



# Ballast Exchange

Newsletter of the West Coast Ballast Outreach Project

Volume 7  Winter 2007

## Greetings

Holly Crosson, Coordinator, West Coast Ballast Outreach Project

Welcome to the Winter 2007 edition of Ballast Exchange, the newsletter produced by the California Sea Grant Extension Program's West Coast Ballast Outreach Project (WCBOP). We have been busy since the Spring/Summer issue was published in May 2006. Some highlights include the distribution of: nearly 3,000 copies of Vol. 6 of Ballast Exchange; more than 2,500 copies of our Stop Ballast Water Invasions poster; and more than 8,500 copies of the updated Stop Ballast Water Invasions brochure. These outreach materials were sent worldwide to destinations as far away as Australia, New Zealand, China, the Netherlands, Israel and Scotland.

We increased our general mailing list to include members of the Pacific States Marine Fisheries Commission, Pacific Merchant Shipping Association, International Ship Managers Association, California Association of Port Authorities, International Association of Maritime Universities and other organizations and individuals. Staff gave presentations about the WCBOP and distributed ballast water outreach materials at over a dozen venues throughout the year. In October, the WCBOP hosted a morning and an afternoon educational seminar by Dr. Ted Grosholz about ballast water and invasive species for 130 cadets at the California Maritime Academy in Vallejo, CA. That seminar is available via video stream and PowerPoint slideshow on the WCBOP website.

As many of you know, Nicole Dobroski left the WCBOP in August of 2006 to join the Marine Invasive Species Program at the California State Lands Commission office in Sacramento. We would like to thank Nicole for all her great work with the WCBOP and wish her well in her new job! Lucky for us, she isn't far away and continues to work on ballast water-related issues. We are pleased to announce that Alisha Dahlstrom has been hired as the WCBOP's Associate Coordinator (see article on page 2).

We would also like to say farewell and thank you to past members of the WCBOP Advisory Committee: Jody Zaitlin (Port of Oakland), Marilyn Leland (Prince William Sound Regional Citizens' Advisory Council), Brian Mulvey (National Marine Fisheries Service), Steve Moore (San Francisco Regional Water Quality Control Board), Michael Gedney (APL Limited), and Scott Smith (Washington Dept. of Fish and Wildlife), who have stepped down or moved on to new positions.

We welcome to the WCBOP Advisory Committee: Lisa Ka'aihue (Prince William Sound Regional Citizens' Advisory Council), Naomi Feger (San Francisco Regional Water Quality Control Board), Melissa B. Escaron (Port of Oakland), Ginny Hessenauer (APL Limited), Allen Pleus (Washington Department of Fish and Wildlife), Korie Schaeffer (National Marine Fisheries Service), Satie Airame (Marine Science Institute), and Tom Maddox (Environmental Technologies, Inc).

We held our annual Advisory Committee meeting on March 12 in Oakland, CA and look forward to incorporating many of the recommendations received into our outreach plan for 2007 and 2008.

Holly Crosson, Program Coordinator  
Alisha Dahlstrom, Associate Program Coordinator  
Jodi Cassell, Program Director

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## WCBOP Hires New Staff Member

We are pleased to announce that Alisha Dahlstrom has joined the West Coast Ballast Outreach Project. Alisha graduated in 2006 from UC Santa Barbara with a double major in Aquatic Biology and Environmental Studies. She recently completed an environmental policy internship with the Ecological Society of America in Washington, D.C. She worked half-time on WCBOP tasks from her east coast office during December and began full-time on January 8, 2007. She is based out of the San Francisco Estuary Project office in Oakland, CA. We look forward to Alisha's expertise, ideas and enthusiasm. You can reach her at (510) 622-5048 or [adahlstrom@ucdavis.edu](mailto:adahlstrom@ucdavis.edu). Welcome, Alisha!

## Calendar

March 19–20, 2007

American Association of Port Authorities Spring Conference in Washington, DC

March 19, 2007

Aquatic Invasive Species Communication Workshop in Portland, OR

March 26–30, 2007

Green Technology Entrepreneurship Academy at Lake Tahoe, CA

March 28–30, 2007

Teaching and Learning in the Maritime Environment at the California Maritime Academy in Vallejo, CA

May 20–24, 2007

Fifth International Conference on Marine Bioinvasions in Cambridge, MA

Sept. 23–27, 2007

15th International Conference on Aquatic Invasive Species (ICAIS) in Nijmegen, The Netherlands

Please see web for more details...

## Workshop on Alternative Ballast Water Exchange Areas: Physical and Biological Oceanographic Considerations

*Stephen Phillips, ANS Program Manager, Pacific States Marine Fisheries Commission*

The Pacific States Marine Fisheries Commission's Aquatic Nuisance Species (ANS) Program focuses on species that have the proven or potential ability to damage fishery resources and/or disrupt ecosystem processes. The discharge of ballast water from commercial vessels—the leading vector for the transfer of potentially harmful aquatic organisms and pathogens around the world—is of great concern to those that depend on fisheries resources as a way of life. The need to protect our natural resources from the ANS threat is especially pertinent now as a commercial fishery failure has been declared for West Coast salmon fishermen due to sharp harvest reductions imposed by the federal government to protect struggling returns of fish to the Klamath River. In these critical times, the region cannot afford the introduction of another invasive species that could put our fisheries resources at further risk.

In 2005, the Government Accountability Office testified before Congress that U.S. waters remain vulnerable to invasive species carried in ballast water and that the current ballast water exchange program is not a viable long-term approach to minimizing the risks posed by ballast water discharges. One of the primary reasons cited for the vulnerability to invasion is that Alternate Ballast Water Exchange Areas (ABWEA) have not been established for use by ships that, for a variety of reasons, are unable to conduct ballast water exchange in the mid-ocean. ABWEAs are areas within the waters of an exclusive economic zone where the exchange of ballast water does not pose a threat for infestation or spread of aquatic nuisance species.

To address these ballast water concerns, the Pacific States Marine Fisheries Commission, in cooperation with the National Oceanic and Atmospheric Administration and U.S. Coast Guard, hosted a technical workshop June 20-22, 2006, in Seattle, WA, that was designed to gain a greater understanding of biological and physical oceanography processes and the ecological risk posed by the exchange of ballast water within the U.S. territorial waters of the eastern Pacific. [The meeting was in part a follow-up to the 2002 publication, "West Coast Oceanography: Implications for Ballast Water Exchange." To see this publication, go to <http://ucce.ucdavis.edu/files/filelibrary/5802/25916.pdf>

This workshop was not a forum on policy or regulatory issues surrounding the potential establishment of ABWEAs on the West Coast. While information presented could be used to help develop ABWEAs, it is hoped that the products and recommendations

from the workshop will help inform management and aid in regulatory decision-making for coastal and estuarine ecosystems.

Workshop presentations by state, federal, and university speakers from the United States and Canada, as well as Ballast Water Exchange Zone Exclusion Maps, can be found by scrolling down to "Past Meetings" at <http://www.psmfc.org/ballast/>

On the last day of the workshop, a smaller working group developed draft workshop recommendations and findings as follows (condensed):

Barring certain exclusion zones, the working group concluded that exchanging ballast water beyond 50 nm and in areas deeper than 1,000 meters, and thereby beyond the continental shelf, will reduce the risk of introducing non-native species to the U.S. coast.

Along the Pacific coast, major estuaries and rivers create plumes that often extend more than 50 nm offshore. If a vessel exchanges ballast water in a river plume, then non-native larvae can easily be retained in the plume and then potentially transported back into estuaries and rivers. Thus, the working group concluded that no exchange zones should be established around these plume areas.

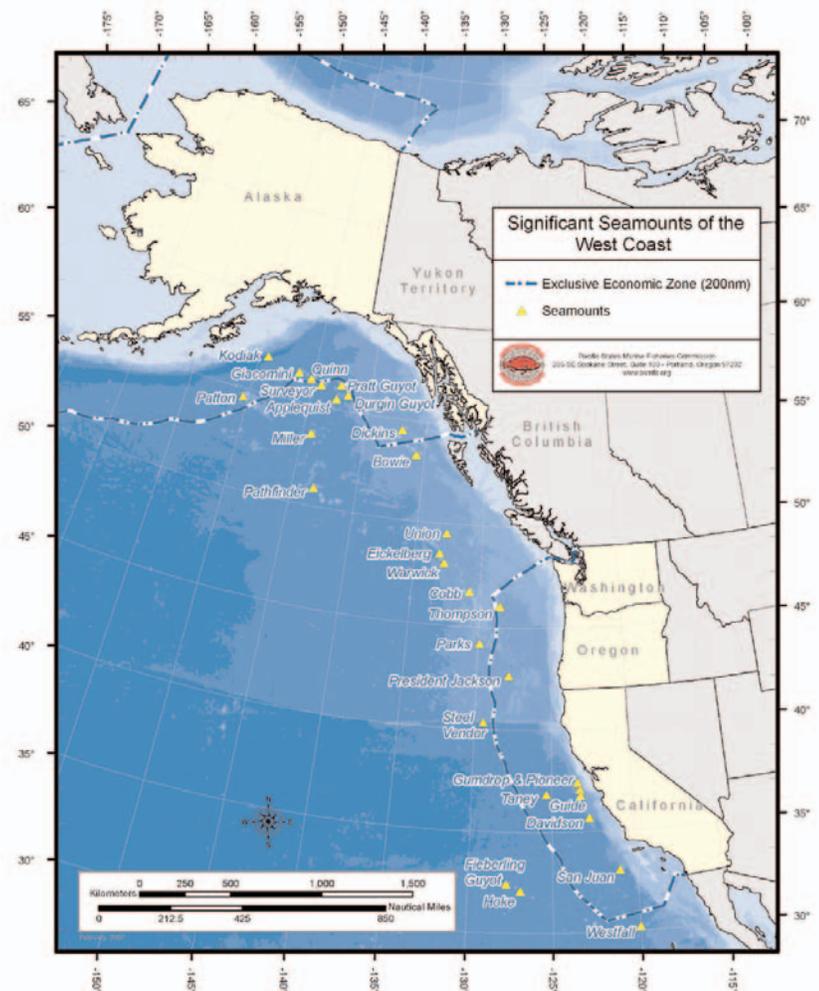
The working group suggested that a workshop should be convened that would involve Mexican officials and be modeled after this ABWEA meeting. The proceedings from this meeting could be used to help establish recommendations and/or exclusion zones to reduce the number of non-native species introduced to both U.S. and Mexican waters.

In contrast to what is known about estuaries, the working group noted that relatively less is known about offshore benthic and pelagic invertebrates and suggested that offshore species lists should be generated by collecting and analyzing more offshore biological samples.

Seamounts are often associated with diverse marine species assemblages. If seamount surfaces are in relatively shallow waters, the working group advocated that it should be placed in a zone that excludes ballast exchanges. Such an exclusionary process is being implemented for a seamount in British Columbia.

There was debate about the frequency at which transoceanic vessels can seek safety exemptions to exchange water within 50–200 nm of the U.S. EEZ. Using the 2005 data for Oregon and Washington ports, research from Portland State University determined that only two out of approximately 800 international vessels exchanged ballast within 50–200 nm.

The workshop proceedings are expected to be released soon. For further information, please contact the Conference Coordinator, Stephen Phillips, at [Stephen\\_phillips@psmfc.org](mailto:Stephen_phillips@psmfc.org)



Seamounts are often associated with diverse marine species assemblages. The ABWEA workshop working group recommended that if a seamount surfaces to relatively shallow depths, it should be placed in a zone that excludes ballast exchanges. Such an exclusionary process is being considered for the proposed Bowie Seamount Marine Protected Area in British Columbia, Canada.

Figure courtesy of: Stephen Phillips

## Hull Cleaning of “Mothball Fleet” in San Francisco Bay Presents Challenges

*Alisha Dahlstrom, West Coast Ballast Outreach Project*

Many dread spring cleaning, even when it involves only a small closet or bedroom. Imagine having to sort through and dispose of obsolete ships weighing hundreds of tons that are decades old and subject to a myriad of regulations, with additional permitting requirements possibly on the way. Such is the task of the Maritime Administration (MARAD), the federal agency in charge of ships from the National Defense Reserve Fleet (NDRF), including those in Suisun Bay, CA.

Many of the ships in the Suisun Bay Reserve Fleet (SBRF) were built in the 1940s or earlier and have been anchored in Suisun Bay in case of emergency or war. These ships have likely accumulated large amounts of fouling organisms after sitting in the water for decades. Never used or maintained, it became apparent that after a certain point, the ships were no longer sound and would never be used. In 2001, Congress passed legislation to give MARAD statutory direction on the disposal of these obsolete ships. In April 2005, the Government Accountability Office (GAO) issued “Maritime Administration: Improved Program Management Needed to Address Timely Disposal of Obsolete Ships”, a report advising MARAD to develop a more integrated ship disposal program.

Based on the 2005 GAO report, MARAD began removal of the SBRF. A major logistical issue facing MARAD was the lack of nearby facilities to handle such disposal. There are no U.S. West Coast vessel dismantling facilities, and the ships had to be towed to operations on the Gulf Coast (Brownsville, Texas). This created a significant environmental problem—these ships harbor an unknown number of fouling species, including microorganisms, mussels, seaweed, anemones, sea squirts, barnacles, shrimp, worms, sea snails, even fish, which have the potential to invade the areas they are towed through. Unfortunately, little is known about how the hull maintenance practices of operational commercial vessels affect the risks of vessel-mediated biological invasions. It is thought that vessels that travel at slow speeds, spend long periods in port, are repainted infrequently, have infrequent dry docking maintenance, travel through areas with low salinity and temperature change, and have large wetted surface areas are more likely to pose a risk, although studies are only now

emerging to support these ideas. However, vessels with a maintenance and activity profile like those in the SBRF are unique, and experts agree that these pose a high potential for invasion.

Legislation regarding hull fouling is also in its nascent stages. Internationally, few countries have hull fouling regulation. Australia has regulations regarding hull cleaning for vessels under 25m only; New Zealand is in the midst of a 2-year study to investigate the characteristics of vessel fouling and is working toward developing biofouling regulations.

The passage of the National Invasive Species Act (NISA) in 1996 gave authority to the U.S. Coast Guard (USCG) to regulate invasive species. In September 2004, the USCG issued regulations (33 CFR 151.2035) requiring that vessels operating in U.S. waters bound for U.S. ports or places must clean ballast tanks regularly to remove sediments, rinse anchors and anchor chains when retrieving anchors, and remove fouling organisms from the hull, piping, and tanks on a regular basis. Any removed substance must be disposed of in accordance with local, state, and federal regulations. Because the USCG has federal jurisdiction over the ANS issue, MARAD works with the USCG before ship disposal. Before any of the SBRF vessels are towed from their fleet locations, the local Coast Guard office with jurisdiction over the respective reserve fleet inspects the vessels to verify compliance with Coast Guard environmental protection and marine safety regulations.

The California State Lands Commission’s (CSLC) recently released a report, Commercial Vessel Fouling in California, ([http://www.slc.ca.gov/Division\\_Pages/MFD/MFD\\_Programs/Ballast\\_Water/Documents/CSLCFoulingRpt\\_Final.pdf](http://www.slc.ca.gov/Division_Pages/MFD/MFD_Programs/Ballast_Water/Documents/CSLCFoulingRpt_Final.pdf)), including recommendations that California adopt legislation to include the control and prevention of ANS release via commercial vessel fouling, expand and coordinate biological research directed toward characterizing ANS risk by vessel behavior and characteristics, and continue long-term ANS monitoring in California waters. Although the CSLC does not have any legal requirements for MARAD to conduct pre-disposal activities, the CSLC is consulting with MARAD on this issue.



*The Suisun Bay Reserve Fleet  
Photo courtesy of Maritime Administration*

To comply with the Coast Guard's federal regulations, MARAD began pre-disposal cleaning of two ships in Richmond and one in Alameda in August 2006, with the intent of removing 35 years of growth of biological organisms before towing the ships to Brownsville, Texas, on August 13. The cleaning had an unforeseen consequence. A report by the company contracted to clean the ships indicated that sheets of decayed metals, hull coatings, and lead paint over one-third of an inch thick and several square feet in area, flaked off during cleaning and were left in San Francisco Bay. Due to the immense size of these ships, the cumulative hull surface to be cleaned is no small order: in this case each ship was 439 feet long and 90% of the submerged hulls were scraped. The concern voiced by state water quality agencies is that this may pose a significant environmental and human health threat due to the presence of toxic metals (lead, tributyltin and copper) from antifouling paints originally applied to the hulls in order to prevent marine growth. Lead is highly toxic to marine life and humans and was banned from use in paints in the 1970s. However, because several of the ships cleaned were built before the ban, they may contain lead.

These water quality concerns have raised regulatory questions. The San Francisco Bay Regional Water Quality Control Board (the board) is concerned that toxic marine paints and other hazardous materials are being introduced during the cleaning process. While hull-cleaning permits may be necessary, Wil Bruhns, a spokesman for the board, stated that additional regulations regarding pre-disposal cleaning are both unwanted and unneeded, as the hull cleaning operations may be covered under the federal Clean Water Act and/or the California Water Code. The board met with MARAD and both parties have agreed to try resolving these issues by coordinating additional ship cleaning and monitoring activities.

MARAD had scheduled the disposal of a SBRF ship at the end of December and the board began sampling hull materials to determine toxicity on Dec. 14, 2006, with results expected in mid-January. However, MARAD was locked into a time-sensitive contract for the disposal of this ship and requested Coast Guard permission to move two vessels without cleaning, maintaining that the fouling species on this particular ship did not present an environmental risk. The USCG did not agree and allowed towing of the vessel without removing the fouling biomass under the conditions that MARAD would have the vessel cleaned prior to entering the receiving state's waters and upon approval by the relevant state authority. The Coast Guard also informed MARAD that it would formally document all actions taken by MARAD that were outside the intent of the Coast Guard's regulations. It is uncertain whether this will set a precedent for future disposals.

Once the toxicological issues are resolved, the board and MARAD can address the general legal/permitting issues of hull-cleaning protocol based on the potential threat to water quality. If the board determines the cleaning would result in a discharge of pollutants posing a threat to the quality of San Francisco Bay, they

may take legal action. This could include a range of activities: forming an agreement between the board and MARAD to monitor further hull-cleaning activities; permitting hull cleaning under existing laws, which could require BMPs (best management practices) to minimize discharges; or requiring a National Pollutant Discharge Elimination System (NPDES) permit.

While this may slow the actual disposal of the ships, the board supports the basic goal of recycling these ships, as they pose a threat of major discharges just through failure of the ship structures if they continue to sit in the Bay. The board is confident the two agencies can resolve this issue in a manner that protects the health of the Bay while allowing for the efficient disposal of the NDRF.

For additional information, please contact Wil Bruhns, Chief of the San Francisco Bay Regional Water Quality Control Board's North Bay Watershed Division at (510) 622-2327 or [wbruhns@waterboards.ca.gov](mailto:wbruhns@waterboards.ca.gov).



*The HMNZS Canterbury, in PVC plastic wrapping.  
 Photo courtesy of Biosecurity, New Zealand*

## New Zealand Studies Scraping Alternative

While scraping is still the predominant form of hull cleaning, some agencies are moving ahead with experimental methods to remove fouling organisms. In New Zealand, the former navy frigate *HMNZS Canterbury* has been wrapped with plastic PVC to remove the sea squirt *Styela clava*. The plastic deoxygenates the water between the wrapping and the hull, killing any unwanted species attached to the hull. Initial monitoring showed the technique works, but monitoring was cut short when heavy tidal flows ripped the plastic PVC wrapping. For more information, visit: [www.biosecurity.govt.nz/pest-and-disease-response/pests-and-diseases-watchlist/sea-squirt](http://www.biosecurity.govt.nz/pest-and-disease-response/pests-and-diseases-watchlist/sea-squirt).

## Monitoring the West Coast: Determining the what, where, when, why and how of invasive species

Dr. Catherine deRivera, Aquatic Bioinvasions Research and Policy Institute, Smithsonian Environmental Research Center and Portland State University

Nonindigenous marine species—species that have invaded new regions beyond their historical range—cause environmental and economic damage to our native organisms and their habitats. They parasitize, eat, and compete with native and cultured species; change habitat and other ecosystem properties; and foul pipes and other structures. As a result, they have reduced the abundance of native organisms, changed their habitat use, and stressed commercial fisheries, among other impacts.

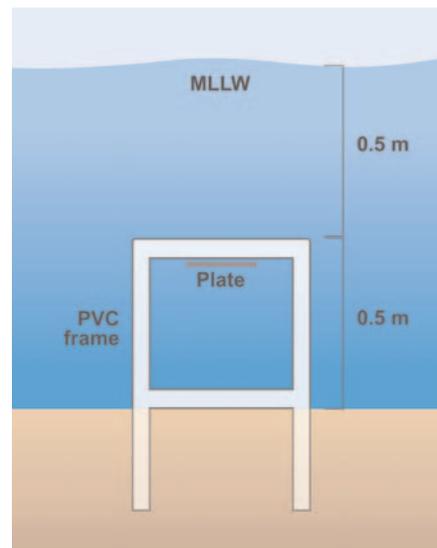
The primary vector of spread for most marine nonindigenous species has been shipping. While we know shipping has transported many species, we lack information on how many species are here and how they are distributed. Understanding this background information is essential to evaluating how ballast water exchange and other management actions are stemming the flow of invaders.

To address this knowledge gap regarding the extent and patterns of marine nonindigenous species, the National Estuarine Research Reserve System (NERRS) and the National Marine Sanctuary Program (NMSP) teamed up with the Marine Invasions Research Lab at the Smithsonian Environmental Research Center (SERC) to conduct a large-scale sampling and research program. The NERRS and NMSP are charged with the conservation and stewardship of ecologically sensitive, biologically diverse areas along all coasts of the United States. However, most reserves have been affected by biological invasions, and the identification of marine invasive species sources remains a high concern for both programs of protected coastal areas. SERC's Marine Invasions Research Lab is important to nationwide efforts of monitoring and studying the patterns and processes of nonindigenous marine species.

This program set out to conduct standardized monitoring for nonindigenous species to meet several related goals. These surveys will provide a baseline against which the impact of future invasions and management actions can be compared. They will also help to determine the diversity, range, and abundance of established nonindigenous species and track their spread. Finally, the surveys may serve to provide early detection of new invasions.

We focused our first surveys on the fouling and nearshore crab communities in protected areas along the U.S. West Coast. The fouling community includes sponges, hydroids, anemones, barnacles, mussels, clams, bryozoans, and tunicates—nearly all marine animals with a stationary life stage that live on hard surfaces. Most of these animals have a planktonic larval phase: they spend

the beginning of their lives in suspension before changing to the stationary adult form. When ready to transform into the stationary stage, they recruit to the undersides of rocks, crevices, and other hard substrates, including marinas, ships, and artificial sampling



An illustration of the plate set-up for natural areas in the reserves. At top, MLLW represents the Mean Lower Low Water mark, which is the average of the lower low water height of each tidal day. Figure courtesy of Chris Bell

substrates (settling plates.) They can be transported by ballast water when they are planktonic and by ship hulls once they have settled.

Our research program employed standardized field approaches in five areas along the length of the U.S. West Coast from Kachemak Bay, Alaska, to San Diego, California.

We collected data from 310 settling plates and 140 crab traps across the nine West Coast reserves and sanctuaries. The four most common taxa on the settling

plates were Bryozoa (moss animals), Tunicata (sea squirts), Cirripedia (barnacles), and Hydrozoa (hydroids). We also documented two nonindigenous species new to the U.S. West Coast (*Balanus reticulatus* in the Tijuana River NERR area marina, and the Atlantic bryozoan, *Bugula fulva*, found in a Monterey Marina, plus three range extensions (for *Balanus improvisus*, *Styela plicata*, and *Victorella pavida*).

We documented two patterns in nonindigenous species, a latitudinal pattern and differences between nonindigenous species impacts in marinas versus non-marina sites. Both the number and percent of nonindigenous species decreased with increasing latitude. The Tijuana River had the most nonindigenous species (21), and Monterey Bay had the highest proportion of nonindigenous species (57%).

Across latitudes, plates in marinas were more impacted by non-indigenous species than were plates in more natural areas. All but one nonindigenous species were found at marinas, whereas only half the nonindigenous species were found at the non-marina sites. In addition, nonindigenous species at marinas accounted for almost 80% of the nonindigenous species per site.

Our trapping study illustrated how recently introduced nonindigenous species quickly can become numerically dominant. At Elkhorn Slough NERR, *Carcinus maenas* was the most abundant



A sampling plate from Olympic Coast (WA) National Marine Sanctuary.  
Photo courtesy of Catherine deRivera

crab in our traps at 3 of 7 Elkhorn sites, yet is a recent introduction to this slough. We are now evaluating control measures for this crab in California.

Our monitoring and research program has provided an important step in gathering baseline information and documenting patterns in nonindigenous versus native fouling and crab communities along the U.S. West Coast. It also provides a foundation for future important research. For example, the SERC marine invasion lab has launched a program to examine the relative

importance of vector activity (e.g., shipping) on the distribution of the nonindigenous species found in this project. Together, these studies will help inform future management decisions to minimize spread of nonindigenous species.

## ANS Update

Alisha Dahlstrom, WCBOP Associate Coordinator

Although careful monitoring is essential to detecting new organisms, it cannot prevent introductions. The last six months have brought some bad news for aquatic ecosystems in the U.S. due to the introduction or range expansion of several new species.

**Viral hemorrhagic septicemia (VHS)** – Thought to have arrived in the Great Lakes via ballast water. The Animal and Plant Health Inspection Service (APHIS) has started to regulate the bait industry to slow the spread to uninfected lakes. Specifically, tackle shops in the Great Lakes region may only purchase minnows from tested and cleared sources, a regulation that may extend to all states by summer 2007, impacting bait shops due to the increased delay and expense of obtaining bait. However, the economic effects on recreational and commercial fishers may be much greater if the disease continues to spread throughout the

Great Lakes and Mississippi Basin.

Sharp, Eric (2007, January 18) Bait shop owners worry spread of VHS disease could decimate minnow sales. The Detroit Free Press. Retrieved January 19, 2007, from <http://www.freep.com/apps/pbcs.dll/article?AID=/20070118/SPORTS10/701180375>

U.S. Department of Animal and Plant Health Inspection Service. Veterinary Services. Viral Hemorrhagic Septicemia in the Great Lakes Region. Washington: Government Printing Office, 2006.

**Bloody Red Mysid, *Hemimysis anomala*** – Found in November 2006 in Muskegon, MI, the mysid shrimp is originally from Eastern Europe (the same region as the zebra mussel and goby), and likely arrived in ballast water from NOBOB (no ballast on board) ships. The shrimp consumes large amounts of microscopic animals, which may significantly impact the food chain by out-competing juvenile fish. It is still uncertain, however, how large the impact will be.

Raloff, J. (2007, January 13). Alien Alert: Shrimpy invader raises big concerns. Science News, 171(2). Retrieved January 12, 2007, from <http://www.sciencenews.org/articles/20070113/fob3.asp>

**Quagga Mussel** – The quagga was found in Lake Mead (located on the border of Nevada and Arizona) in January 2007 by divers. This find represents a major setback, as it is the first quagga report in the Western U.S. If they spread to California's water distribution system, the mussels could clog pipes and damage water lines supplying water to Southern California. During scheduled maintenance March 6-27, 2007, the Metropolitan Water District of Southern California will shut down its 242-mile aquaduct system, treating it with chlorine or copper sulfate and completing a visual survey in an effort to detect and kill any mussels present. Even these efforts, however, are unlikely to remove the mussel from the aquaduct system permanently.

Muir, Bob pers. comm. February 22, 2007. Metropolitan Water District of Southern California.

"Quagga Mussels in California." Department of Fish and Game. 27 February 2007. State of California. 27 February 2007 <http://www.dfg.ca.gov/quaggamussel/>.

**The Introduced Aquatic Species in California Open Coastal Waters Final Report** – this report states that of the 26 introduced species identified along the outer coast, six were new to California. In addition, the report named three probable vectors: oyster aquaculture, ballast water, and ship fouling. For more information, click on the report at: <http://www.dfg.ca.gov/ospr/organizational/scientific/exotic/MISMP.htm>

Maloney, E., Fairey, R., Lyman, A., Reynolds, K., Sigala, M. 2006. Introduced Aquatic Species in California Open Coastal Water. Final Report. California Department of Fish and Game. Office of Spill Prevention and Response. Sacramento, CA., 93pp.

## Eliminating Aquatic Invasive Species Using Ozone: A Partnership between BP and Nutech

Michael Jennings, Nutech O3, Inc., and Nicole Dobroski, West Coast Ballast Outreach Project\*

An ozone ballast water treatment system developed by Nutech O3, Inc., is currently being tested onboard British Petroleum's (BP) oil tanker *Prince William Sound*, the second BP vessel fitted with a Nutech ozone ballast water treatment technology. The partnership between BP and Nutech began in March 1998, when BP requested that Nutech develop an effective ballast water treatment technology for use on its oil tankers. In 2000, Nutech installed their first commercial ozone ballast water treatment system aboard the BP tanker *Tonsina*.

Several characteristics of ozone make it a desirable agent for ballast water treatment. Ozone has been used in municipal water treatment systems since the 19th century and today is used by bottled water suppliers, soda bottlers, brewing facilities and sewage treatment facilities. Ozone is a powerful oxidation agent that is soluble in water. It has an extremely short half-life, after which it reverts to oxygen. In seawater, ozone reacts with naturally found constituents and forms hypobromous acid (HOBr) and hypobromite ion (OBr-), which become the "killing" mechanism when their levels exceed easily monitored toxic thresholds. After treatment, residual ozone levels degrade to normal ambient conditions, and thus the ozone-treated ballast water may be discharged with no harm to receiving waters. Ozone has been proven to not accelerate corrosive forces already at work in seawater at the dosage levels required for ballast treatment, and ozone can be generated easily onboard, which eliminates the need for chemical storage.

In September 2000, Nutech's first prototype ozone system, SCX 2000, was installed on the 125,000 dead weight ton BP oil tanker, *Tonsina*. The *Tonsina* carries approximately 12 million gallons of ballast water. Extensive at-sea and post-installation testing was

conducted by research scientists and engineers from the Urban Water Research Center at the University of California, Irvine, Iowa State University, the University of Washington, the University of Western Washington, the Smithsonian Institution's Environmental Research Center in Edgewater, Maryland and the U.S. Fish & Wildlife Service's Kenai, Alaska, field office.

The results from the *Tonsina* system show species elimination rates in excess of 99.99%, with survival and re-growth rates of 0%. Laboratory testing at the University of Washington and the La Que Institute for Corrosion Research in Wrightsville Beach, North Carolina, preceded the system's installation. The La Que Institute testing demonstrated that ozonated ballast water did not cause an increase in the rate of corrosion to the ship's hull. Based on these results, Nutech moved forward with a more efficient method of ozone treatment, Venturi Injection.



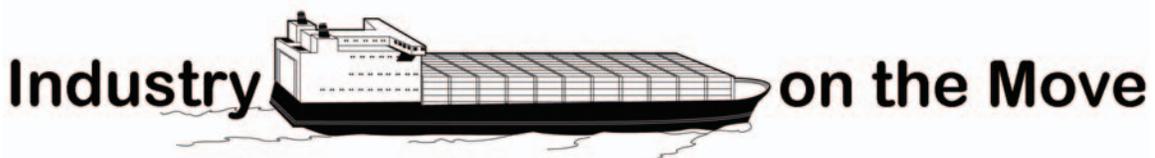
*The ozone generator component of the system installed in the engine of the Prince William Sound*  
 Photo courtesy of Northeast Technical Services Co., Inc.



*The ozone generator component of the system installed in the engine of the Prince William Sound*  
 Photo courtesy of Northeast Technical Services Co., Inc.

A member of the research team investigating the efficacy of the Nutech system, Dr. William Cooper, University of California, Irvine, comments that, "The studies that the scientific team are conducting are the most comprehensive to be carried out at full scale on a working vessel. The partnership of industry and academia with Sea Grant funding has proven to be an effective way to demonstrate the efficacy of ozone for ballast water treatment."

Nutech's second ozone treatment system, Mark III, has a footprint approximately 1/3 smaller than the SCX 2000 System and can generate more than 2.5 times as much ozone. The Mark III System injects ozone at a rate greater than 4,500 grams per hour into the ballast water via a Venturi Injector. In the older system, only 1,800 grams per hour of ozone could be injected using over 1,200



stone diffusers. This increase in efficiency has allowed for the injection of ozone into the ballast water as it comes on board the ship instead of injecting it into the ship's ballast tanks after they are filled. The Mark III System was installed on the BP oil tanker, Prince William Sound, in Singapore from July through September 2006. Testing began in October 2006. Cooper states, "With this new design and significant capital cost reduction, we are optimistic that this will provide a cost-effective process for minimizing invasive species in ballast water."

For more information about Nutech O3, Inc., contact Michael Jennings, Director of Operations, mikej@nutech-o3.com. For more information about the vessel, Prince William Sound, and BP's ballast water testing program, please contact Grant Johnson at Grant.Johnson@BP.com.

\*Nicole Dobroski now works in the Marine Invasive Species Program at the California State Lands Commission. You can reach her at dobrosn@slc.ca.gov.



## Canada Publishes New Ballast Water Regulations

*Bivan R. Patnaik, U.S. Coast Guard, and Chris Wiley, Transport Canada and Fisheries and Oceans Canada*

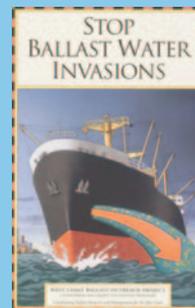
On June 28th, 2006, Transport Canada (Canada's department responsible for developing transportation regulations) published ballast water control and management regulations, which are intended to reduce the risk of aquatic invasive species from being introduced into Canadian waters through vessels' ballast water. The regulations convert several existing voluntary guidelines into mandatory requirements. To the extent possible, these regulations correspond with the U.S. Coast Guard's ballast water management regulations and with IMO's International Convention for the Control and Management of Ship's Ballast Water and Sediments.

In the regulations, ships are required to exchange their ballast water at least 200 nautical miles from shore and in waters having a depth of at least 2,000 meters before entering Canadian waters. When ships do not travel beyond 200 nautical miles from shore, or when ships cannot exchange their ballast water in mid-ocean because of weather or other related safety issues, they will be required to follow other best management practices. These practices include treating the ballast water or keeping the water onboard. The regulations also specify alternative zones—located within Canadian waters—where ballast water can be exchanged to minimize potential impact. These alternative exchange zones have been identified based on scientific advice provided by the Department of Fisheries and Oceans.

The new regulations also specify actions for vessels declaring no ballast onboard and unable to manage their ballast water. They must follow certain sections of the Shipping Federation of Canada's Code of Best Management Practices for Ballast Water Management or conduct saltwater flushing in an area at least 200 nautical miles from shore before entering Canadian waters.

Under the regulations, all ship operators will have to develop a ballast water management plan for each ship. This plan must outline the measures and procedures established by the operator to ensure that ballast water is being managed safely, effectively, and in compliance with regulations. Transport Canada inspectors will use refractometers to measure the salt content of ballast water carried by ships arriving at Canadian ports. For freshwater ports, this check ensures that salinity is not greater than 30 parts per thousand (ppt) because scientific evidence suggests that freshwater organisms exposed to such salinity are unlikely to survive. For marine ports, the salinity is an extra check (in addition to examining the ship's documents, log book, etc.) that exchange was in fact carried out. Ocean seawater has a known salinity around the world—if the salinity in the tank is not consistent with where the ship supposedly exchanged its ballast, then perhaps further investigation by the inspectors might be warranted. For example, if a ship ballasted in the Mediterranean around Italy, the salinity would likely be in the 37 ppt range. If it was heading to Halifax, which is also a saltwater port, and the inspectors find that the salinity in the tank is still in the 37 ppt range, the chances are quite good that no exchange was carried out as salinity in the Atlantic is less than 37 ppt. The refractometers used are calibrated with the "expected" seawater so are quite accurate.

For more information on the Canadian ballast water regulations, please refer to Transportation Publication 13617, "A Guide to Canada's Ballast Water Control and Management Regulations," which may be found at the following web site:  
<http://www.tc.gc.ca/MarineSafety/TP/Tp13617/menu.htm>



For more information on ballast water invasions or to receive a poster or brochure please contact:

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## The U.S. Coast Guard's Shipboard Technology Evaluation Program (STEP)

Dr. Richard Everett and Heather St. Pierre, U.S. Coast Guard

### Why is STEP needed?

The potentially negative impacts of aquatic nuisance species (ANS) on our environment, food supply, economy, health, and biodiversity are universally accepted as significant and growing. As one of many initiatives aimed at reducing the introduction of ANS into U.S. waters via ballast water, the U.S. Coast Guard established STEP, a program aimed at facilitating the testing and refinement of experimental shipboard ballast water treatment systems.

### How does STEP work?

Navigation and Vessel Inspection Circular 01-04 (NVIC 01-04) (<http://www.uscg.mil/hq/gm/mso/images/step%202004%20nvic.pdf>) establishes the vessel owner application process for acceptance into STEP. Briefly, applicants prepare and submit to the Coast Guard a detailed description of the planned shipboard experimental evaluation, as well as background data and information from prior land-based experiments that indicate the treatment system has good potential to effectively reduce the numbers of living organisms in discharged ballast water. The Coast Guard reviews the application packages to determine whether the proposed experimental evaluations are likely to produce high-quality data on the performance of the treatment systems under shipboard operating conditions.

### Why will STEP work?

Established in 2004, STEP is intended to encourage research and development of effective shipboard ballast water treatment systems, creating more options for foreign and domestic vessel owners seeking alternatives to ballast water exchange. Because technology developers and vessel owners have expressed a reluctance to invest the resources to install and operate experimental treatment systems that may not meet discharge standards mandated by future regulations, this program allows the Coast Guard to grant equivalencies to vessel owners that participate in STEP. This means that vessels accepted into STEP will be considered to meet ballast water management requirements when using the installed experimental treatment systems. The increase in vessels collecting data will quicken the development rate of proven treatment technologies. Participation in STEP is open to all vessels subject to the Coast Guard's Ballast Water Management regulations (33 CFR 151 Subparts C and D). Vessels regulated under the Trans-Alaskan Pipeline Authorization Act, (15 CFR 754.2(j)(1)(iii)) for oil exports, are not eligible for acceptance into STEP.

### What is the current status of STEP?

Two STEP applications were received by the Coast Guard in 2004, but were denied after review because the proposed work entailed too many uncertainties regarding the experimental methods that would be used. In March 2006, a Federal Register

announcement was published and a public meeting was held to discuss revisions to the STEP application guidance documents, and announce the deadline for receipt of applications to be reviewed in 2006. Three applications were received and are currently under review.

### How do I find more information on STEP?

More information on the Coast Guard's ballast water program and STEP application process, including the NVIC and guidance to applicants on the preparation of submissions, are available at: [http://www.uscg.mil/hq/g-m/mso/mso\\_1.htm](http://www.uscg.mil/hq/g-m/mso/mso_1.htm). Potential applicants should monitor the website for announcements of any future program changes and submission deadlines, and are also encouraged to contact the Coast Guard Environmental Standards Division (G-PSO-4) staff at 202-372-1402 or [environmentalstandards@comdt.uscg.mil](mailto:environmentalstandards@comdt.uscg.mil) prior to submission, to discuss the criteria for acceptance, application process, and documentation requirements.

## Governor Schwarzenegger Signs Ballast Water Regulation Bill

*Alpa Wintzer, UC Davis Integrative Graduate Education and Research Traineeship (IGERT) Program*

California Governor Arnold Schwarzenegger signed SB 497 on September 18, 2006, a bill aimed at protecting the state's coastal resources and water quality by further regulating ballast water. Introduced by California Senator Joseph Simitian (D-Palo Alto), it mandates that ships treat ballast water onboard to kill invasive species before it can be released into California ports or coastal areas. Treatment standards will be developed by the California State Lands Commission and adopted by early 2008. These standards will be phased in starting 2009, and by 2020, all ships must comply with zero detectable live-organism discharge. This new law makes California the first state to make ballast water treatment mandatory, although other states, including Michigan, Washington, and Oregon, have ballast policy in place that is more stringent than current U.S. Coast Guard regulations.

## Oregon Introduces Ballast Water Bills

*Pacific Ballast Water Group*

Two bills relating to ballast water have been introduced in the Oregon legislature that implement some of the recommendations of the Oregon Ballast Water Task Force.

SB 643 makes minor changes to the definition of a cargo vessel that brings it into line with the USCG and recreates and expands the purview of the Task Force to include shipping related pathways other than ballast water.

SB 644 creates a position with Oregon DEQ to run the program. You can download the bills here:

[www.leg.state.or.us/07reg/measpdf/sb0600.dir/sb0643.intro.pdf](http://www.leg.state.or.us/07reg/measpdf/sb0600.dir/sb0643.intro.pdf)  
[www.leg.state.or.us/07reg/measpdf/sb0600.dir/sb0644.intro.pdf](http://www.leg.state.or.us/07reg/measpdf/sb0600.dir/sb0644.intro.pdf)

## Online Resources

Aquatic Bioinvasion Research and Policy Institute  
<http://www.clr.pdx.edu/abrpi/>

Aquatic Nuisance Species (ANS) Task Force  
<http://www.anstaskforce.gov/>

California State Lands Commission  
<http://www.slc.ca.gov/>

Marine Invasive Species Program (MISP), California Dept. of Fish and Game  
<http://www.dfg.ca.gov/ospr/MISMP.htm>

Great Lakes Panel on Aquatic Nuisance Species  
<http://www.glc.org/ans/panel.html>

Global Ballast Water Management Programme  
<http://globallast.imo.org/>

National Ballast Water Information Clearinghouse  
<http://invasions.si.edu/nbic/>

National Invasive Species Information Center  
<http://www.invasivespeciesinfo.gov/>

Northeast-Midwest Institute – Aquatic Invasive Species  
<http://www.nemw.org/biopollute.htm>

Oregon Department of Environmental Quality  
<http://www.deq.state.or.us/>

Sea Grant Nonindigenous Species Site  
<http://www.sgnis.org/>

Stop Aquatic Hitchhikers!  
<http://protectyourwaters.org/>

U.S. Coast Guard Ballast Water Management Program  
<http://www.uscg.mil/hq/g-m/mso/estandards.htm>

Washington Department of Fish and Wildlife  
<http://www.wdfw.wa.gov/>

Western Regional Panel on ANS  
<http://www.fws.gov/answest/>

West Coast Ballast Outreach Project  
<http://ballast-outreach-ucsgep.ucdavis.edu/>

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## WCBOP Outreach Evaluation Surveys

How well do the WCBOP's outreach materials serve your needs? In order to enhance our communication of ballast water issues, we would appreciate it if you took the time to evaluate the WCBOP poster, brochure, and this issue of our project newsletter, Ballast Exchange. The surveys can be found at, <http://www.surveymonkey.com/s.asp?u=996051932215>

## One more evaluation survey: WCBOP's Website!

We have updated the WCBOP website. The new website contains up-to-date information on general Aquatic Non-indigenous Species (ANS) and ballast water issues, WCBOP outreach materials, including our "Stop Ballast Water Invasions" poster and brochure, as well as previous issues of Ballast Exchange and a calendar of upcoming events. The URL remains <http://ballast-outreach-ucsgep.ucdavis.edu>. Please fill out the brief "Website evaluation survey" found at <http://www.surveymonkey.com/s.asp?u=888333356592>

## Coming soon – Treatment Technology Section!

Ozone, Biocides, and UV – oh my! With the expanding number of ballast water standards and regulations, there has been a growing interest in developing feasible treatment technologies (TT). While the number of TT is large, the number of researchers involved and research protocols used are even greater. Many databases exist that include TT, but the information is not easily accessed or deciphered by some non-technical audiences. The WCBOP is in the process of developing a more user-friendly option, enabling site visitors to easily review and understand the current research. We will include a comment/discussion section for users to ask questions or provide input. We hope to launch the page within a few months – check the WCBOP's home page for updates!