and Stanley J. Spirlock

The Tulsa District of U.S. Army Corps of Engineers is responsible for 35 reservoirs and five locks, totaling 443,876 acres of water and 138 miles of navigation channel (see map). The channel has three locks and two hydropower dams on the Arkansas River, and two locks on the Verdigris River. Zebra mussels were first noticed in the Arkansas River at locks 14 (W.D. Mayo), 15 (R.S. Kerr), and 16 (Webbers Falls) in late January 1993. They were found in the Verdigris River at lock 17 (Chouteau) in mid June 1993 and lock 18 (Newt Graham) in mid-January 1994.

There have been no confirmed infestations in any of the inland lakes within the district. However, three boats carrying zebra mussels have been intercepted at two lakes. The first boat was being transferred to Eufaula Lake in west-central Oklahoma from the R.S. Kerr Reservoir, approximately 50 miles away, on 15 May of 1997. It had been dry-docked all winter and the mussels were dead.

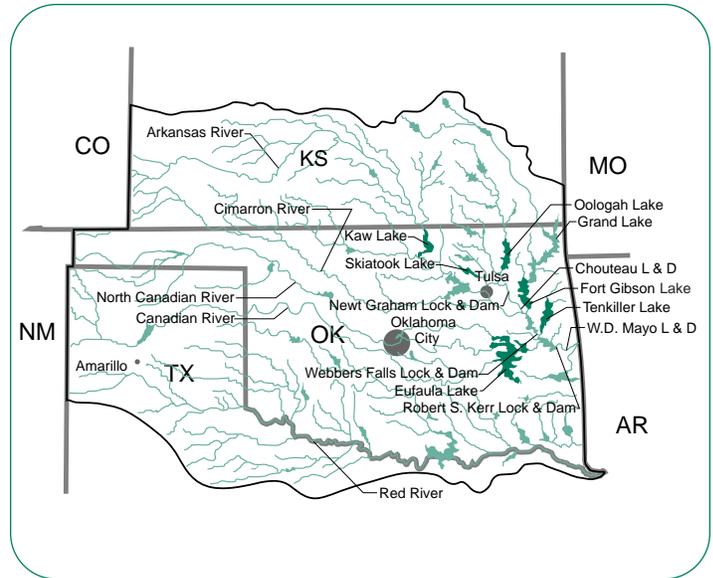
The second boat was discovered at the same marina on Eufaula Lake in July of 1998. It was transported from the Ohio River and had been out of the water for 10 days. The marina owner said the mussels were six inches deep on the hull and he filled two 55-gallon barrels with mussels that he removed with a high-pressure sprayer.

The third boat was discovered on 19 October 1998 on Grand Lake in northeastern Oklahoma. The boat had been on the road for five days from Lake Michigan. The marina owner sprayed the zebra mussels with chlorine after discovering them, and did not launch the boat for several more days. The mussels were removed before the boat was launched.

Fee records from campgrounds adjacent to Fort Gibson, Tenkiller, Eufaula, Skiatook, Oologah, and Kaw lakes in northeastern Oklahoma were reviewed to determine what states visitors came from and how many came from states known to have zebra mussels. The campgrounds received 7,127,263 visitors during the March through September 1998 summer recreation season (see Table 1). Visitors were from 48 other states, 18 of those states were known to have zebra mussels. There were 1,427 visitors to the six lakes from infested states. Arkansas and Missouri represented 78% of those visitors with 1,117. The Great Lakes states provided 13% with 182 visitors. Of those visitors from out-of-state, 39% to 50% were from infested states.

Although these visitors represent an very small percentage of the total number of visitors to the six lakes, they are infestation opportunities. It is not known what portion of those visitors were boaters, how many actually brought boats or equipment from infested water bodies, or how long it had been since they had been in contact with contaminated water. The numbers do, however, indicate that there is a potential threat of overland infestations from out of state visitors to the Tulsa District lakes.

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Tulsa District, U.S. Army Corps of Engineers

Table 1. Visitors from Zebra Mussel Infested States (March through September 1998) to lakes in the Northeastern Oklahoma, Tulsa District, Corps of Engineers

STATE	LAKE					
	Ft. Gibson	Skiatook	Kaw	Oologah	Eufaula	Tenkiller
Alabama	6	1	3	0	8	6
Arkansas	14	9	9	27	165	712
Illinois	3	3	7	11	14	8
Indiana	5	1	1	7	6	4
Iowa	5	1	3	5	13	5
Kentucky	2	0	2	4	0	0
Louisiana	5	1	4	4	9	2
Michigan	3	0	2	6	17	6
Minnesota	1	1	0	1	6	1
Mississippi	2	2	2	1	5	1
Missouri	13	9	23	41	65	30
New York	1	0	2	5	6	0
Ohio	0	2	5	5	5	3
Pennsylvania	0	1	4	3	6	2
Tennessee	1	2	2	4	7	7
Vermont	0	0	0	0	1	1
W. Virginia	0	0	0	1	0	0
Wisconsin	1	1	2	5	5	4
No. of Visitors	62	34	71	130	338	792
Total Visitors	2,892,770	558,190	700,309	1,259,319	2,518,344	1,215,872
% from Infested States	0.000021%	0.000061%	0.000101%	0.000103%	0.000134%	0.000651%

State-of-origin of Visitors from outside Oklahoma:

Total States	28	27	35	39	41	35
Total Infested States	14	13	15	16	16	15
% Infested States	50%	48%	43%	41%	39%	43%

Clinton Issues Executive Order to Combat Invasive Species

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two years with an accompanying public report on the success of implementation. The first edition of the Management Plan will review relevant existing programs and authorities, recommend needed actions, and identify legislative needs.

Many ecologists believe the spread of NIS is one of the most serious yet least appreciated threats to biodiversity. Invasive plants inflict a heavy toll on American agriculture, reducing the quality and raising the cost of food, feed, and fiber. Experts estimate that invasive plants already infest over 100 million acres. Three million acres, an area twice the size of Delaware, is lost to invasive plants each year. The total cost of invasive plants to the U.S. economy is estimated to be about \$123 billion annually. Invasive animals wreak billions more in damage to crops and range land. Some examples of the economic and ecological damage caused by NIS include:

- ◆ Zebra mussels can impair electrical utilities by clogging water intake pipes and threaten to cause an estimated \$5 billion in damage by 2002, if unchecked (see "The Cost of Zebra Mussels" in *ANS Digest* 1(1)).
- ◆ Leafy spurge causes more than \$144 million in livestock-forage damage each year in Montana, North Dakota, South Dakota, and Wyoming.
- ◆ Sea lampreys caused the collapse of lake trout and other Great Lakes fisheries, costing the U.S. and Canada \$13 million annually to control.
- ◆ On Guam, brown tree snakes have bitten more than 200 people, and caused over 1200 electrical outages and the extinction of most native forest birds (see "Trouble in Paradise" in *ANS Digest* 1(3)).
- ◆ Asian long-horned beetles so severely damaged trees in Brooklyn, New York, that more than 2000 trees had to be destroyed, costing the federal and state governments more than \$5 million. A similar infestation now plagues Chicago.

Aggressive federal actions are already underway, including measures to prevent the entry of NIS, to eradicate NIS before establishment, to control NIS once established, and to conduct outreach and education for the general public. Existing programs to combat NIS include:

- ◆ The USDA has more than 1,300 inspectors at over 90 ports of entry inspecting commodities to prevent entry of NIS — the inspectors are assisted in some ports by the Beagle Brigade, a group of dogs trained to sniff out prohibited agricultural products.
- ◆ The USDA has prohibited the importation of untreated wood packing material from China, which has previously carried the Asian long-horned beetle into the United States — and has proposed extending this ban to wood packing materials from other countries.

- ◆ The U.S. Fish and Wildlife Service will build a barrier this spring in the Chicago Ship Canal, to prevent the spread of invasive species between the Great Lakes and the Mississippi River basins (see "Controlling Round Gobies" in *ANS Digest* 2(2)).
- ◆ The Interior Department is spending \$4.5 million annually to prevent the spread of brown tree snakes from Guam. The Department of Defense is part of this effort. Key elements are an extensive control program on Guam, support for research effort to develop new control measures, and participation in Oahu's island-wide surveillance and response plan.
- ◆ The National Oceanic and Atmospheric Administration (NOAA), the Interior Department, and other federal and state agencies are working to restore the natural ecology of the south Florida and Everglades ecosystems. As this massive replumbing gets underway, NOAA and the Interior Department have made clear that safeguards must be taken to ensure that the new water flows do not become highways to transport NIS through Florida's fragile environment.
- ◆ NOAA, together with the Great Lakes Protection Fund and others, is sponsoring research on new technologies for treatment of ballast water to reduce the threat of foreign organisms being discharged into U.S. waters.
- ◆ The Federal Interagency Committee for the Management of Noxious and Exotic Weeds collaborated on research and publication of a comprehensive fact book on invasive plants available from the Government Printing Office.

The full text of the Executive Order can be viewed on the Web at <http://refuges.fws.gov/FICMNEWFiles/eo.html>. 

For more information about the Executive Order, contact: USDA, Andy Solomon (202) 720-4623; Department of the Interior, Tim Ahern (202) 208-5089; or Department of Commerce, Matt Stout (202) 482-6090.

••NEW•• Print and Electronic Publications

NEW PRINT PUBLICATIONS

Westbrooks, R. 1998. *Invasive plants, changing the landscape of America: Fact book*. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), Government Printing Office, Washington DC. 109 pp.

NEW ELECTRONIC PUBLICATIONS

CD-ROM information systems designed by USACOE, *Aquatic Plant Management and Noxious Nuisance Plant Management* - Contact Michael J. Grodowitz, Ph.D. USACOE (601) 634-2972.

Nuisance Notes from the Western Regional Panel on ANS

State Updates

Alaska: 1 October 1998 marked completion of the first year of a two-year investigation entitled "Biological Invasions of Cold-Water Coastal Ecosystems: Ballast-Mediated Introductions in Port Valdez/Prince William Sound, Alaska." Contact Bob Piorowski (907) 465-6150.

Arizona: Arizona is in the process of developing ANS working group with the goal of developing an ANS State Plan. Contact Larry Riley (602) 789-3258.

California: The CA Fish and Wildlife Commission decided to deny requests to establish a mitten crab commercial fishery. Two ballast water regulatory bills are before the CA legislature. Senate Bill 394 amending the Fish and Game Code and AB703 amending the Water Code. In January 1999 a vessel with zebra mussels attached was intercepted at the border by CDFG. CALFED has provided FY 98 funding to the U.S. Fish and Wildlife Service to develop an NIS Program as part of their restoration effort in the Bay-Delta. Contact Randy Brown (916) 227-7531.

Colorado: Recent addition of *Dreissena bugensis* to state's "Prohibited Species" list. Eurasian water milfoil identified in the upper Rio Grande River at Alamosa. Contact Chuck Loeffler (303) 291-7451.

Guam: Brown tree snake control and monitoring program in place. Contact Michael W. Kuhlmann (671) 734-3942.

Kansas: Big head carp distribution and impact study being developed for lower Missouri River in collaboration with KSU-BRD-USGS, Proposed for 2000. Contact Patrick Cassidy (913) 573-9856 or Tom Mosher (316) 342-0658.

Montana: MT Dept. of Fish, Wildlife and Parks and MT Dept. of Agriculture are planning a invasive species work group meeting with the goal of developing a joint invasive species plan in 1999. Contact Tim Gallagher (406) 444-2448.

Nebraska: NE Dept of Agriculture is chairing a state interagency work group to address invasive species in NE. Steve Schainost (402) 471-5443.

New Mexico: Fisheries Division is developing an ANS management plan. Final plan will be out in 1999. Contact Brian Lang (505) 827-9904.

North Dakota: Briefing conducted for fisheries division of wildlife department on ANS. 100th Meridian efforts will be expanded to include boaters on Sakakawea and Devils lakes. Contact Terry Steinwand (701) 328-6313.

Oklahoma: ZM density on the Arkansas River, OK, on 25 February 1999 was 688/sq. meter. Same unit on 21 November 1997 density was 1,255/sq. meter. Decrease in numbers attributed to the extremely hot summer in 1998. Powerhouse personnel reported water temperature was over 80°F most of the summer and there were several weeks of over 90°F. Contact Everett Laney (918) 669-7411.

Oregon: The OR Dept. of Fish and Wildlife co-hosted a workshop on management implications of co-occurring native and introduced fishes. The OR Dept. of Agriculture supported coordination of aquatic nuisance species management in the Pacific Northwest through the Pacific States Marine Fisheries Commission and Portland State University in collaboration with the WA Dept. of Fish and Wildlife, CA Dept. of Water Resources, Bonneville Power Authority, and US BOR. The OR legislature approved establishment of a Center for Lakes and Reservoirs at Portland State University that will focus on technical assistance and management planning for ANS. Contact Andrew Schaedel, Oregon Department of Environment.

South Dakota: 100th Meridian efforts will be expanded to include lakes Sharp and Oahe and Interstate-90. Contact Dennis Unkenholz (605) 733-6770.

Texas: Exotic shrimp diseases-TPW Coastal Fisheries staff continued to monitor populations of Gulf and bay shrimp for presence of viral diseases. Importation of exotic shrimp species for use in south TX aquaculture facilities have raised concerns about the possibility of infection of native shrimp by viral transfer from infected exotic species. Some evidence of low levels of shrimp viruses have been found in wild populations of shrimp, however, no exotic shrimp viruses, which have been problematic in south TX shrimp farms, have been found in native shrimp species. Contact Bill Harvey (512) 389-4394.

Utah: The UT Interagency ANS Action Team has initiated a comprehensive outreach effort through ZM outreach materials. Contact Randy Radant (801) 538-4812.

Washington: Completed the recommendations from the Zebra Mussel and Green Crab Task Force. WDFW assisted in the drafting of a state ANS bill, based upon the Task Force recommendations, that would establish an ANS Coordinating Committee and provide additional authority and funding for ANS projects to various state agencies. WDFW presented a proposal to the Fish

and Wildlife Commission that would establish an ANS Washington Administrative Code to declare ANS and establish authority to allow for volunteer monitoring programs. Contact Scott Smith (360) 902-2328.

Wyoming: Beginning 1 April 1999 bait dealers can no longer import minnows from other states and can only sell bait fish that were commercially raised or seined in WY. Inspections have often revealed that imports of golden shiners and fathead minnows were contaminated with undesirable species. The new regulation will reduce introduction of exotics such as stickleback and rudd. Contact Mike Stone (307) 777-4559.

Tribal Updates

Coastal Tribes: Contact Derrick Toba (360) 651-4480. Several western tribes are currently involved in exotic weed removal efforts through the Bureau of Indian Affairs. These eradication and control programs include exotic wetland and intertidal weeds on tribal reservations. Tribes currently participate in the Washington State Exotic Species Implementation, the Exotic Species Workgroup of the Puget Sound/Georgia Basin Task Force, the Ballast Water Subcommittee of the Puget Sound Marine Committee, and other committees dealing with ANS.

Provincial Updates

Manitoba: Monitoring efforts indicate that zebra mussels have not established in MB. Efforts continue towards public information and education regarding zebra mussel prevention in the province. Custom officials and the general public have provided zebra mussel display cases at the major border crossing with North Dakota for easy identification. Road signage has been cost-shared again this year with Ontario along the busy east-west corridor. Contact Wendy Ralley (204) 945-8146, wralley@gov.mb.ca, or Dwight Williamson (204) 945-7030.

Federal Updates

U.S. Fish and Wildlife Service: ANS coordinators are available to provide technical assistance to state, federal, and private interests in regard to ANS. Region 1 (CA,OR,WA,ID,NE,HI): Denny Lasseby, Portland, OR (503) 230-5973; Region 2 (TX,NM,OK,AZ): Bob Pitman, Tishomingo, OK (580) 384-5710; and Region 6 (MT,WY,UT,CO,ND,SD,NE,KS): Linda Drees, Manhattan, KS (785) 539-3474, x20. Natl ANS Coord. Arlington, VA: Bob Peoples (703) 358-1718.

Bureau of Reclamation: The Bureau of Reclamation WZMTF homepage can be accessed at <http://www.usbr.gov/zebra/wzmtf.html>. The Western Regional Panel on Aquatic Nuisance Species Page can be accessed at <http://www.wrp-ans.org>. Contact Tracie Greene (303) 445-2205.

U.S. Geological Survey-Southeastern Biological Science Center: The Center maintains a nonindigenous aquatic species geographic information system and current zebra mussel location maps. On the Web at <http://www.nfrcg.gov> or contact Amy Bensen (904) 378-8181.

Sea Grant: The National Sea Grant College Program, New York Sea Grant maintains a aquatic nuisance species information clearinghouse and publishes an information review, *Dreissena polymorpha*. A corbicula library is now being developed. Contact Charles O'Neill, Jr. (716) 395-2638. Minnesota Sea Grant is working with USFWS to develop a boat inspection video for use by resource managers and the public. The video will provide the viewer with information on specific exotics and how to remove them from different boat types. Contact Doug Jenson (218) 726-8712. Washington and Oregon Sea Grant Programs are collaborating on a new joint program called the Pacific Northwest Marine Invasive Species Team (PNW MIST). The objective of PNW MIST is to coordinate information and outreach along the west coast of the U.S. on nonindigenous species such as the European green crab (*Carcinus maenas*) and the varnish clam (*Nuttallia obscurata*). Pacific Northwest MIST plans to provide two-way communication between researchers and others in the NIS community as well as the affected water resource users such as divers, boaters, volunteer groups, etc. For more information: In OR, contact Paul Heimowitz (503) 722-6718, or in WA, contact Nancy Lerner, (206) 616-8403.

U.S. Army Corps of Engineers: North Pacific Division is developing an ANS display for location in ACOE office. ZM prevention signs being placed along the Columbia River. Contact Jim Athern (503) 808-3935. Tulsa District verified ZM sighting on trailered boat in Grand Lake, OK. Initial review of visitors visiting two Corps managed lakes in OK finds many traveling from infested states. Contact Everett Laney (915) 669-7411.

The 100th Meridian Initiative: The multi-state boater education/inspection initiative created to prevent the western spread of ZMs into the western U.S. will be in action during summer 1999. Boater education sites will be staffed in ND, SD, NE, KS, OK, TX. Contact Bob Pitman (580) 384-5710.

The CALFED Nonnative Invasive Species Program

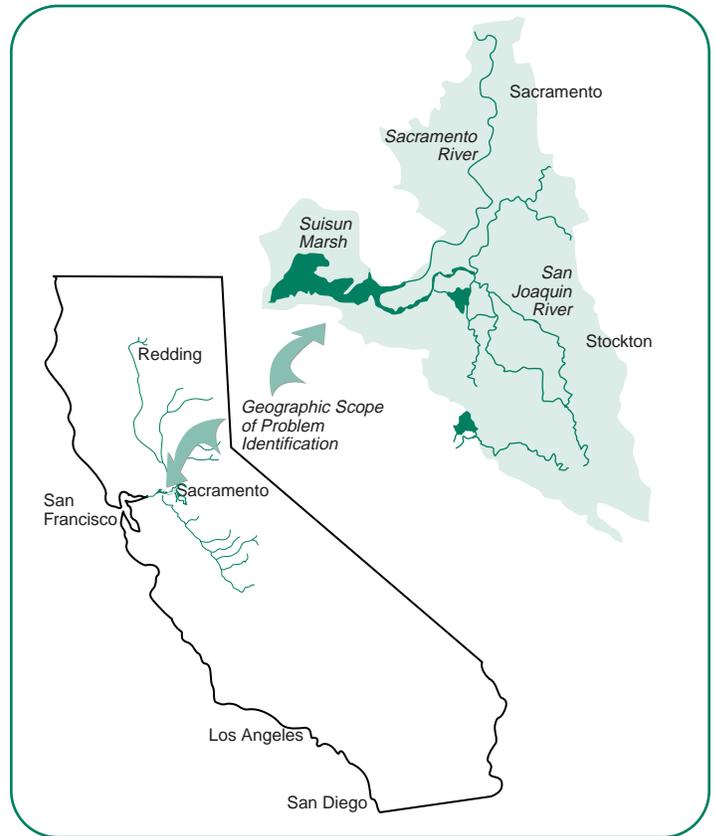
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As we have come to recognize the threat nonnative invasive species represent to healthy ecosystems and to restoration efforts, it has become apparent that restoration work must address these threats. As part of the ERP, the U.S. Fish and Wildlife Service has accepted responsibility for developing, implementing, and coordinating a nonnative invasive species program in the San Francisco Bay-Delta Estuary which will include terrestrial as well as aquatic species. This program, with the cooperation of CALFED staff, agencies, and interested stakeholders, will focus on the San Francisco Bay, the Sacramento and San Joaquin rivers and their watersheds. The program objectives are to:

- develop a long-term strategy to manage nonnative invasive species in the Bay-Delta Estuary and its watersheds;
- support prevention-oriented management and research projects to prevent or minimize the introduction of additional invasive species into the Bay-Delta Estuary and its watersheds, and;
- support control-oriented management and research projects to eradicate or manage invasive species once they have arrived and to prevent or delay their proliferation.

An agency team and a technical team have been formed, which will work on planning this program. A strategic plan is currently in draft form and work on an implementation plan is just beginning. At the conclusion of this planning process, on-the-ground work will begin to address nonnative invasive species and their effects on the Bay-Delta.

CALFED member-agencies include the National Marine Fisheries Service, Environmental Protection Agency, U.S. Fish and Wildlife Service, Bureau of Reclamation, U.S. Army Corps of Engineers, Department of Agriculture-NRCS, California Environmental Protection Agency, State Water Resources Control Board, California Department of Fish and Game, and the California Department of Water Resources. 



Kim Webb, a Fisheries Biologist with the U.S. Fish and Wildlife Service, is the CALFED Nonnative Invasive Species Coordinator; 4001 North Wilson Way, Stockton, CA 95205; (209) 946-6400 ext. 311; E-mail: kwebb@delta.dfg.ca.gov. For more information also see the CALFED Web site, <http://calfed.ca.gov>.

Upcoming Meetings

Western Regional Panel on ANS Fall Meeting

5-6 October 1999

Austin, TX

Contact: Bill Harvey, TXPWD; (512) 389-4642
or Linda Drees; (785) 539-3474, x20.

Exotic Organisms in Greater Yellowstone: Native Biodiversity Under Siege

11-13 October 1999

Yellowstone NP

Contact: Joy Perius; (307) 344-2209.

Send meeting announcements to:

Editor, ANS Digest

2500 Shadywood Rd., Navarre, MN 55331

e-mail: freshwater@freshwater.org

Deadline for the next issue is 15 May 1999

Glossary

Abiotic:

Nonliving environmental factors, including light, temperature, and atmospheric gases.

Acre-foot:

The volume of water that would cover one acre to the depth of one foot, about 43,560 cubic feet.

Brine drip:

Salt-laden secretions of the saltcedar.

Evapotranspiration:

The process by which liquid water is lost as vapor from the ground and from plants.

Monocultures:

A stand of vegetation of only one species.

Riparian:

The banks and adjacent land of a river, stream, lake, or other water body.

News from the Great Lakes Panel on Aquatic Nuisance Species

ANS UPDATE

Winter/Spring 1999

Volume 5, No. 1

Great Lakes Panel Update

On April 29, the Panel sponsored a symposium titled *Ballast Water Management and Aquatic Nuisance Species: Setting a Research Agenda for the Great Lakes*, in conjunction with the *Ninth International Zebra Mussel & Aquatic Nuisance Species Conference held in Duluth, Minn.* Participants assessed current approaches to ballast water management and identified the technologies and research approaches with promise for preventing new ANS introductions via ballast water. The project outcome will be a detailed ballast water research agenda that addresses unmet needs and identifies research priorities for the Great Lakes basin.

The Great Lakes Action Plan for Prevention and Control of Nonindigenous Aquatic Nuisance Species was favorably received at the January Panel meeting and currently is being revised for final approval by the Panel. The Panel's policy document, *Legislation, Regulation and Policy for the Prevention and Control of Nonindigenous Aquatic Nuisance Species: Model Guidance for Great Lakes Jurisdictions* has been approved by the Panel. **Contact:** Kathe Glassner-Shwayder, Great Lakes Commission, 734-665-9135, shwayder@glc.org.

News from Around the Basin

ILLINOIS: IL-IN Sea Grant distributed 3,000 can coolers at two regional boat shows. The coolers were imprinted with Panel guidelines to strengthen efforts to prevent ANS dispersal. **Contact:** Pat Charlebois, IL-IN Sea Grant, 847-872-0140, p_char@ix.netcom.

INDIANA: The DNR's 1999 Fishing Guide contains a revised page on aquatic invaders, highlighting a cooperative statewide exotic species advisory sign program involving the IN DNR and IL-IN Sea Grant. This information is available online at: www.state.in.us/dnr/fishwild. **Contact:** Randy Lang, IN DNR, 317-232-4094, lang@dnr.state.in.us.

MICHIGAN: The Office of the Great Lakes announced funding for projects under their state management plan: 1) The Nature Conservancy will conduct surveys to update records and population estimates for native mussel communities at sites in the Grand River watershed; 2) A workshop will be conducted on the development of policies and institutional structures for dealing with Great Lakes ANS invasions at the International Joint Commission's 1999 Biennial Forum on Great Lakes Water Quality, to be held in Milwaukee, Wis., Sept. 24-26, 1999. **Contact:** Mark Coscarelli, 517-335-4227, coscarem@dnr.state.mi.us.

MINNESOTA: Sea Grant and the DNR report no new infestations of zebra mussels, round goby or Eurasian ruffe in Minnesota's inland waters. Growing infestations of zebra mussels and round goby in the Duluth-Superior harbor raises concern over potential

impacts to industry and for overland transport by boaters and anglers. **Contact:** Doug Jensen, MN Sea Grant, 218-726-8712, djensen1@d.umn.edu.

NEW YORK: DEC submitted a proposal for FY99-2000 to the ANS Task Force to support the following activities: 1) continuation and expansion of the Finger Lakes zebra mussel monitoring project; 2) non-target toxicity testing of a bacteriological bio-control agent for zebra mussels; and 3) funding to revise New York's state management plan to establish consistency with federal guidance. **Contact:** Bill Culligan NYS DEC, 716-366-0228, nysdecck@netsync.net.

OHIO: The DNR is planning to review the state's existing ANS laws, rules and regulations for ANS prevention and control along with the Great Lake Panel's model guidance. To assist states in the Mississippi River Basin with the development of state ANS management plans, a list of possible impediments and solutions was produced as an outcome of the workshop held at the *60th Midwest Fish and Wildlife Conference* (Dec. 1999). **Contact:** Randy Sanders, OH DNR, 614-265-6344, randy.sanders@dnr.state.oh.us.

ONTARIO: A survey was sent to 3,000 Ontario boaters and anglers in 1998 to assess the current level of ANS program effectiveness, as well as to discover ways to improve awareness. Volunteer monitoring revealed new zebra mussel and bythotrephes infestations in several inland lakes in Ontario in 1998. **Contact:** Ed Paleczny (705)755-1890, palecze@gov.on.ca.

WISCONSIN: The state ANS management plan and five-year workplan is under review by DNR staff and soon will be available for public review and input. Implementation of the interstate ANS management plan for the St. Croix Scenic Riverway will begin this spring with funding from the USFWS and state match. The DNR has sent out 100 packets of information on traditional and biological control options to groups, organizations and individuals with an interest in controlling the spread of purple loosestrife. **Contact:** Ron Martin, WI DNR, 608-266-9270, martir@dnr.state.wi.us.

Washington Watch

The following FY2000 funding requests are being submitted by interested members of Congress to the appropriations committees responsible for the prevention and environmentally sound management of aquatic nuisance species.

Interior Appropriations Committee: The committee is urged to at least match the Administration's proposed increase of \$2.5 million to \$4.7 million to fund implementation of NISA programs through the U.S. Fish and Wildlife Service (USFWS). This funding will support the USFWS in its national responsibilities including co-leadership of the ANS Task Force and

associated activities; grants to states with approved state management plans; development of ANS regional panels; and work with the National Oceanic and Atmospheric Administration (NOAA) to fund research on effective ballast management technologies. The committee is also urged to provide a \$2.5 million increase for invasive species management on USFWS refuge lands. To support the U.S. Geological Survey's Biological Research Division's work on ANS research and control, the Administration's request of \$6.7 million, a \$1.7 million increase, is recommended.

Commerce, Justice, State and Judiciary Appropriations Committee: Funding recommendations to the committee are equal to the President's request of \$4.5 million for NOAA activities pursuant to NISA, including at least \$3 million for ANS Task Force co-leadership, Sea Grant research and funds for ballast technology development. Funding of \$10.4 million is requested for NOAA's National Ocean Service to research harmful algal blooms, such as *Pfisteria*, to help states develop emergency response strategies and rapid assessment techniques.

Energy and Water Development Appropriations Committee: The U.S. Army Corps of Engineers (ACOE) is responsible under NISA for the development of management techniques that are environmentally sound for nonindigenous species already established, such as the removal of zebra mussel from public facilities. It is recommended that ACOE funding match the President's request \$1.5 million for public facility research and development and to provide \$300,000 (\$200,000 above the President's request) for design and construction of environmentally sound dispersal barrier in the Chicago Ship and Sanitary Canal. The committee is also urged to provide \$5 million for the Aquatic Plant Control Research program, \$2 million more than proposed by the Administration.

Transportation Appropriations Committee: The Secretary of Transportation is directed under NISA to issue national guidelines to prevent ANS introductions into U.S. waters. The committee is urged to provide \$4 million for the U.S. Coast Guard to implement its new national Ballast Water Management Program, a \$1 million increase over the President's \$3 million level funding recommendation. This program, based on ballast water exchange to prevent ANS introductions, would include a ballast water information clearinghouse to assess rates of compliance and ballast discharge surveys. **Contact:** Allegra Cangelosi, Northeast-Midwest Institute, 202-544-5200, acangelo@nemw.org

Upcoming Events

Second International Round Goby Conference. May 27-28, 1999; Case Western Reserve University, Cleveland, OH (in conjunction with the annual meeting of the *International Association of Great Lakes Research*). **Contact:** Pat Charlebois, IL-IN Sea Grant, 847-872-0140, p_char@ix.netcom.com.

Full copies of the *ANS Update*, a quarterly newsletter prepared by the Great Lakes Panel on Aquatic Nuisance Species, are available upon request from the Great Lakes Commission. The feature article of this issue (Vol. 5, No. 1) is authored by Dr. Michael J. Donahue, Executive Director, Great Lakes Commission, and is titled, *The Executive Order on Invasive Species—Presidential directive offers regional opportunity*. **Contact:** Kathe Glassner-Shwayder, Great Lakes Commission, 734-665-9135, shwayder@glc.org.

Saltcedar Biological Control and the Saltcedar Consortium

by Scott Stenquist

Saltcedar is an invasive species within the family Tamaraceae, native to dry climates from the Mediterranean Sea to eastern Asia. Most saltcedar species are trees or shrubs shorter than about 25 feet, with slender, scale-like leaves and pink colored flowers. Two species, *Tamarix ramosissima* and *T. parviflora*, are present in the southwestern and western U.S. A related species, athel (*T. aphylla*) occurs in southern California and south of a line from Phoenix and Tucson, Arizona, to the Lower Rio Grande Valley, Texas, and in northern Mexico. Athel is a large evergreen used as an ornamental shade tree and is not a target for biological control.

Saltcedar in North America

Saltcedar was first reported in the U.S. in 1837 and was widely planted to stabilize stream banks (DeLoach and Tracy 1997), and to provide windbreaks and shade (DiTomaso 1996). It became established in the early 1900s and continued to spread across the western landscape. Saltcedar now occupies over 1.5 million acres of **riparian*** habitat in the western U.S. (Lovich 1996). Approximately 29,000 acres on 33 national wildlife refuges, managed by the U.S. Fish and Wildlife Service strictly for fish, wildlife, and their habitats, are infested with saltcedar (see map)(Stenquist 1996).

Effects of Saltcedar on Biodiversity

Ecosystem biodiversity is generally reduced in the presence of saltcedar. Saltcedar out-competes native vegetation and quickly forms dense **monocultures**. Riparian saltcedar forms solid stands increasing the soil salt content through **evapotranspiration** and resulting **brine drip**. Cottonwood and other native vegetation are less able to survive the increased salinity. Cottonwood seedlings, for example, are also at a disadvantage under the shade provided by saltcedar. Saltcedar can take up water either from ground water or surface runoff, whereas cottonwood can take up water only from ground-water sources. Annual water consumption by saltcedar is estimated at 1.4 to 10.5 **acre-feet** per acre (Bureau of Reclamation 1992); in areas where saltcedar density has been reduced, there has been an increase in the availability of surface water. At the Coachella Valley Nature Preserve, after the Nature Conservancy removed saltcedars over a five-year period, surface water and the natural year-round stream returned (Kan 1998).

Saltcedars generally provide unsuitable habitat for most wildlife species; Lovich and De Gouvenain (1998) noted that saltcedar-dominated riparian areas have severely diminished fauna diversity. Saltcedar flowers, seed, and foliage have little forage value compared to species such as mesquite. The exotic honey-bee, however, does feed on the pollen. Saltcedar is used for nesting by some birds including mourning doves, Mississippi kites, and black-chinned hummingbirds. Saltcedar ranked sixth out of seven vegetation types sampled along the Rio Grande River in terms of rodent density, and it ranked fifth in total numbers of



Figure 1. Saltcedar on the National Wildlife refuge system.

species found (Lovich and De Gouvenain 1998). In saltcedar stands in the Grand Canyon and on the Rio Grande River, Lovich and De Gouvenain (1998) reported that reptile densities and diversity were very low. Saltcedar has displaced riparian flora; cottonwood and willow have disappeared along riparian areas where saltcedar has become established in such places as the lower Colorado River (DeLoach and Tracy 1997). Additional factors may be responsible for the decrease in native vegetation along these river corridors, such as flood-control dams that reduce or stop seasonal runoff which alter stream-bank habitat, and disturbance of riparian habitat through human-influenced activities such as livestock grazing, off-road driving, and wild fires.

Biological Control and the Saltcedar Consortium

The Saltcedar Consortium, developed by Drs. Jack DeLoach, Ray Carruthers, Ernest DeFosse (all USDA–Agricultural Research Service), Dr. Juli Gould (USDA–Animal and Plant Health Inspection Service (APHIS), and Scott Stenquist (U.S. Fish and Wildlife Service), functions as a leadership forum and working group for the biological control of saltcedar. The group is open to all parties interested in the management of saltcedar. Many private, academic, and governmental organizations have become involved (Table 1).

*words in bold type are defined in the glossary on page 18

Saltcedar continued from previous page

The Consortium first met in November of 1998 as part of the Entomological Society of America annual meeting in Las Vegas, Nevada. Members focused on the biological control of saltcedar, implementation of biological control using leaf beetles (*Diorhabda elongata*) and mealybugs (*Trabutina mannipara*), and site-specific monitoring at 12 proposed experimental release sites (Table 2). The leaf beetle, native to central Asia, feeds on saltcedar leaves. The mealybug, native to Israel, damages saltcedar branches. These two insects are scheduled for experimental release into cages during the spring of 1999, pending review by USDA-APHIS of public comments on the environmental assessment for leaf beetles.

Consortium members agreed to step-up their involvement once the U.S. Fish and Wildlife Service finalized its decision for the release of the two biological controls under the authority of the federal Endangered Species Act. Host-range testing and feeding trials of leaf beetles and mealybugs on athel indicated that the tree is not a favored host (DeLoach and Tracy 1997). Although both insects fed minimally on athel, noticeable damage is not expected.

The second Consortium meeting was held in February of 1999 at the Weed Science Society of America annual meeting in San Diego, California. The Consortium developed a mission statement, goals, and monitoring teams. Monitoring team responsibilities and projects include:

- creation of an ad hoc management committee;
- establishment of monitoring and implementation plans;
- data management collection;
- a memorandum of understanding, research support, and coordination group, and;
- technical transfer and public education.

The monitoring plan and implementation team consists of several subgroups designed to provide site-specific monitoring information on biological-control insects, restoration of native vegetation and wildlife, **abiotic factors**, and suppression of insects should they move beyond the experimental release sites.

Biological Control Implementation

Saltcedar biological control efforts were begun 12 years ago by Dr. Jack DeLoach, research entomologist with the USDA–Agricultural Research Service’s Grassland, Soil, and Water Research Laboratory in Temple, Texas. Overseas laboratory and greenhouse investigations, domestic quarantine tests with selected target and nontarget plants, release of leaf beetles and mealybugs into caged sites, and ultimately experimental release at specific sites, are part of the effort. The proposal to begin research with leaf beetles and mealybugs was approved by the Technical Advisory Group for the Biological Control of Weeds (TAGBCW) in 1991 (see Table 3 for a list of members).

TAGBCW approved petitions for release of the insects in 1994. The draft environmental assessment was prepared by USDA–APHIS, but the finding of no significant impact (FONSI) was never issued based on the listing of the southwestern willow flycatcher (*Empidonax trailii extimus*) as endangered in March 1995.

Table 1. Member-Groups of the Saltcedar Consortium

California Cattlemen’s Association
California Dept. Food and Agriculture
California Exotic Pest Plant Council
Los Angeles Dept. Water/Power
Native Plant Society
Nature Conservancy
New Mexico Natural Heritage Association
New Mexico State University
Texas A & M University
Texas Parks and Wildlife Dept.
University of California–Berkeley
University of California–Davis
University of Wyoming
USDA–Agricultural Research Service
USDA–Animal and Plant Health Inspection Service-Plant Protection and Quarantine
USDA–Forest Service
USDA–Natural Resource and Conservation Service
USDI–Bureau of Land Management
USDI–Bureau of Reclamation
USDI–Fish and Wildlife Service
USDI–Geological Survey–Biological Resources Division
USDI–National Park Service
USDOD–Air Force, Holloman Air Force Base
USDOD–Army, Ft. Hunter–Liggett Military Reservation
Wyoming Dept. Agriculture

Table 2. Proposed Release Sites for Leaf Beetle (*Diorhabda elongata*) and Mealybug (*Trabutina mannipara*) in the Western United States.¹

Location	Land Owner ²	USFWS Region	Insect(s) for Release
Ft. Hunter-Liggett Military Reservation, CA (Nacimiento Creek)	USDOD–AR	1	Leaf Beetle
Clearlake, CA (Cache Creek)	USDI–BLM	1	Leaf Beetle
Independence, CA (Owens River)	Los Angeles Dept. Water and Power	1	Leaf Beetle
Lovelock, NV; Stillwater National Wildlife Refuge; Walker River Paiute Indian Reservation	Private, USDI–FWS, Walker River Paiute Indian Reservation	1	Leaf Beetle
Delta, UT (Severe River)	USDI–BLM	6	Leaf Beetle
Lovell, WY (Big Horn River)	WY Game and Fish Dept.	6	Leaf Beetle
Pueblo, CO (Arkansas River)	USDI–BR	6	Leaf Beetle
Holloman Air Force Base, NM (Tularosa Basin)	USDOD–AF	2	Leaf Beetle and Mealybug
Artesia, NM, (Pecos River)	Private	2	Leaf Beetle and Mealybug
Big Bend National Park, TX	USDI–NPS	2	Leaf Beetle and Mealybug
Seymour, TX (Wichita River)	Private	2	Leaf Beetle
Laredo, TX (Rio Grande River)	Private	2	Mealybug

¹As modified from: DeLoach and Gould (1998).

²USDI–BLM = U.S. Dept. Interior, Bureau of Land Management
 USDI–BR = U.S. Dept. Interior, Bureau of Reclamation
 USDI–FWS = U.S. Dept. Interior, Fish and Wildlife Service
 USDI–NPS = U.S. Dept. Interior, National Park Service
 USDOD–AF = U.S. Dept. Defense, Air Force
 USDOD–AR = U.S. Dept. Defense, Army

DeLoach initiated and completed the draft biological assessment, "Effect of Biological Control of Saltcedar (*Tamarix ramosissima*) on Endangered Species" in 1997. Endangered species biologists, integrated pest/weed management coordinators, and other parties actively participated in the review of the document. After a series of discussions in 1998 with biologists from many federal agencies, DeLoach proposed to make research releases of the two insects at sites which are geographically isolated from sites important to southwestern willow flycatcher reproduction. Target and nontarget monitoring at the release sites, to be accomplished by members of and cooperators with the Saltcedar Consortium, will also occur over the next five years.

The U.S. Fish and Wildlife Service concurred in December of 1998 that the experimental release of leaf beetles and mealybugs would "not adversely affect the southwestern willow flycatcher" based on geographical isolation of the 12 release sites, distance from any saltcedar stands occupied by flycatchers (at least 200 miles), and on monitoring protocols described in the August 1998 proposal, "Biological Control of Exotic, Invading Saltcedars (*Tamarix* spp.) by the Introduction of Tamarix-specific Control Insects from Eurasia."

What Lies Ahead?

Insects are scheduled for experimental release at the 12 sites (see Table 2) in May and June of 1999. They will be placed in special sleeve bags within cages at the sites; this strategy allows for precise insect monitoring, and enables personnel to easily relocate the insects in the cages. USDA-APHIS-Plant Protection and Quarantine (USDA-APHIS-PPQ) is in the process of preparing an environmental assessment for the field release of the leaf beetle and inviting public comment on the assessment. A separate environmental assessment for field release of the mealybug will also be issued. Once public comments are analyzed from the environmental assessments, USDA-APHIS-PPQ will proceed with permits for insect release.

The Invasive Species Executive Order No. 13112, dated 3 February 1999, provides a critical link to this saltcedar biological control project (see related article in this issue and the Web site: <http://refuges.fws.gov/FICMNEWFiles/eo.htm>). It has been proposed that the site-specific monitoring effort be funded for five years at \$20,000 per site each year through the Executive Order and the U.S. Department of Interior.

Once leaf beetles and mealybugs have become established and if monitoring reveals no unintended consequences, other biological control agents that are being considered to augment leaf beetles and mealybugs may be released. Slow, deliberate laboratory analysis of the effects these agents have on target and nontarget organisms will take place, along with evaluation through the National Environment Policy Act, similar to the studies of leaf beetles and mealybugs. Table 4 provides a partial list of insects that are being considered for future efforts to control saltcedar.

Table 3. Members of the Technical Advisory Group for the Biological Control of Weeds (TAGBCW)

Direccion de Regulacion Fitosanitaria (Government of Mexico)
Eastern Cereal and Oilseed Research Centre (Government of Canada)
National Plant Board
U.S. Environmental Protection Agency
USDA-Agricultural Research Service
USDA-Animal and Plant Health Inspection Service-Plant Protection and Quarantine
USDA-Cooperative State Research, Education, and Extension Service
USDA-Forest Service
USDI-Bureau of Land Management
USDI-Bureau of Reclamation
USDI-Fish and Wildlife Service
USDI-Geological Survey-Biological Resources Division
USDI-National Park Service
USDOD-Army Corps of Engineers
Weed Science Society of America

Table 4. Insects Being Tested for Biological Control of Saltcedar.¹

Insect ²	Damage	Origin ³
<i>Diorhabda elongata</i> (leaf beetle) ^{4,10}	foliage	CH, KZ, TM
<i>Trabutina mannipara</i> (mealybug) ^{5,10}	branch	IS, TM
<i>Coniatus tamarisci</i> (weevil) ⁶	foliage	FR
<i>Ornativava</i> spp. (Gelechiid moth) ⁷	foliage	CH
<i>Agdistis tamaricis</i> (plume moth) ⁸	foliage	IS
<i>Cryptocephalus sinaita</i> (leaf beetle) ⁸	foliage	IS
<i>Trabutina serpentina</i> (mealybug) ⁸	branch	IS, KZ, CH
<i>Amblypalpis tamaricella</i> (gelechiid moth) ⁷	stem gall	IS, KZ, CH
<i>Psectrosema noxium</i> (gall midge) ⁷	stem gall	CH, KZ
<i>Colposcena aliena</i> (psyllid) ⁷	stem	CH, TM
<i>Crastina tamaricina</i> (psyllid) ⁷	stem, flower gall	KZ, IS, TM
<i>Trabutina crassispinosa</i> (mealybug) ⁹	stem	TM
<i>Parapodia sinaica</i> (gelechiid moth) ⁸	stem gall	FR, IS
<i>Corimalia</i> spp. (seed weevil) ⁸	flower gall	FR, CH
<i>Adiscodiaspis tamaricola</i> (scale) ⁹	stem	TM, KZ
<i>Leoncleonus clathratus</i>	root gall	TU, TK, IS, CH
<i>Acanthococcus orbiculius</i> (mealybug) ⁹	stem gall	CH
<i>Psectrosema</i> spp. (branch tip gall, gall midge) ⁹	stem gall	CH
<i>Asias halodendri</i> (long-horned beetle) ⁹	stem borer	CH

¹From: DeLoach (1996)

²Listed in order of approximate readiness for release:

⁴Environmental Assessment released by USDA-APHIS for public comment on 18 March 1999. Comment closed 19 April 1999.

⁵Environmental Assessment pending by USDA-APHIS, has not been released for public comment.

⁶Testing complete in U.S. quarantine, results to be submitted to TAGBCW approval for release.

⁷Approved for testing in U.S. quarantine

⁸Testing underway overseas.

⁹Testing beginning overseas.

³CH = China; FR = France; IS = Israel; KZ = Kazakhstan; TM = Turkmenistan

Coordinated Integrated Weed Management

Chemical, physical, and biological methods are used together in an integrated weed management approach for saltcedar. Chemical herbicides such as glyphosate (Rodeo), triclopyr (Garlon 4, Garlon 3A, Pathfinder II), or imazapyr (Arsenal) in combination with glyphosate (Rodeo) are applied to saltcedar either to the ground, to stumps, or from aircraft. In situations where plants are in water, glyphosate (Rodeo) is the preferred herbicide. These materials can be used effectively and produce desired results when kept away from nontarget vegetation and sensitive sites. Generally, these herbicides are cost effective over small areas. All herbicide use must follow label instructions and conditions, including any state-specific pesticide regulations. [Note: no endorsement by the U.S. Fish and Wildlife Service of any herbicide is expressed or implied.]

Physical or mechanical management of saltcedar is another option. Heavy equipment such as bulldozers can push over saltcedar plants into large piles where the material is dried and burned. Back-hoe equipment can pull saltcedar plants up and out of the soil. While these methods can be effective under the right conditions, they cause tremendous disturbance to the soil habitat. In most situations, saltcedar root crowns will resprout. Wind-borne saltcedar seeds also produce new plants. Disturbed sites, if not immediately planted and managed for native vegetation, can quickly become the site of other invasive weeds such as perennial pepperweed, knapweed complex, or other nonnative vegetation. The combination of physical management through cutting saltcedar and then applying a chemical herbicide on the stump is also a management option, although this tactic is very labor intensive.

Biological control of saltcedar, as part of an integrated management strategy, probably offers the greatest opportunity for site-specific management. Biological control is a slow process which depends on living organisms. Such organisms stress and weaken target plants, but rarely by themselves kill the plants. This “selective” toxic effect of the leaf beetle, for example, was apparent in its native range in the Charyn River Valley, Kazakhstan; while saltcedar branches were affected, the entire plants were not noticeably harmed (Stenquist 1999).

In addition to DeLoach’s work on biological weed-control, the USDA-Agricultural Research Service has formed a new research unit, the Exotic and Invasive Weed Research Unit, in Albany, California. Dr. Ray Carruthers is the Research Leader at this facility with an expanded mission that includes a major commitment to develop and implement biologically-based weed control alternatives for terrestrial, aquatic, and semi-aquatic integrated weed management. This unit will focus on a number of important weeds including saltcedar, yellow starthistle (*Centaurea solstitialis*), Scotch thistle (*Onopordum acanthium*), perennial pepperweed (*Lepidium latifolium*), German ivy (*Senecio mikanioides*), water hyacinth (*Eichornia crassipes*), hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil (*Myriophyllum spicatum*), and egeria (*Egeria densa*). Dr. Carruthers may be contacted at (510) 559-5800, or E-mail: ric@pw.usda.gov. 

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SALTCEDAR CONSORTIUM

Mission: Develop and implement a cooperative science-based team that will study the release of biological control agents and their effect in controlling saltcedar (*Tamarix*) and associated riparian responses. This meets the monitoring requirement required by the U.S. Fish and Wildlife Service.

Goals:

1. Restore and/or rehabilitate using biological control western riparian ecosystem dominated by saltcedar, and;
2. Evaluate the effectiveness of biological control agents in controlling saltcedar and restoring western riparian systems.

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Thank You!