



December 2, 2009 • Admiral Fell Inn, Baltimore, Maryland

SPEAKER TITLES AND ABSTRACTS

Vector Heterogeneity, Integrated Vector Management (IVM) and the Vector Early Warning System (VEWS)

James T. Carlton, Williams College

Vector diversity and complex multivector systems pose significant management and policy challenges in the prevention of the invasion of new introduced species and of the spread of established introductions. Vector science distinguishes the cause, route, and the vector itself, and further recognizes vector tempo, origin, biota, and strength as additional measurable attributes. Integrated Vector Management (IVM) is the approach that focuses management strategies and technologies on the total range of a vector's period of active life, from origin (donor region) to destination (recipient region), with the goal of reducing or preventing the transmission and release of living organisms. IVM interfaces with the emigration phases (species pool adjacencies, entrainment, and transport) and immigration phases (discharge, survival, reproduction and establishment), as well as secondary emigration (secondary dispersal). Fundamental to IVM is a regularly monitored, coordinated program that emphasizes repeated assessments and reassessments, directed research programs, and flexible, adaptive strategies. To forecast vector behavior and associated species transfers, a Vector Early Warning System (VEWS) combines projections by an interdisciplinary group (including futurists, economists, trade specialists, shipping industry forecasters, live trade industrialists, aquaculturists, biologists, and others) to predict patterns of commerce on fixed time horizons. This approach triggers management actions to reduce invasions associated with new or altered vector patterns, shifting management emphasis from reactive to proactive modes, utilizing a vector interruption framework (intervention, disassembly, and disablement). To permit managers to have their finger on the invasion pulse, the concept of a Vector Blitz is reviewed.

Commercial Shipping and Invasion Opportunity in North America

Whitman Miller, Smithsonian Environmental Research Center

Using data from the National Ballast Information Clearinghouse (>108,000 arrivals), patterns of arrival, ballast water discharge, and ballast water exchange are examined. When the Gulf of Mexico, east and west coasts are compared, significant differences in ballast water delivery and management suggest strong differences in invasion opportunity. These patterns indicate some limitations of the ballast water management approaches currently used in the United States.

International and National Ballast Water Management (1)

Richard Everett, U.S. Coast Guard

The International Maritime Organization (IMO) adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments at a Diplomatic Conference in London in February of 2004. Subsequently, the IMO has worked to develop a comprehensive suite of guidelines for implementing the provisions of the Convention. The Convention enters into force 12 months after the date at which not less than 30 States (countries), the combined merchant fleets of which constitute not less than 35% of the gross tonnage of the world's merchant shipping, have ratified or otherwise acceded to the Convention. The key provisions of the Convention, and its latest status regarding entry-into-force, will be summarized, and an update provided on current activities at IMO related to aquatic invasive species. Domestically, the U.S. Coast Guard (USCG) is

authorized and directed by Congress to develop and implement a program of guidelines and regulations to ensure to the maximum extent practicable that AIS are not discharged into waters of the U.S. from vessels. Beginning in 1999, the USCG has implemented a suite of voluntary guidelines and regulations intended to reduce and eventually prevent the introduction of AIS to U.S. waters via the activities of ships. Most recently, the USCG has proposed a regulation that includes a ballast water discharge standard and procedure for approval of ballast water treatment systems. The key elements of the proposed regulation will be summarized, and similarities and differences compared to the IMO Convention discussed.

International and National Ballast Water Management (2)

Robin Danesi, U.S. Environmental Protection Agency

EPA finalized the Vessel General Permit (VGP) on December 18th, 2008. The VGP covers over 60,000 US flagged commercial and 8,000 foreign flagged vessels. This talk will provide an overview of the permit, including the ballast water provisions and an update on EPA's efforts with regard to ballast water management.

From Paper to Policy — Implementing California's Marine Invasive Species Act ***Mauria Falkner, N. Dobroski, C. Scianni, L. Takata, California State Lands Commission***

In October 1999, California enacted the nation's first statewide mandatory ballast water management law designed to prevent or reduce the introduction and spread of nonindigenous aquatic species (NIS) via ship's ballast into California waters. While the Marine Invasive Species Program's (MISP) initial focus was on foreign ballast water management, during the 2003 Legislative session the law was reauthorized and the MISP was restructured into a multi-faceted program that more comprehensively pursues the prevention of NIS via commercial shipping. Stakeholder involvement has become integral to MISP policy development. Technical Advisory Groups consisting of scientists, regulators, environmental organizations and shipping industry representatives, are regularly convened to inform management strategies. The program melds education and outreach with enforcement efforts, resulting in compliance rate levels exceeding 90%. The MISP's success is a result of our comprehensive and multi-pronged approach that includes: Sound policy development in consultation with a wide array of stakeholders; funding and coordination of targeted, applied research; development and management of an extensive database of commercial shipping-related vector management practices; and outreach to bridge the knowledge gaps between stakeholders. This talk will provide a general overview of the Marine Invasive Species Program, and highlight the drivers, development, and rationale behind recent major initiatives.

Implementing Ballast Water Regulations: Treatment Systems and Enforcement

Mario Tamburri, Chesapeake Biological Laboratory

Establishing regulations is only one step in managing vectors of invasive species. Key steps in the successful management of ballast water to prevent the introductions of aquatic invasive species also include development of: (a) effective, reliable and safe shipboard treatment systems, (b) methods, approaches and facilities to quantify and verify treatment system performance, and (c) effective compliance monitoring and enforcement. Dr. Tamburri, the Director of the University of Maryland's Maritime Environmental Resource Center, will review the status of ballast water treatment systems, test facilities and challenges to evaluating the efficacy of ballast water treatments, and approaches for routine compliance monitoring once discharge regulations are in place.

Hull Fouling as a Vector of Marine Nonindigenous Species

Ian Davidson, Portland State University

Hull fouling is an important vector of marine species with a long history and global reach. The vector provides species, many with limited self-dispersal abilities, with a means of rapid and repeated transport across previously impenetrable biogeographic barriers. In bygone times, when slow-moving wooden ships predominated, countless numbers of organisms were dispersed via this transfer mechanism. More recently,

faster steel ships are thought to have reduced biofouling vector risks while ballast water emerged as a higher priority for study.

Species transfers and invasions via hull fouling endure, however, and there has been a resurgence of interest and research in the vector. Recent analyses have suggested that between 55% and 69% of more than 1700 marine introductions throughout the world are fouling related. Moreover, the continued detection of hull-mediated invaders reveals an active and potent vector with commercial, recreational and other vessels acting simultaneously to increase the vector's global footprint.

This presentation will examine three classes of vessels and their biofouling vector characteristics: (1) commercial vessels, (2) recreational boats, and 3) stochastic vessels (decommissioned vessels, floating docks, oil platforms etc). We have conducted case studies on all three vessel categories and recorded species transfers that pose a risk of invasion to recipient ports and harbors. Our work and studies from the literature reveal differential invasion risks within and among these vessel-types because of varying characteristics that influence biofouling transfers such as residence times, transit speeds, and frequency of arrival.

As a result, there are a variety of biofouling management strategies and tools that can be employed across vessel-types. These affect species transfers by targeting pre-transit, transit, and post-transit components of the vector process and range from international agreements to individual boater behaviors. The case for managing biofouling vectors rather than employing species-by-species approaches is compelling because it is preventive and proactive rather than reactive.

Invaders for Sale: The Potential for New Invasions via Live Organisms in Aquarium, Aquascape, Seafood, Aquaculture and Bait Trades
Edwin Grosholz, University of California, Davis

Despite the focus on ship vectors, we know that several other vectors have been responsible for the introduction of marine invaders. In general, these vectors include the sale and distribution of live organisms for home aquaria, outdoor aquascape/landscape, seafood, aquaculture and fishing bait. Invasions are the result of the subsequent (usually) unintentional release or escape of these organisms, either before or after purchase, into freshwater, estuarine and marine systems. Unlike ship vectors, there are few data on the identity and volume of species in trade and virtually none on the frequency of introduction via releases or escapes. My goal is to outline what we know and don't know about these vectors, what tools we have available to reduce the likelihood of introduction by these vectors and where we can make the most progress in the future. I discuss which vectors may be most amenable to risk reduction, as well as, approaches to reduce risk that include: 1) gathering better information on the sales volume and patterns of distribution of non-native species in trade, 2) educating industry participants about best/better management practices as well as educating their customer base, and 3) increasing regulation or improving enforcement of existing regulations.

Wildlife Importation: Broken screens — The Regulation of Live Animal Imports into the United States
Peter T. Jenkins, Defenders of Wildlife

To avoid unwanted impacts of invasive imported wildlife, and from pathogens that imported animals may carry, we should block their initial entry into the United States. Several reports have described the Federal regulatory system applied to imports of live non-native species as outdated and negligent in view of the massive trade volume and the serious environmental, economic and health risks involved. Current Federal animal import laws hold few species back, blocking only the most glaring invaders and disease vectors.

In a ground-breaking 2007 study, *Broken Screens - The Regulation of Live Animal Imports in the United States*, *Defenders of Wildlife* addressed the risks of all intentionally imported wildlife taxa (see www.defenders.org/animalimports). Defenders obtained, and made public for the first time, complete listings of the 2,241 known, non-native, animal species imported according to U.S. Fish and Wildlife Service data, from 2000 to 2004. Defenders then preliminarily evaluated the invasion and disease risks they present. Defenders also commissioned a project with the IUCN Invasive Species Specialist Group to compare the U.S. animal import list with global lists of species known or predicted to be invasive or otherwise harmful.

This “coarse screen” found preliminary evidence that a large percentage (16% of vertebrates) of imported wildlife species pose risks to native animals, human and animal health, or the economy. Defenders recommends most of those species should not continue to be imported unless full, science-based, risk analyses are prepared and case-by-case regulatory decisions made regarding the acceptability of risks these species may present. All risk cannot be eliminated but, given the continuing increases in live animal imports, our fragmented, excessively liberal, Federal regulatory system fails the national interest. Defenders’ study provides eleven detailed policy recommendations to fix these “broken screens”.

Live Trade in the Mid-Atlantic Area: A View from the NAS Database

Pam Fuller, U.S. Geological Survey

An analysis of freshwater animal introductions in the mid-Atlantic drainage area revealed that a surprising high percentage (42%) of species had been introduced via pathways involving live trade; namely bait release, aquarium and pet release. The majority of species that have been introduced through aquarium and pet releases are species that would not survive and reproduce in the region. However, there are a few exceptions to that. The bait trade is comprised mainly of species that will survive and reproduce. HACCP training of bait dealers and state regulations are probably the best approaches to managing this vector.

Overview of State Invasive Species Policy Tools

Read Porter, Environmental Law Institute

In 2002, the Environmental Law Institute (ELI) published *Halting the Invasion: State Tools for Invasive Species Management*, which reviewed state invasive species laws and regulations in all 50 states and identified the many policy tools that states use to address these species. A forthcoming study by ELI updates the findings in *Halting the Invasion* by reviewing how legal authorities have changed in the ensuing years and reviews how states currently apply these policy tools. This talk will review the policy tools and focus on how state regulators can apply them to develop more effective and proactive legal authorities, with a special focus on tools that can be used to prevent introductions via existing aquatic invasive species invasion pathways. In particular, it will propose and discuss how specific policy tools may assist states in addressing invasions from ballast water, hull fouling, and live trade.

Vector Management, A State Perspective on Program Development and Implementation Challenges

David Adams, New York State Department of Environmental Conservation

The NYS Invasive Species Council, comprised of 9 agencies, is charged with implementing a program, with input from a 25 member Advisory Committee, structured after the federal model. Program components in development include partnerships for invasive species management, eradication grants, response teams, regulatory initiatives, iMap GIS database, a virtual research institute, and an information clearinghouse. Progress has been made using a vector management approach, and existing federal regulatory frameworks, to address ballast water management, though more work is needed. Firewood movement and baitfish vectors have also been addressed. Efforts are underway to draft a policy and regulatory tools to reduce the propagule pressure from the recreational boat vector. Additionally, work is in progress to develop a regulatory set of lists prohibiting the sale and distribution of highly invasive non-native species, though this latter effort is challenged to use a vector management approach.

Changing Human Behavior to Reduce AIS Transport Risk

Robert Wiltshire, Center for Aquatic Nuisance Species

As aquatic invasive species (AIS) spread across the country it is obvious that many introductions are the result of unintentional human movement. One important component of the effort to reduce the spread of AIS involves getting people to change their behaviors to reduce the possibility that they are moving AIS. Achieving permanent behavior change based on voluntary choice is more effective than trying to change action through

regulation. To achieve voluntary behavior change, targeted outreach approaches designed to elicit specific actions must be developed. This presentation will briefly examine the range of human activities that lead to AIS spread and will provide an overview of the process of crafting effective behavior change outreach programs.