

Director's Message

John Calhoun, *Director*



This month our newsletter focuses on the marine programs at UW ONRC. Many of you familiar with our facility may not even realize we have an active, innovative program of research and operations in marine sciences. Locally, we are best known for our research in forestry. But our enabling legislation also directs us to maintain and promote a program in marine research as well.

Integrating ecological values into commercial management of natural resources – with a special emphasis on impacts to resource-dependent communities – is a mission that fits well in managing both forest and marine resources. The issues are often similar, only the applications are different.

Consistent with the guiding principles from our strategic plan, UW ONRC seeks out opportunities for contributions in the Marine Program that can make a noticeable difference and address under-served areas. Our fo-

cus is on nearshore environments at Willapa Bay and along the Pacific coast. We operate from shared offices at the Washington State University Extension located in Long Beach. Our Marine Program Manager Miranda Wecker and a small staff of specialists carry out their duties close to the resource.

The bay and estuary at Willapa Bay is a spe-

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cial place. Important commercial oyster beds and significant Pacific flyway bird feeding habitat are only two of the important commercial and ecological services this area provides.

However, issues abound. Shellfish growers are currently threatened with the changing regulations on the use of chemicals to control a pest – the burrowing shrimp – that damages substrate to the point of making it useless to

grow oysters. Bird feeding mud flats are being invaded by the exotic weed *Spartina* that also damages rearing habitat for salmon and Dungeness crab.

Digging razor clams is a hugely popular past time along our coast. High levels of the biotoxin domoic acid cause disruptions to the recreational harvest of the Pacific razor clam and disappointment to thousands of clam diggers that enjoy this activity. Our razor clam monitoring efforts are contributing to more harvest days per year and benefit more people directly than any other program at UW ONRC, marine or forestry.

UW ONRC staff members are making significant contributions to address these issues. The following articles will describe some of these activities.

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Recent Developments in the Marine Program

Miranda Wecker
Marine Programs Manager



In this issue, we summarize some of the latest developments in our two centerpiece projects – *Spartina* in Willapa Bay and coast wide monitoring of domoic acid contamination in razor clams. UW ONRC has made a number of valued contributions to the *Spartina* eradication program, including:

1. research and implementation of biological control options
2. Geographic Information Systems (GIS) and modeling services to formulate and depict long term plans as well as spatial evaluation of tides to optimize the efficacy of chemical applications
3. coordination of overall analysis and planning, and
4. outreach to the public and stakeholders.

UW ONRC Bio-control Specialist Fritzi Grevstad describes her recent success in securing an additional two years of federal support for close monitoring of the effects of the *Spartina* bio-control agent *Prokelisia marginata*.

UW ONRC's latest contributions to domoic acid monitoring will be described by Anthony Odell, UW ONRC's technical coordinator for the Olympic Region Harmful Algal Bloom (ORHAB) partnership.

UW ONRC organized ORHAB to bring together stakeholders who share a common interest in understanding the periodic outbreaks of domoic acid. The partnership includes scientists and managers from federal, state, and tribal agencies as well as representatives and scientists from the private sector. The National Oceanic and Atmospheric Administration's (NOAA) Monitoring and Event Response for Harmful Algal Blooms (MERHAB) office provided over \$2M for OR-

HAB's coast wide plankton and toxin monitoring effort over the past five years. As a direct result of the foundational information established by ORHAB, a team of world class HAB scientists led by Dr. Barbara Hickey of UW School of Oceanography were able to secure \$8 million from the National Science Foundation and NOAA's Ecology and Oceanography of Harmful Algal Blooms (EOHAB) program, to carry out extensive oceanographic research and delve deeper into the ocean dynamics that give rise to toxin outbreaks. (Visit the ORHAB www.orhab.org and EOHAB www.ecohabpnw.org websites for more information.)

A vast amount of new information has emerged from this research about the origin of blooms, the environmental conditions that lead to shellfish contamination, and the possible role of domoic acid in the biology of the plankton that generate it. This research has served the needs of state, federal, and tribal managers through what NOAA has repeatedly called "a model for all regions of the nation" – collaboration among scientists and managers aimed at serving the public interest and building local capacity and self-reliance. In recognition of the importance of this work, the Washington State Legislature established a permanent source of funding for UW ONRC to continue coast wide HAB monitoring.

Many new projects have been launched as the key priorities for the region's stakeholders emerge.

The UW ONRC Marine Program has received several grants from the USDA Forest Service to explore the feasibility of the biological control of knotweed. Knotweed, an invasive weed, is considered among the top ten worst invaders through-

out the world. It infests many of the riparian areas in the Olympic Peninsula region and southwestern Washington and undermines investments made in restoring this habitat for salmon. UW ONRC is providing initial GIS services to Clallam County's Noxious Weed Control Board to integrate information into the GIS system on knotweed locations and control work for Water Resource Inventory Area 20.

A new project addresses the most serious threat to shellfish aquaculture in Grays Harbor and Willapa Bay – excessive populations of native burrowing shrimp. UW ONRC has agreed to supply GIS services to an effort underway that is developing new ways to control burrowing shrimp.

Another recent project responds to heightened interest in the restoration of salmon habitat in near-shore or estuarine areas. Most of the salmon habitat restoration work has been done in freshwater or upland areas. In the last two years, more efforts are underway to look at opportunities in marine or salt-water areas. UW ONRC has partnered with the Washington Cooperative Fish and Wildlife Research Unit and the Coastal Resources Alliance of Raymond, Washington, to carry out an analysis of priorities for restoration in the Willapa Bay estuary.



Miranda Wecker was appointed last year to the Washington Department of Fish and Wildlife Commission by Washington State Governor Christine Gregoire.

ORHAB Monitoring Program

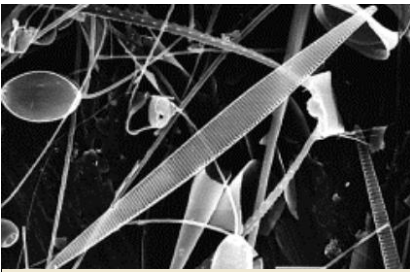
Anthony Odell

ORHAB Technician



Recent Monitoring Data

2005 has been a fairly typical year in the phytoplankton world. We have seen two major *Pseudo-nitzschia* blooms at the time of year we have come to expect them. The first bloom came in mid-April along our southern



Pseudo-nitzschia australis

coast, from Grays Harbor and to the south. Although cell counts were relatively low, the species of *Pseudo-nitzschia* was the most potentially toxic, *P. australis*. The exact species was confirmed by Research Scientist Brian Bill at the National Oceanic & Atmos-

pheric Administration (NOAA) Northwest Fisheries Science Center in Seattle, Washington, using a scanning electron microscope. The spring bloom did produce enough toxin to be taken up by razor clams but not enough to reach the Washington State Department of Health closure action level of 20 parts per million.

The bloom of *Pseudo-nitzschia* in August 2005, although quite large, was of a smaller species type and did not produce detectable amounts of toxin in the surf zone. This bloom seemed to originate in the north and head to the south, signifying the possibility of a Juan de Fuca gyre-generated event. The species of *Pseudo-nitzschia* appears to be *P. cuspidata*, a known toxin producer. Domoic acid levels did increase slightly along the entire Washington coast at the end of this bloom. But again, not

enough toxin

was absorbed by the razor clams to result in a closure to the recreational harvest of razor clams.

ECOHAB Cruise

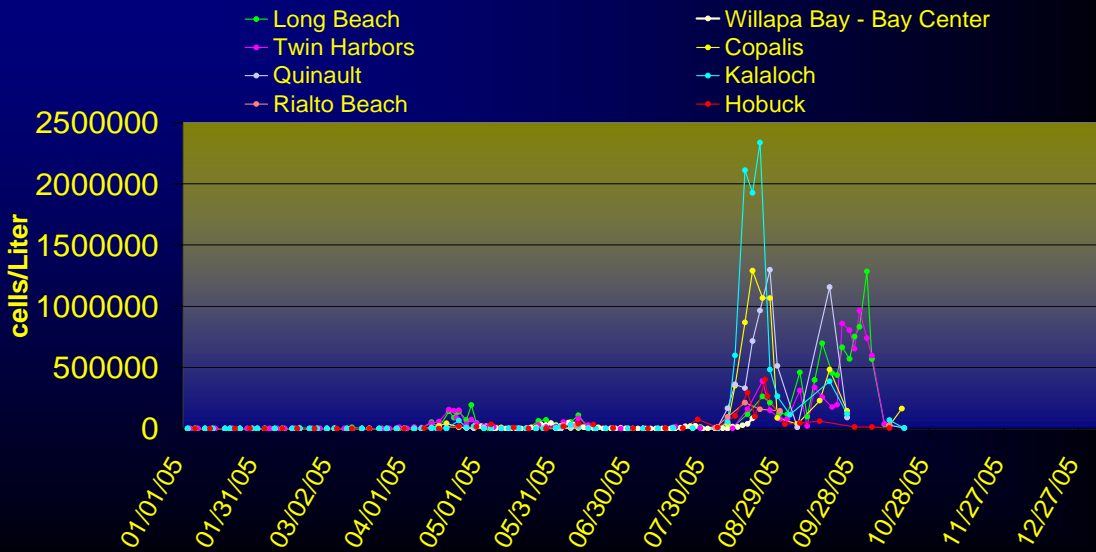
In September, I participated on an Ecology and Oceans Harmful Algal Bloom Pacific Northwest (ECOhab PNW) cruise off the coasts of Washington state and Vancouver Island, British Columbia. ECOhab PNW consists of a large consortium of multidisciplinary scientists from around the United States and Canada, chemists and biologists from the University of Maine, University of California at Santa Cruz, NOAA Seattle; and oceanographers from UW School of Oceanography, Northwest Fisheries Science Center, and Fisheries and Oceans Canada. The principal investigators of the project are Dr. Barbara Hickey, UW School of

Oceanography, and Dr. Vera Trainer, NOAA Northwest Fisheries Science Center. The focus of ECOhab PNW is to better understand the oceanographic conditions which produce toxic blooms of plankton along our coast. The main area of focus is a region called the Juan de Fuca

(Continued on page 4)

Rita Horner
University of Washington

2005 Washington Coast Pseudo-nitzschia Cell Counts



ORHAB Monitoring Program

(Continued from page 3)

gyre which sits off the north coast just outside the Strait of Juan de Fuca. The area is considered to be a large upwelling zone and initiation site of most of the large late season *Pseudo-nitzschia* blooms.

I assisted in many aspects of the research, from phytoplankton taxonomy and cell counts to filtering water for chlorophyll levels and nutrients. But my main duty was to deploy and retrieve the measurement device for conductivity (a way to measure salinity), temperature, and depth (CTD). A large cylindrical frame supports several instruments: a photosynthetically active radiation sensor to detect sunlight; a pump which continuously pumps water through a conductivity and temperature meter; and a rosette of large Niskin bottles that can be commanded from the lab to snap shut to capture water samples from any given depth. Water from the Niskin bottles is then analyzed for chlorophyll, nutrients, and various toxin levels, as well as whole water cell counts. The CTD is lowered from the surface to the ocean bottom (or to the end of the cable when positioned off of the continental shelf).

The is done literally hundreds of times across a huge grid, from Grays Harbor to North Vancouver Island and from near-shore to far off the continental shelf. This produces a large database of measurements for many oceanographic variables. Much of this data is then used to



Jim Postel, UW School of Oceanography, and Anthony Odell retrieve of the CTD before dawn

create oceanographic models which will later be used for prediction of oceanic currents and *Pseudo-nitzschia* blooms.

The findings of ECOHAB PNW this year indicate a somewhat anomalous year. Little, if any, *Pseudo-nitzschia* species were found in the gyre region. Most of the *Pseudo-nitzschia* species were found off the southern Washington coast from Grays Harbor and south and far up north outside of the Barkley Sound in central Vancouver Island. This is mostly likely due to the wind and weather conditions which produced unfavorable conditions for upwelling that is needed to bring nutrients to the surface to feed the phytoplankton. On average, 2005 was a very warm year for waters off the Washington coast, greatly minimizing plankton production.

New Plate Reader in Taholah

Recently, ORHAB purchased an Enzyme-linked Immunoabsorbant Assay (ELISA) plate reader for the detection of toxin in shellfish and seawater. The plate reader now has a new home at the Quinault Indian Nation Fisheries Lab in Taholah, Washington. Quinault Natural Resources constructed a modern and secure lab to house the plate reader. Taholah, with its location along the central coast, provides an excellent lab site for this new technology. Although the Quinault ORHAB technician Dawn Radonski has moved on to another position, her replacement along with Quinault Shellfish Biologist Kelly Curtis and me will be using the plate reader as a part of our collaborative harmful algal bloom monitoring efforts.

Advances in Marine Program's Weed Biocontrol Efforts

Fritzi Grevstad
Bio-Control Specialist

Spartina

The UW ONRC Marine Program has maintained a persistent effort in establishing a biological control program against *Spartina alterniflora* and *Spartina anglica*, two introduced cordgrasses invading intertidal mudflats of Washington's estuaries. The planthopper *Prokelisia marginata*, a natural enemy of *Spartina* from the Atlantic Coast, was introduced into Willapa Bay beginning in 2000 and into the Puget Sound in 2003 after extensive testing demonstrated it would not harm non-target plants. Each year between one- and two-hundred thousand insects were reared in our insectary and released into *Spartina* infestations in Willapa Bay and the Puget Sound. While many of the initially-released colonies failed to establish or grow, the combination of improved site selection and the use of different ecotypes of *P. marginata* have contributed to improved establishment and dramatic increases in abundance of the insects in recent years.

Currently, there are four regions of Willapa Bay where *P. marginata* populations are well-established and expanding. These include Leadbetter Marsh, North Cove, Tarlatt Slough, and Tokeland. At North Cove, *P. marginata* can be easily found over an area of about 20 acres. In approximately two of these acres, the insects were recently

measured at densities of 20-29,000 insects per m² and have caused browning of the plants ("hopper burn") in advance of normal fall senescence. In Tokeland, the browning of the plants was localized to the vicinity of the immediate release points. However, *P. marginata* at this site could be easily found as far as ¼ mile from the release points. These represent substantial increases in both abundance and area occupied over previous years. It is expected that continued feeding by *Prokelisia* at these densities and at even higher densities in the future, should lead to eradication of the plants.

In the Puget Sound, *P. marginata* populations are established and growing in one location near Stanwood and in two locations in Turner's Cove on the Swinomish Reservation. A recent survey by Washington Department of Fish and Wildlife crews found densities of 49 and 57 nymphs per stem. This represents 7- and 12-fold increases in density over the past two years.

The *Spartina* biocontrol program recently received a boost from the National Sea



The planthopper *Prokelisia marginata* has attained densities of 20-30,000 per m² in some locations. Visible on this leaf are many nymphs (juvenile stage) and one adult

Grant Program in the form of a \$170,000 research and outreach grant. I will use the funding to compare the performance of different ecotypes of *P. marginata*, quantify the impacts of these insects on *Spartina* in Willapa Bay and the Puget Sound, investigate the integration of biological and chemical control approaches, and offer outreach activities to educate the public about the biocontrol program.

(Continued on page 6)

Advances in Marine Program's Weed Biocontrol Efforts



Spartina plants in the foreground are suffering from "hopper burn" as a result of high densities of *P. marginata* at North Cove, Willapa Bay

(Continued from page 5)

Japanese and Giant Knotweeds

UW ONRC is partnering with the USDA Forest Service and Cornell University in Ithaca, New York, to develop a biological control program against Japanese and Giant knotweeds (*Fallopia japonica* and *F. sachalinense*). These plants and a hybrid between the two can be found throughout the temperate zone in North America. They are especially invasive along stream banks in the Northeastern and Northwestern United States. Knotweeds crowd out other vegetation and prevent trees from growing along the stream banks, thus reducing shading which is important for productive salmon habitat. Moreover, the above ground foliage dies back and breaks off in winter, leaving the soil

exposed and vulnerable to erosion. Knotweeds can damage roads and buildings. The forceful rhizomes are capable of penetrating concrete.

A biological control program for Japanese knotweed is

already being developed in Europe, where knotweed is also a serious environmental problem. Several promising insects and pathogens from Asia (knotweed's native range) have been identified by the Commonwealth Agricultural Bureaux International (CABI) Biosciences in the United Kingdom. These agents are currently being tested for their host specificity. Because the bulk of the preliminary research has already been completed by the Europeans, biocontrol of knotweeds in the United States could be accomplished with relatively low cost of development. I will be carrying out research to ensure that the candidate agents will not feed on native North American plants that were not previously tested by the European program. UW ONRC is working with the USDA Forest Service and other groups to secure funding to carry out this work.



Invasive knotweeds (*Fallopia* species) are the next target of the UW ONRC Weed Biocontrol Program