

WRITTEN TESTIMONY OF
TIMOTHY R.E. KEENEY
DEPUTY ASSISTANT SECRETARY OF COMMERCE FOR
OCEANS AND ATMOSPHERE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Good morning, Chairman Gilchrest and Members of the Subcommittee. I am Timothy Keeney, Deputy Assistant Secretary of Commerce for Oceans and Atmosphere, and the National Oceanic and Atmospheric Administration (NOAA) co-chair of the Aquatic Nuisance Species Task Force. I appreciate the opportunity to present NOAA's perspective on invasive species in Hawaii.

As anyone who has ever been to the Islands will tell you, Hawaii is truly unique. Unfortunately, it is not only unique in its beauty, but also in its vulnerability to species invasions. Although the science of invasion biology is relatively young, for decades we have known that island ecosystems are particularly vulnerable to invasions. Hawaii is no exception, and as the seminal study done by the Office of Technology Assessment (Harmful Non-Indigenous Species in the United States, 1993) pointed out, problems caused by introduced species are more pervasive in Hawaii than in any other part of the United States. Although less visible than terrestrial habitats, the waters around the Islands are no less infested. A representative from the Bishop Museum will be speaking on this in more detail this morning. I would like to point out that not all non-native species are invasive, and we do not know the potential impacts of many others. However, there are very real environmental and economic costs associated with some non-native species.

As Co-Chair of the U.S. Coral Reef Task Force, I note that perhaps the most striking example of the impacts of non-native aquatic species is a number of algal species that have been introduced and are fouling coral reef ecosystems in Hawaii (*Hypnea musciformis*, *Gracilaria salicornis*, *Acanthophora spicifera*, *Avrainvillea amadelpa*, and *Kappaphycus* spp.). Not only are Hawaii's coral reefs beautiful, but they are the keystone to a productive marine ecosystem. In addition to the environmental harm, there have been real economic costs as a result of the algal invasions. The beaches of Waikiki, which have been a magnet for tourists for decades, are being fouled by *Gracilaria*. Similarly, Maui's beaches are also heavily impacted by invasive algae. A study done by the University of Hawaii estimated that the costs associated with introduced algal species are \$20 million annually on Maui alone. There are a wide variety of costs which make up this total figure, but the primary costs are lost tourist income and reduced property values. In addition, the state loses \$1.8 million a year in property tax revenue.

While introduced algal species have received considerable attention, they are only one aspect of the problem. I would like to present a couple of other examples. Black coral is used in precious coral jewelry and is regulated through a Federal fishery management plan. The black coral bed off the coast of Maui has produced coral with a retail value of over \$30 million annually. The introduced snowflake coral (*Carijoa riisei*) is overgrowing black coral, and in significant portions of the Maui bed, over 90 percent of the black coral colonies are dead.

In a freshwater environment, the State of Hawaii recently had to spend approximately one million dollars to remove giant salvinia from the Lake Wilson/Wahiawa Reservoir. The invasive aquatic weed had covered the entire 300 acre surface of the reservoir.

Before I discuss NOAA's role in addressing aquatic invasive species in Hawaii, I would like to acknowledge the yeoman efforts of the State government to address invasive species issues. Perhaps because invasive species have created so many problems in Hawaii, the State government is in the forefront of all of state governments in dealing with this issue. At the last meeting of the Aquatic Nuisance Species Task Force, the

Hawaii Aquatic Invasive Species Management Plan was approved. Not only is the Plan among the most comprehensive of those submitted, but it provides a very good blueprint for the steps that should be taken to address key issues. It is also important to note that the Plan is extremely ambitious and will require significant resources if it is to be successful.

NOAA was asked to address the issue of whether a single-species or comprehensive approach would be the most effective strategy against nonindigenous invasive species. I would respond that the two are not mutually exclusive. When screening intentional introductions, it will be necessary to take a single species approach and look at the characteristics of the particular species being introduced. It is a relatively new concept to evaluate individual species before they are introduced. To cite an example, at least some of the algae fouling Hawaii's reefs were originally introduced to determine the commercial potential of growing algae for carrageenan production.

The State of Hawaii has already taken steps to evaluate species before they are introduced. The State Department of Agriculture has set up committees to evaluate proposals for introducing species from different taxonomic groups. NOAA Fisheries is pleased to serve on the Department's Subcommittee on Marine and Invertebrate Animals. The Aquatic Nuisance Species Task Force has also developed a tool which may be of use in making such evaluations. In 1996, its Risk Assessment and Management Committee completed a Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process.

Control activities, in contrast to screening activities, often require a single-species approach. For example, the State of Hawaii is undertaking a large effort to deal with Miconia, a large non-native plant that overgrows and crowds out native plants, similar to the way Kudzu acts in the continental U.S. When an introduced species has reached the point where it is a serious problem, management efforts are often directed specifically towards that species.

However, an exclusively single species approach is inadequate and ultimately more costly than an approach that takes a more comprehensive view. For decades, the typical method of dealing with invasive species was to deal with them as individual pest problems after a species had been introduced. The more effective and less costly method probably would have been to prevent the introduction of species before becoming a problem. Prevention efforts are often more successful when they address invasion pathways, such as ballast water and hull fouling, rather than individual invasive species. In aquatic environments, prevention is even more important because available tools for control are much more limited than is the case with terrestrial invasives.

In aquatic areas, much of the focus over the last decade has been on dealing with ballast water as an invasion pathway. A study by Ruiz et al., published in 2000, ("Invasion of coastal marine communities in North America: apparent patterns, processes and biases." Annual Review of Ecology and Systematics 31: 481-531) examined known introductions of non-native species into coastal marine ecosystems. Their conclusion was that ballast water was by far the most significant current pathway for introductions.

I may be overly optimistic, but I think that we are well on our way to successfully dealing with this pathway as a result of a number of domestic and international initiatives have come together. Internationally, the International Maritime Organization has approved a convention on the control and management of ships' ballast water to address unwanted introductions of harmful aquatic nuisance species. Although this treaty will not enter into force for several years, it signifies the importance that the international community places on this issue.

Domestically, a number of different approaches are being developed. The Coast Guard has announced that they expect to have regulations in place by the end of the year that mandate ballast water management nationwide. For the time being, this will mean that ballast water exchange will be required. All parties recognize, however, that ballast water exchange is only an interim solution until treatment technologies are developed. Under §1104 of the Nonindigenous Aquatic Nuisance Prevention and Control Act, NOAA and the U.S. Fish and Wildlife Service (FWS) have funded research into a number of new technologies. These have included chemical treatments, filtration, thermal treatment, ultraviolet radiation, ozone injection, and a number of other technologies. Although none of these technologies is ready for widespread application to the world's fleets, considerable progress has been made, and we are well beyond the proof-of-concept stage for some of these technologies.

The Maritime Administration has made a significant contribution to this effort by offering testing platforms as the technologies are scaled up. Finally, the Coast Guard also has put in place a process to exempt ships testing promising technologies from ballast water exchange requirements.

We recognize that the State of Hawaii also is looking at this issue. NOAA participates in, and has helped fund, Hawaii's Hull Fouling and Ballast Water Task Force. Initial funding for the State employee who heads up the Task Force was provided by NOAA's Coastal Zone Management Program.

While it is certainly the most significant introduction pathway, ballast water is far from being the only pathway. In this respect, Hawaii is again unique. The list of non-native introductions into Hawaiian coastal waters contains more instances of probable introduction through hull fouling than from ballast water. Recognizing that more needs to be learned about hull fouling as a pathway for introductions, NOAA's Center for Sponsored Coastal Ocean Research provided \$84,000 in FY 2002 to the Bishop Museum to study this issue. One of the priority items in the Aquatic Nuisance Species Task Force's current five-year strategic plan is to determine other high-risk pathways and to develop interdiction methods. For instance, the single largest pathway for the spread of invasives is recreational boaters. The Aquatic Nuisance Species Task Force is undertaking an extensive public education program directed at recreational boaters.

As a back-up to prevention, early detection and rapid response is important. Although there may be seriously invasive species that we know should be on a watch list, it is almost impossible to predict what the next unintentionally introduced invasive species will be. It is important, therefore, that monitoring for new invasions take place. Both the National Invasive Species Council and NOAA recognized the importance of early detection in addressing the invasive species problem. In the first cross-cut budget developed by the National Invasive Species Council for FY 2004, it was decided to develop a pilot project setting up an early detection system for all taxa. Because of the unique problems confronting Hawaii, the Council chose the island of Maui as its pilot project. Working with the Bishop Museum, NOAA's National Centers for Coastal Ocean Science decided to expand the effort, and has worked to set up an early warning system for all of the Islands.

The Hawaii pilot project is the first step in a much more ambitious project. NOAA is working with the U.S. Geological Survey and the Smithsonian Environmental Research Center on monitoring activities and setting up interconnected databases. The early warning component will allow managers to determine if a species is, in fact, a new introduction, and, if so, to determine whether the species is likely to become invasive. Because eradication is often only possible very early in the invasion process, such a system should improve the chances of stopping a nascent invasion in its tracks.

Last month we asked our Hawaiian partners to try out the prototype Hawaiian early warning system and let us know what they thought about its utility. By early summer, Hawaiian managers, such as Department of Land and Natural Resources personnel, and Park personnel, who are most likely to use the system, will be asked to make suggestions for its improvement. We hope to have the tested pilot Inventory and Warning System ready for the public by this fall.

When open to the public, visitors to the Hawaiian Pilot website will be able to:

- 1) Check species in the database to see if they are Hawaiian natives or previously reported nonnatives, report a new species not currently included, and have a taxonomic expert confirm its identity;
- 2) Check any alien species alerts (participating managers will be directly notified by e-mail);
- 3) Search the species database network, map species distributions, and acquire data;
- 4) Find in-depth information on particular aquatic species and risk assessments to provide guidance on whether a particular species is likely to become invasive; and
- 5) Access other relevant databases via partner organization websites.

This project would not have been possible without strong partnerships. The Bishop Museum, the University of Hawaii, the Waikiki Aquarium, the Smithsonian Institution, NOAA Fisheries, and others are helping to build a reliable inventory of all Hawaiian aquatic species (both native and non-native) listed by location. NOAA's National Environmental Satellite, Data and Information Service has been responsible for developing the data management system and the web site. In addition, to improve the odds of detecting a new introduction in a timely fashion, several organizations have agreed to use volunteers as another set of eyes. These include the Reef Environmental Education Foundation, which will share results of fish surveys by SCUBA divers, Reef Check, and Reef Watch.

During fiscal year 2004, the National Ocean Service will spend approximately \$200,000 out of accounts other than those for invasive species to cover salary and data management costs for the early warning system.

NOAA's efforts in the Pacific islands have not been limited to Hawaii. As a first step in a similar process for Guam, NOAA's National Sea Grant College Program funded a study in 1998 for \$125,000 with matching funds of \$83,000 from the University of Guam to help determine non-native species occurrences in the waters surrounding Guam.

For several years, NOAA has been actively engaged in addressing the problem of reef fouling by non-native algal species. Funds have been provided not only for removal projects, but also to look at other control methodologies, the ecology of the invaders, and restoration techniques. In fiscal year 2004, NOAA's National Sea Grant College Program will be providing a \$250,000 grant to address this issue. NOAA's Coral Reef Program has also consistently provided funding in this area; in fiscal years 2002 and 2003, \$441,000 was awarded for individual projects as part of grants to the University of Hawaii for the Hawaii Coral Reef Initiative Research Program and the Ecology and Oceanography of Harmful Algal Blooms program. Awards for fiscal year 2004 will be announced in the near future.

In cooperation with NOAA's National Undersea Research Program and its Hawaii Undersea Research Laboratory, studies of the biology of snowflake coral are currently being funded by the Hawaii Sea Grant Program out of their core funds, with the Sea Grant Program providing \$22,700, and matching funds totaling \$73,000, bringing the total to \$95,700. Hawaii Sea Grant has indicated that invasive species will be a focal area over the next two years. NOAA also has had the opportunity to fund research on the impacts of several different types of invaders in Hawaii through the National Sea Grant College Program aquatic nuisance species competition. Over the last five years, NOAA has provided \$291,000 in competitive grant awards to study impacts of mangroves, marine invertebrates, and non-native fish species in Hawaii. These funds have been supplemented by \$163,000 in matching funds.

There are other NOAA activities in Hawaii that include an invasive species component for which it is impossible to isolate the portion of expenditures related to invasive species. As an example, monitoring of nonindigenous species is a component of extensive ecosystem surveys of coral reef ecosystems conducted by NOAA Fisheries' Pacific Islands Fisheries Science Center. These taxonomic surveys record both native and non-native species of fish, corals, other invertebrates and algae. To date the surveys have been focused on the northwestern Hawaiian Islands, but NOAA will soon begin cooperative reef surveys in the main Hawaiian Islands. In a related activity, NOAA's National Ocean Service's Center for Coastal Monitoring and Assessment has provided \$100,000 annually since fiscal year 2000 through its Coral Reef Fund grant program to the Hawaii Department of Land and Natural Resources to monitor reef biota off the main and northwestern Hawaiian Islands. The same amount has been awarded each year to American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands for monitoring their coastal waters. Several National Estuarine Research Reserves have sponsored demonstration projects requiring invasive species monitoring. In addition, observations on non-native species are an element of monitoring activities for the National Marine Sanctuary Program.

Chairman Gilchrest and members of the Subcommittee, perhaps more than in any other part of the country, invasive species are a cancer which is steadily eating away at much of what makes Hawaii unique. Substantial progress is being made on the aquatic side of the equation. The State of Hawaii has developed an excellent management plan for aquatic invasive species, and we are in sight of significantly reducing the risk of ballast water as a major pathway. It would be naive, however, to assume that the problem of invasive species will be solved in the near future, either in Hawaii or in the country at large. It is a problem that will require a continuing commitment. NOAA is aware of the problems caused by aquatic invasive species, and we recognize that we have a responsibility to help prevent invasions and reduce the impact if such invasions occur. NOAA also recognizes that success requires partnerships with other Federal agencies, State and local governments, and the private sector. This concludes my testimony, and I would be happy to answer any questions.