



University of Washington

Pacific Northwest Center for Human Health & Ocean Studies

Center Briefing Materials

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For more information, visit: <http://depts.washington.edu/pnwh2o/index.html>

Center Overview

Introduction

The University of Washington's Pacific Northwest Center for Human Health and Ocean Studies (the Center) was created in response to the critical need to understand links between ocean processes and human health. The focus of the Center is on mechanisms that underlie development of toxic blooms of the diatom *Pseudo-nitzschia* and the public health consequences of toxic events. Domoic acid (DA) is produced by *Pseudo-nitzschia*. Consuming fish (finfish or shellfish) contaminated with DA can cause amnesic shellfish poisoning, including memory loss, and death.

Along the Washington State coast, DA has been measured in shellfish since 1991. Prior to 2003, no shellfish closures had occurred within the highly populated inland estuaries of Puget Sound, including Hood Canal. Since then, there have been three closures within the Sound: two at the mouth in the summers of 2003 and 2005 and one well within the Sound in the fall of 2005. One goal of the Center is to understand what combination of factors have changed over the last few years such that closures may be on the rise within the Sound yet still do not occur as frequently as on the coast. Seasonal beach closures can result in severe economic losses, especially to coastal communities dependent on recreational razor clamming in Washington State.

Elaine M. Faustman, PhD, DABT, (left) from the Department of Environmental and Occupational Health Sciences, is the Center's Director; E. Virginia (Ginger) Armbrust, PhD, Director of the School of Oceanography, (right) is co-director.

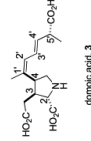


The Center, which has leveraged over \$19 million since its inception in 2003, brings together researchers from 5 different departments within the University of Washington with expertise in fisheries and biological, chemical and physical oceanography ('ocean science') to work with researchers with expertise in molecular and cellular mechanisms of toxicity, neurodevelopmental biology, behavior and risk assessment ('public health science'). Research is coordinated across this multi-disciplinary group through the concept of a "risk chain" illustrating the ways that ocean processes influence toxic algal blooms and how these blooms cause public health impacts and risks. Center researchers have identified circulation-based explanations for the sporadic nature of toxic blooms along the WA coast; developed molecular approaches to quickly distinguish between different species of *Pseudo-nitzschia* in seawater samples and thus link environmental conditions and species distributions; and detected genomic features that define *Pseudo-nitzschia*. Furthermore, Center researchers have created biosensors that can rapidly determine toxin levels within shellfish tissues; identified differences in shellfish consumption of toxic *Pseudo-nitzschia*; determined behavioral and cultural practices that serve as important risk factors for exposure of humans to contaminated seafood; and studied genetic factors in mammals that influence toxic oxidative stress responses following exposure to DA.

View, at a glance, an overview of the Center on the next page 

What is the Problem?

The Center investigates the mechanisms by which environmental conditions trigger blooms of harmful algae in our marine waters and ultimately how these blooms impact public health and can cause environmental disease.



Domoic acid (DA) is produced by the diatom *Pseudo-nitzschia*. Consuming fish (finfish or shellfish) contaminated with DA can cause amnesic shellfish poisoning, including memory loss.

Who's Affected?

- Populations potentially at risk
 - Children & aging populations
 - High fish consuming groups (Tribes, subsistence fishers, Asian and Pacific Islanders)
 - Those with underlying health conditions
- Coastal and Puget Sound communities
- Commercial growers

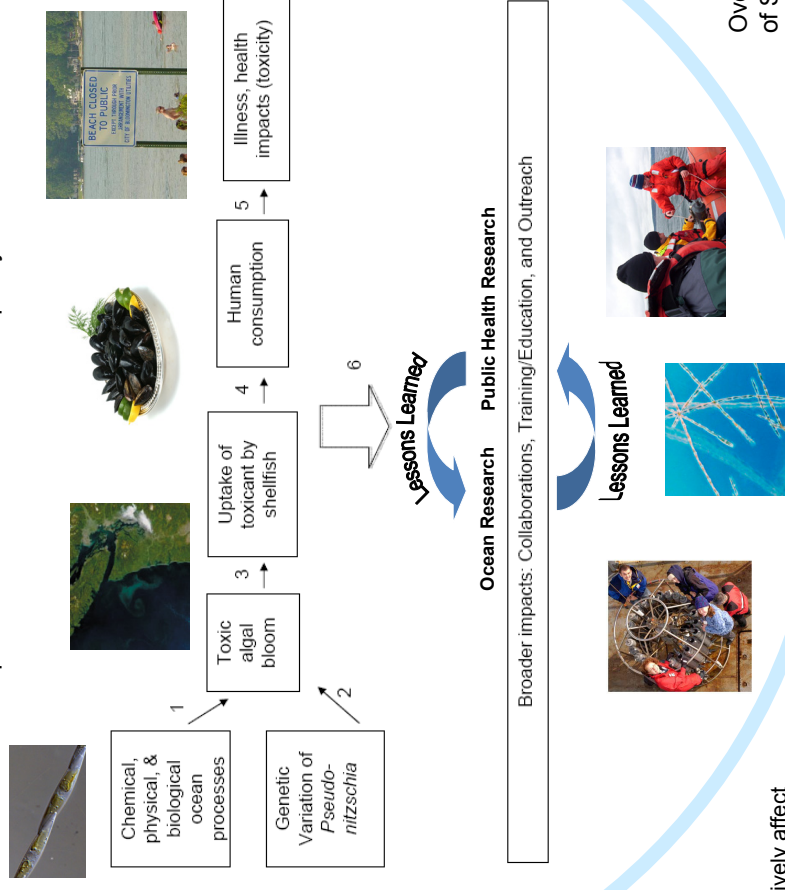
How do we Approach the Problem?

Two Thematic Questions Guide the Center:

1. How do environmental and genetic factors interactively affect *Pseudo-nitzschia* abundance, diversity and DA toxicity?
2. What geographic, physiological, temporal, and cultural/behavioral factors impact the potential for DA toxicity in humans and other organisms on the PNW coast and in Puget Sound?

Integrating Oceans and Human Health

Oceans and Human Health research is integrated through the "risk chain" connecting the ways that ocean processes influence toxic algal blooms and how these blooms cause public health impacts and risks. The risk chain is bidirectional, allowing us to move both forward and backward to identify ocean and public health factors as well as policy needs.



Taking Action

What do we do?

Research

- Take cutting-edge science in comparative genomics and health and move forward with identifying mechanisms of susceptibility.
- Identify and characterize factors (geographic, physiological, temporal, and cultural/behavioral) influencing potential for DA toxicity by optimizing sensing and modeling.

Education

Equip new researchers with multidisciplinary training and expertise relevant for issues affecting oceans and human health.

Translation

Provide information and dialogue with diverse communities and stakeholders regarding exposure and potential health risks from DA.



What do we leverage?

Over the past 7 years, the Center has leveraged a total of \$19 million in funding. One hundred sixty-seven days of ship time have been leveraged from other funding sources, including WA state, for sample collection and analysis.

Center researchers foster the development of a next-generation of oceans and human health researchers by supervising dozens of early-career scientists consisting of post-doctoral researchers, graduate students, undergraduates, and research scientists/staff. Center researchers play key roles in helping define the newly emerging discipline of oceans and human health by conveying the importance of their findings through scientific venues and different types of outreach, advice for monitoring agencies, and interactions with potentially at-risk groups (Asian and Pacific Islanders and Tribal Nations) that consume high levels of seafood. Outreach and education have been defining features of the Center.

The Center, jointly funded by NIEHS and NSF for 5 years with a 2-year no-cost extension, has included four research projects, four facility cores and an administrative core. In 2009, the Center was awarded an American Recovery and Reinvestment Act (ARRA) Administrative Supplement as well. The Center has furthermore funded, and continues to have progress and updates on, three pilot projects. Figure 1 below illustrates the Center structure, which enables a high level of interaction across research projects and facility cores.

Pacific Northwest
CENTER FOR HUMAN HEALTH & OCEAN STUDIES

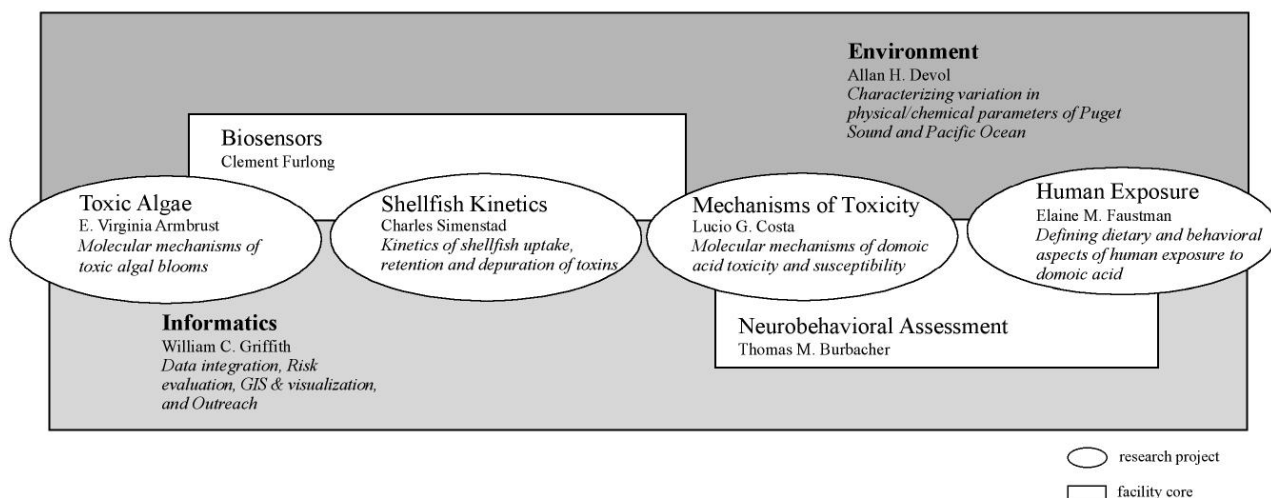


Figure 1. Structure of Center Research Projects and Facility Cores

In addition, the Administrative Core facilitates the pursuit of leveraged funding and also facilitates three other broader impact goals of the Center : 1) fostering of collaborations between Center investigators and external partners such as state agencies concerned with harmful algal blooms; 2) education of new researchers with multidisciplinary training and expertise relevant for issues affecting oceans and human health; and 3) providing informational resources and exchange with diverse communities with exposure and potential health risks from DA.

View on the next page a selection of Center Highlights →

Center Highlights

- The genome size estimate for *P. multiseriis* has been confirmed at around 300 megabases, about 1 order of magnitude larger than the genome sizes of previously sequenced diatoms. EST and genome sequencing will proceed in parallel. Supported by partnership grants with the Department of Energy and the Gordon and Betty Moore Foundation.

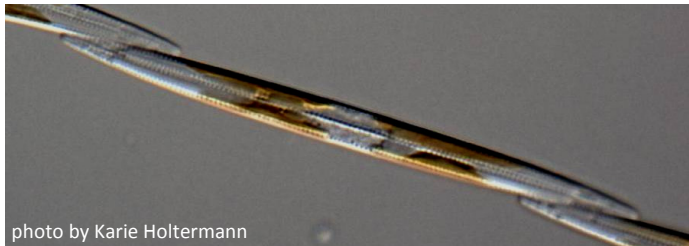


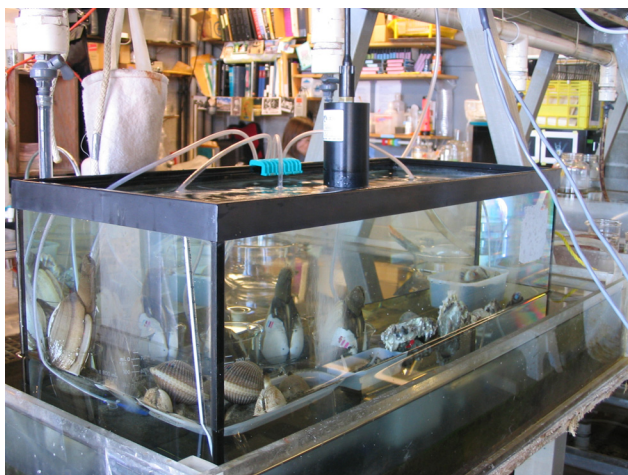
photo by Karie Holtermann



- A portable surface plasmon resonance (SPR)-based biosensor system has been developed that can detect the *Pseudo-nitzschia* toxin domoic acid. Efforts to increase sensitivity and specificity are underway.

- Lab based studies have identified iron storage strategies in *Pseudo-nitzschia* that helps explain its growth and distribution dynamics.

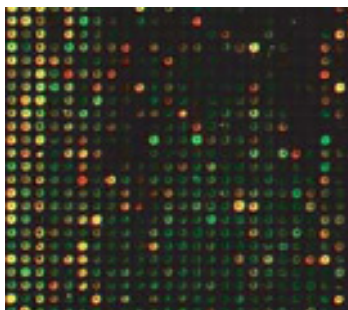
- Center researchers have developed molecular fingerprinting techniques to rapidly identify *Pseudo-nitzschia* species and have tracked species diversity signatures under bloom conditions in Puget Sound in field samples.



- Feeding experiments demonstrated differential clearance rate of *Pseudo-nitzschia* and toxin retention times in different species of intertidal invertebrates, including economically important harvest species. Using these data, DA retention is being evaluated using Bayesian-based mathematical modeling and statistical analyses.



- Completion of studies in the zebrafish model system reveals that acute DA exposure treatments result in quantifiable changes in gene expression in brain tissue. Our findings provide insight into the chronic effects of sub-acute DA exposure.



- Center researchers have determined that DA neurotoxicity is due to oxidative stress and is enhanced in mice lacking oxidative stress proliferative pathways (Gclm (-/-) mice). This response has caused oxidative stress-mediated apoptotic cell death.

- These findings provide a new paradigm of gene-environment interaction. Additional results indicate the importance of oxidative stress-activated JNK and p38 MAP kinase pathways in DA-induced apoptosis in cerebellar granule neurons.

- A Center funded Pilot Study with the Washington State Department of Health (DOH) exploring seafood exposures among Asian and Pacific Islander communities in the Puget Sound area has revealed important differences in shellfish consumption patterns between high seafood consuming groups. These differences have been evaluated in conjunction with biomarkers for exposure to improve our ability to understand exposure response and additional benefits.

- In October 2006 public health and oceanography scientists, undergraduate and graduate students from the Center embarked on a 4-day research cruise with the goal of focusing on multi-disciplinary research and learning. The Center received funding for additional cruises that took place in Oct. 2007, Nov. 2009 and Oct. 2010.



- NSF-funded Research Experience for Undergraduates program has funded research projects for 14 undergraduates to date.

- The Center continues to co-host the Seminar Series in Oceans and Human Health that began in 2003 in partnership with NOAA's Center for Ocean and Human Health.

- The Center has leveraged a total of \$19,016,365 of research funding with an additional \$1,228,998 pending. In addition, 167 days of ship time have been leveraged from other funding sources for sample collection.


Focus on Climate

By virtue of its multidisciplinary structure linking researchers from oceans and public health sciences, the Center is highly collaborative and capable of addressing and contributing toward our understanding of complex issues, such as climate change.

Special Series in *Environmental Health*

In 2008, the Center worked together with the other NSF/NIEHS-funded Oceans and Human Health Centers to produce a special series of articles in the journal *Environmental Health*. Among other articles, the Center collaborated on the piece shown below:

Environmental Health



Proceedings

Open Access

Impacts of climate variability and future climate change on harmful algal blooms and human health

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from Centers for Oceans and Human Health Investigators Meeting
Woods Hole, MA, USA. 24–27 April 2007

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Abstract

Anthropogenically-derived increases in atmospheric greenhouse gas concentrations have been implicated in recent climate change, and are projected to substantially impact the climate on a global scale in the future. For marine and freshwater systems, increasing concentrations of greenhouse gases are expected to increase surface temperatures, lower pH, and cause changes to vertical mixing, upwelling, precipitation, and evaporation patterns. The potential consequences of these changes for harmful algal blooms (HABs) have received relatively little attention and are not well understood. Given the apparent increase in HABs around the world and the potential for greater problems as a result of climate change and ocean acidification, substantial research is needed to evaluate the direct and indirect associations between HABs, climate change, ocean acidification, and human health. This research will require a multidisciplinary approach utilizing expertise in climatology, oceanography, biology, epidemiology, and other disciplines. We review the interactions between selected patterns of large-scale climate variability and climate change, oceanic conditions, and harmful algae.

The article provided a much-needed synopsis of the current state of knowledge of climate impacts on HABs (harmful algal blooms) and their known or potential consequences for human health.

Diatoms and the Climate Connection in *Nature*

The Center is able to contribute to our understanding of climate issues at the intersection of Oceans and Human Health not only because of the Center's multidisciplinary structure, but because the Center is comprised on top-notch scientists. In 2009, Center co-director Dr. Armbrust published a review article in *Nature* describing the life of diatoms (which include domoic acid producing *Pseudo-nitzschia*) and their connection to global climate.

NATURE|Vol 459|14 May 2009|doi:10.1038/nature08057

REVIEW INSIGHT

The life of diatoms in the world's oceans

E. Virginia Armbrust¹

Marine diatoms rose to prominence about 100 million years ago and today generate most of the organic matter that serves as food for life in the sea. They exist in a dilute world where compounds essential for growth are recycled and shared, and they greatly influence global climate, atmospheric carbon dioxide concentration and marine ecosystem function. How these essential organisms will respond to the rapidly changing conditions in today's oceans is critical for the health of the environment and is being uncovered by studies of their genomes.

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Dr. Armbrust states that "It is important to know how diatoms affect ocean ecology and biogeochemistry at any given time in any given region. Sequencing the genomes of additional representative diatoms, in combination with analysing the genomes of diatom communities in nature, will identify the core attributes that allowed these organisms to cope with past conditions and will help to interpret responses to today's conditions." Dr. Armbrust concludes that "This increasingly genomic approach will make it possible to move beyond speculation about the state of the environment to instead document the changes actually occurring in critical groups such as diatoms before they become the new canaries in the coal mine."

Special Panel on Climate Change

In the Spring of 2010, the Center worked with its NOAA partners to convene a special panel discussion focused on linking Oceans and Human Health research with climate research. This panel discussion featured experts from academia and government and focused on issues for the Pacific Northwest.

Climate Change and Seafood Safety

The Center has also published a short piece, on the following page, on the concern of what climate change might mean for the safety of Pacific Northwest seafood resources, both recreational and commercial.

[View Climate Change & Seafood Safety on the next page](#) 

Climate Change & Seafood Safety

It was not a welcome headline that graced the *Chinook Observer* the morning of October 2, 2002: “Clam opener canceled due to high toxin count.” That day the Washington coast’s largest newspaper relayed disappointing news to the thousands of would-be razor clam diggers who are drawn each fall to Washington’s coastal beaches for the limited harvest season. Harvest closures have been a recurring problem on the Washington coast. They result from marine biotoxins, including domoic acid and paralytic shellfish poisoning toxin, and bacteria that cause intestinal disease in humans.

Because marine biotoxin production seems to hinge on a complex set of factors, including water temperature, researchers are beginning to wonder what role climate change might play in future seafood harvest seasons and the availability of safe seafood resources throughout the Pacific Northwest.

Pacific Northwest seafood resources, both recreational and commercial, represent a means of sport and employment. They also represent a way of life among tribal communities that depend on these resources for sustenance and cultural identity.

The University of Washington’s Pacific Northwest Center for Human Health and Ocean Studies, directed by Elaine M. Faustman and Ginger Armbrust, researches how environmental factors trigger blooms of the marine algae that produce domoic acid, which caused the 2002–2003 harvest closure. When people eat seafood contaminated by domoic acid, they may experience nausea, memory loss, confusion, seizures, and even death. Faustman, Professor of Environmental and Occupational Health Sciences, leads the center’s human exposure research project.

While controlled laboratory studies are beginning to illuminate environmental and genetic factors that contribute to domoic acid production, Armbrust, Professor of Oceanography, says researchers are not certain of causes of domoic acid production in the environment. Domoic acid has prompted beach closures dating back to 1991 and has become an emerging concern in Puget Sound, where three closures have occurred since 2003. The 2002–2003 harvest closure on the Washington coast cost the local economy an estimated \$10 million.

Some studies suggest that harmful algal blooms, including blooms of domoic acid, are on the rise.

According to an article by Moore *et al.* in the journal *Environmental Health*, little progress has been made in teasing out the role of climate impacts from the many other variables thought to contribute to harmful algal blooms. The article suggests that studying documented and predicted impacts of ocean warming from large scale climate variability (such as *El Niño*) can help predict future anthropogenic climate change. While researchers suspect that a type of algae known as diatoms might struggle because of its physiology, a type called dinoflagellates might fare better. If warmer waters occur for greater lengths of time each year and favor growth of some kinds of dinoflagellates, such as the kind that produce paralytic shellfish poisoning (PSP) toxins, harvest closures could increase. In Washington State, harvest closures result when PSP toxin levels in seafood are too high.

In addition to testing for domoic acid and PSP toxins, the Washington State Department of Health tests for bacteria that cause the intestinal disease vibriosis. Levels of these bacteria in shellfish increase as summer temperatures rise. A large outbreak of vibriosis in 2006 in Washington State sickened dozens of people. Nationwide, about 300 people were infected by contaminated Pacific Northwest oysters that year, threatening the entire industry. Another outbreak in 2004 in Alaska made dozens ill. The Alaska outbreak is of particular note because, at the time, scientists did not think Alaskan waters were warm enough to permit the growth of the *Vibrio parahaemolyticus* bacteria sufficient to make people ill. Researchers who studied the outbreak concluded that increased ocean temperatures played a role.

The effect of future climate change on susceptibility of Northwest seafood resources to biotoxins and bacterial contamination is not yet fully known. However, as we put more effort into understanding these mechanisms now, the story may help those who count on these resources for income, food—and even cultural identity—to weather the changes. ■

Authors

Alison Scherer, MS, is a Research Scientist in the University of Washington’s Pacific Northwest Center for Human Health and Ocean Studies and Elaine Faustman, PhD, is the Center’s Co-director.

Alison Scherer
Elaine Faustman

Resources

Moore SK, Trainer VL, Mantua NJ *et al.* (2008). Impacts of climate variability and future climate change on harmful algal blooms and human health. *Environmental Health*, 7(Suppl 2): S4.

Policy Impacts

The Center has made a number of Oceans and Human Health policy impacts at the state, regional, tribal, national, and international levels as described below.

State Impacts

Washington State Department of Ecology's Model Toxics Control Act

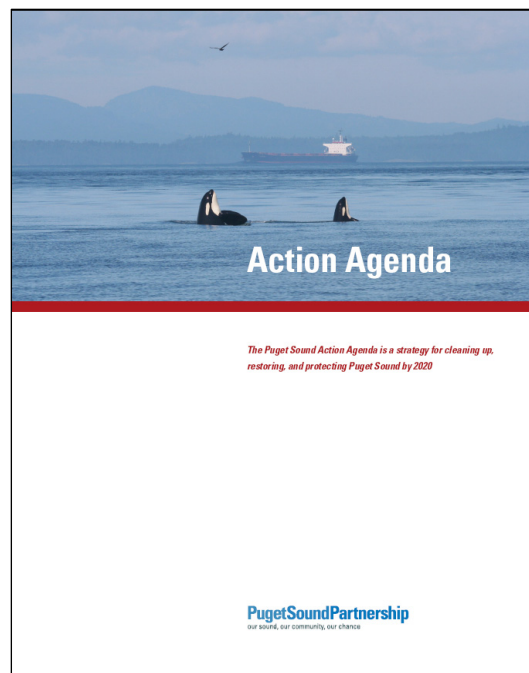
Dr. Faustman serves in an advisory capacity for the Washington State Department of Ecology's Model Control Toxics Act. The Department of Ecology continues to revise the fish and shellfish consumption rates that they use to establish clean-up standards for contaminated waterways. In doing so they consider the following questions: What rule revisions are needed to incorporate new scientific information and federal guidance on the health risks for persons consuming larger amounts of fish and shellfish? Does the MTCA cleanup regulation default fish consumption rate provide a reasonable maximum exposure? How will Ecology establish fish consumption rates, fish diet fractions, and other exposure parameters protective of high exposure groups? What considerations go into establishing site-specific fish consumption rates?

In 2010, the Department of Ecology began the process of updating the MTCA cleanup regulation on fish consumption. In order to develop the technical support document for this, the Department of Ecology is using an electronic library of fish consumption reference materials that the Center compiled in 2009. This resource will hence play a critical role in supporting the update of the MTCA cleanup regulation on fish consumption in Washington State.

Regional Impacts

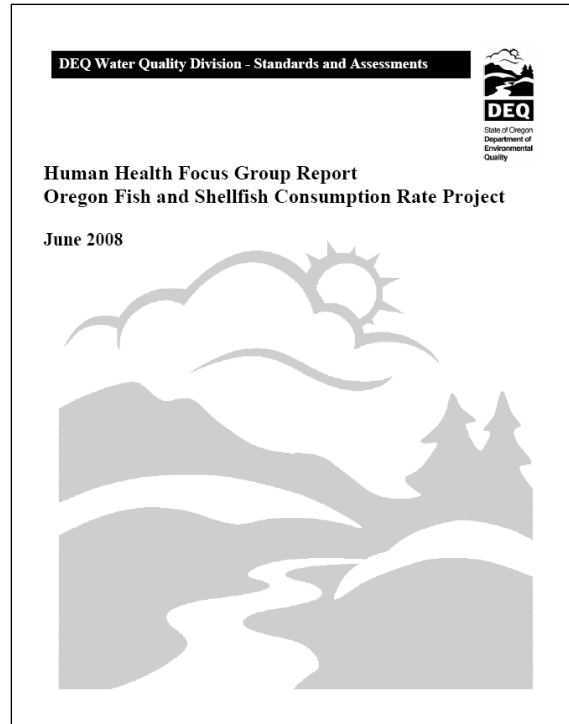
Puget Sound Partnership's Goal of Healthy People Supported by a Healthy Puget Sound

Dr. Faustman provided expert review of the Puget Sound Partnership's "Human Health Topic Forum" Discussion Paper. The Washington state legislature charged the Puget Sound Partnership with the task of creating an Action Agenda, a "roadmap to health for Puget Sound," by 2009 (see right). The Puget Sound Partnership, a collaborative effort involving diverse stakeholders, is driven by six goals, including "healthy people supported by a healthy Puget Sound," to be achieved by 2020. The Action Agenda strives to prioritize cleanup and improvement projects; coordinate federal, state, local, tribal, and private resources; and make sure that all stakeholders work together cooperatively. The Puget Sound Partnership aims to base decisions on science, focus on actions that have the biggest impact, and hold people and organizations accountable for results.



Oregon Department of Environmental Quality Fish Consumption Rate Project

The Oregon Department of Environmental Quality (DEQ) Fish Consumption Rate Project, a cooperative effort with U.S. EPA and the Confederated Tribes of the Umatilla Indian Reservation, sought to reconsider the fish consumption rate used in setting the state of Oregon's water quality standards for toxic chemicals. Dr. Faustman served on project's Human Health Focus Group along with others from academia, private consulting, and government. The objective of the Human Health Focus Group was to recommend a process for selecting an appropriate or relevant fish consumption rate(s) for revision of Oregon's water quality standards. As described in the technical report it developed (shown at right), the group found that: 1) that the current fish consumption rate (17.5 grams/day) does not reflect fish consumption for Oregon residents; 2) that all types of fish including Pacific salmon regardless of their habitat preference should be included in fish consumption rates; and 3) that water quality standards should protect people who eat fish, particularly the most vulnerable.



Subsequent to the release of these recommendations, the Oregon Environmental Quality Commission, Oregon DEQ's rulemaking body, directed Oregon DEQ to revise Oregon's toxics criteria using a 10-fold higher fish consumption rate of 175 grams/day. In June 2010, U.S. EPA took a Clean Water Act action to disapprove Oregon's old 2004 human health water quality criteria for toxics that was based on the 17.5 grams/day rate. In June 2011, Oregon DEQ is proposing adoption of a revised rule based on the newly recommended 175 grams/day rate, and U.S. EPA has stated to Oregon DEQ that it believes "that Oregon's adoption of human health criteria ... using a fish consumption rate of 175 grams per day statewide would be adequate to address EPA's disapproval of the ... human health criteria adopted in 2004." U.S. EPA touted the work of the Oregon DEQ Human Health Focus Group and said that the Oregon DEQ Fish Consumption Rate Project "resulted in a solid foundation to support the development of human health criteria protective of consumers of fish caught in Oregon's water. This foundation considers the relatively high level of fish consumption in Oregon's general population, the consumption patterns of Tribal and other subsistence fishers in the State, the cultural importance of fish to Tribes in Oregon and your government-to-government relationship to those Tribes."

Tribal Impacts

Swinomish Indian Tribal Community Bioaccumulative Toxins in Shellfish Advisory Board

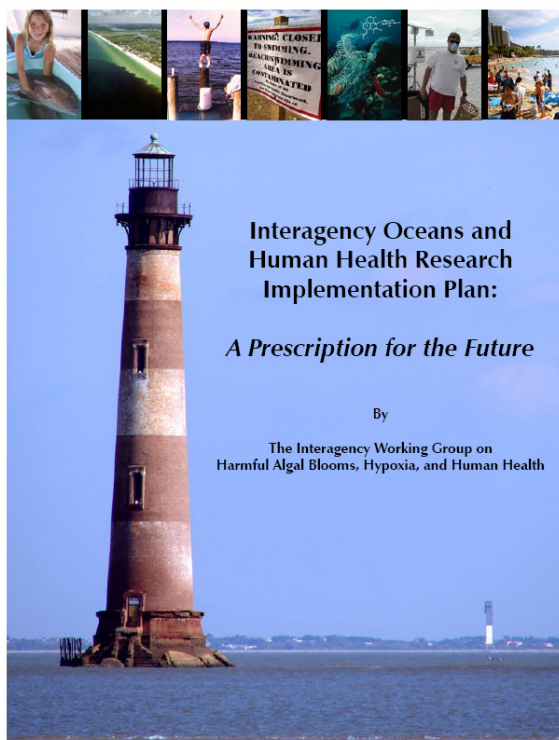
Center investigator Dr. William Griffith has served on the advisory board for the Swinomish Indian Tribal Community regarding the analysis of bioaccumulative toxins in shellfish. The work of the tribe has included collection and measurement of toxins in shellfish growing in traditional areas used by the tribe. This study was funded by the U.S. EPA and included a tribal seafood consumption survey. The results of this project have been used by the tribe to develop consumption advisories for tribal members.

National Impacts

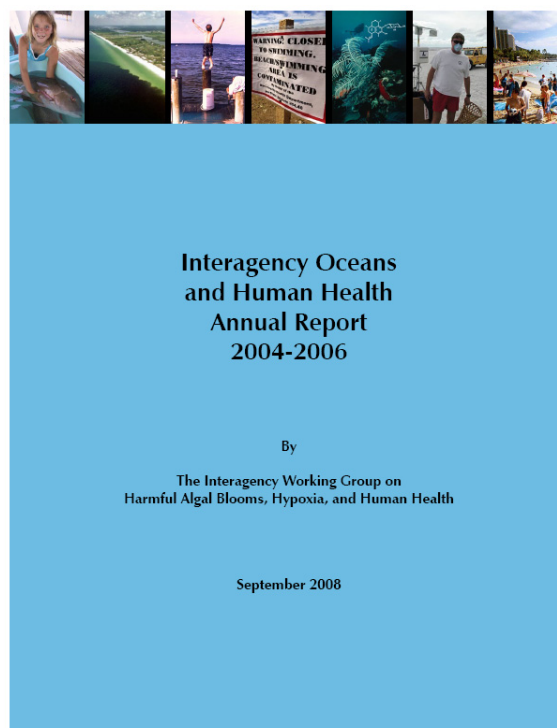
Interagency Reporting

The Center has made contributions to several interagency reports, including the 2007 *Interagency Oceans and Human Health Research Implementation Plan: A Prescription for the Future* (see below, left). The report was authored by the Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health, which was chartered through the Joint Subcommittee on Ocean Science and Technology of the National Science and Technology Council. The report describes the Interagency Program in Oceans and Human Health, established after Congress passed the Oceans and Human Health Act In 2004, and outlines areas of research emphasis for the next decade.

The Center also contributes to annual reports prepared by the Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health. An example of a report released in 2008 is shown below on the right.



Sandifer, P., C. Sotka, D. Garrison, and V. Fay. 2007. *Interagency Oceans and Human Health Research Implementation Plan: A Prescription for the Future*. Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.



Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health. September 2008. *Interagency Oceans and Human Health Annual Report 2004-2006*. Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

International Impacts

FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption

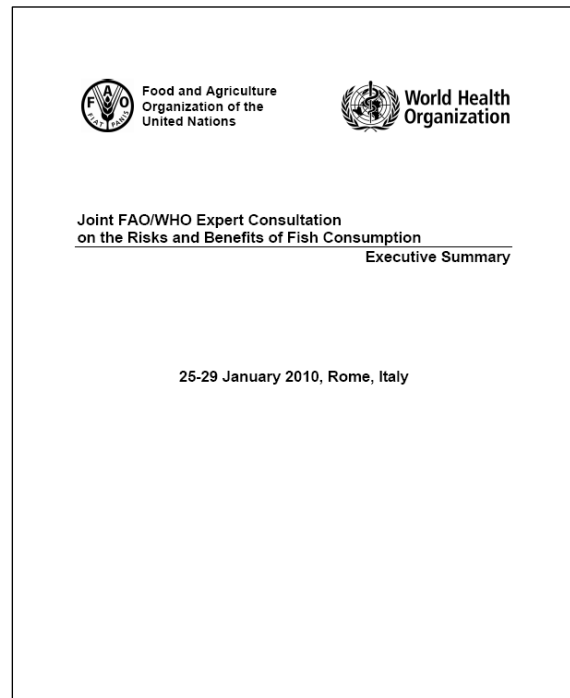
The FAO (Food and Agriculture Organization of the United Nations) and WHO (World Health Organization) jointly convened the Expert Consultation on the Risks and Benefits of Fish Consumption January 25-29, 2010, in Rome, Italy. Center Director Dr. Faustman and Center investigator Dr. Lucio Costa participated as Consultation experts. The main goals of the Consultation were to consider the risks of dietary exposure to methyl mercury, dioxin, and dioxin-like PCBs from consumption of fish for vulnerable groups of the population, i.e. women of childbearing age, fetuses, infants, and small children and high consumers, versus the nutritional and health benefits of consumption of fish. Furthermore, the Consultation sought to address the lack of a comprehensive evaluation of the risks and benefits of fish consumption.

Drs. Faustman and Costa also served as lead authors on two of the three background documents prepared in advance of the expert consultation. Costa prepared the background document on the assessment of fish consumption risks while Faustman prepared the background document on fish risk-benefit assessment. These background papers are slated for publication in the peer-reviewed literature, and the Center is coordinated this effort.

The experts worked together to prepare an Executive Summary (shown at right) conveying the recommendations that resulted from the Consultation. These were as follows:

To minimize risks in target populations, the Consultation recommended a series of steps that member states should take to better assess and manage the risks and benefits of fish consumption and more effectively communicate with their citizens:

- Acknowledge fish consumption as an important food source of energy, protein, and a range of essential nutrients and part of the cultural traditions of many peoples.
- Emphasize the benefits of fish consumption on reducing Coronary Heart Disease (CHD) mortality (and CHD mortality risks of not eating fish) for the general adult population.
- Emphasize the neurodevelopment benefits to offspring of fish consumption by women of childbearing age, particularly pregnant women and nursing mothers, and the neurodevelopment risks to offspring of such women not consuming fish.
- Develop, maintain, and improve existing databases on specific nutrients and contaminants, particularly methyl mercury and dioxin-like compounds, in fish consumed in their region.
- Develop and evaluate risk management and communication strategies that both minimize risks and maximize benefits from eating fish.



Productivity

Publications and Presentations

The Center is proud of its high level of productivity, including dissemination of research results and publication in the peer-reviewed literature. Center investigators also present their work at professional and society meetings, workshops and conferences, community meetings, and other venues.

Figure 2 below illustrates the Center's cumulative number of publications, as well as submitted and in preparation manuscripts. Publication of research represents a primary goal of Center outreach activities. Many Center publications represent collaborative work spanning multiple research projects and cores. This reflects the interdisciplinary nature of the Center and its structure, through which research projects and cores work together in response to the critical need to understand links between ocean processes and human health.

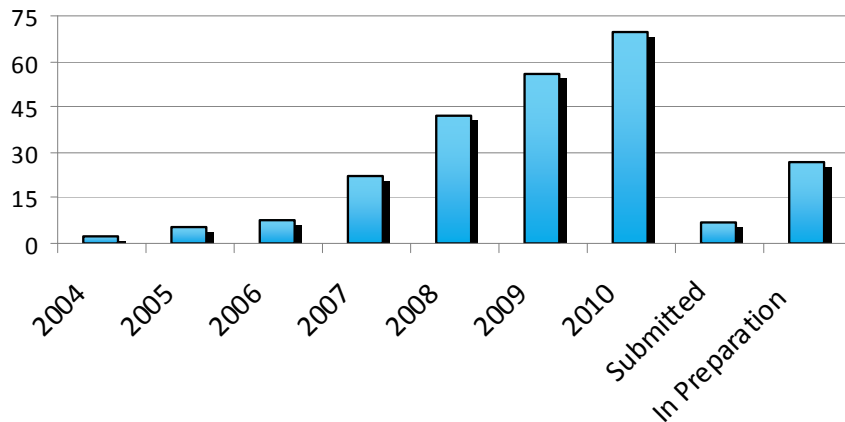


Figure 2. Cumulative number of Center publications

Center investigators have also given over 200 outreach presentations (poster and oral) describing Center research, including many by students, to audiences spanning ocean sciences and public health sciences. Presentations have been given at the local, state, regional, national, and international level. In many cases, outreach presentations made by Center research are done in a collaborative manner across research projects and cores.

Pilot Projects

The Center has been proud to support three highly-productive pilot projects. These have included: 1) Assessing Dietary Intake of the Asian/Pacific Islander Communities; 2) Institutional Responses and Management in Relation to the Threat of Harmful Algal Blooms, and 3) Age-Specific Susceptibility and Chronic Effects of Algal Toxin Exposure in the Vertebrate Nervous System.

Leveraged Funding

Since its inception in 2003, the Center has leveraged over \$19 million of funding, and has submitted a total of nearly \$30 million in requests. Over 170 days of ship time have been leveraged from other funding sources for sample collection as well. These achievements were made possible through collaborations within the Center and with other researchers and institutions. These leveraged funding successes illustrate how the Center has multiplied many times over the investments its joint sponsors, NSF and NIEHS, have contributed to the Center.

Figure 3 below illustrates the Center's leveraged funding to date:

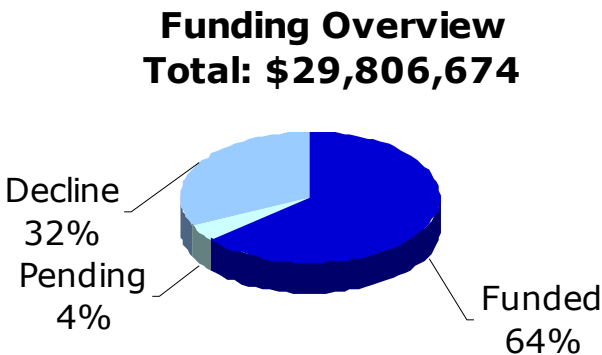


Figure 3. Center Leveraged Funding, 2003 - current

The pursuit of leveraged funding has helped the Center foster multidisciplinary collaboration both within and beyond the Center and has also been a means to train and educate the next generation of Oceans and Human Health scientists.

Specific, targeted leveraged funding examples are highlighted below:

Interdisciplinary Research Cruises

Ship time leveraged through the UW School of Oceanography supports a series of short (2-4 day) education cruises on the R/V Thomas G. Thompson in Puget Sound waters to not only conduct research but also to bring together the Oceans and Human Health disciplines that comprise the Center. In 2005, the Center participated in a one-day research cruise to introduce public health scientists to oceanographic methods. In October 2006, Center participants from all disciplines completed a four-day cruise (see Figures 4-5) that accomplished four goals: 1) provide a capstone experience for the Center REU program, 2) promote interdisciplinary connections among Center graduate students and post-doctoral fellows, 3) discuss creation of a graduate curriculum on Oceans and Human Health, and 4) sample sites of Fall 2005 domoic acid shellfish closures. Cruise education sessions were facilitated by Veronique Robigou, the director of COSEE – Ocean Learning Communities. Science writer Eric Scigliano was aboard and wrote an article on oceans and human health for *Seattle Metropolitan* magazine.



Figure 4. Center research scientist Finn Krogstad and Center graduate student Michele Guannel work with research technician Eric Coker to guide a rosette of water sampling bottles and an instrument to measure salinity and temperature overboard as part of the Center's 2006 interdisciplinary research cruise exploring links between Oceans and Human Health. Photo by Alison Scherer.



Figure 5. In a Zodiac near Whidbey Island, Center investigator Dr. William Griffith and research scientists/engineers Jarred Swalwell and Ellen Lin prepare to collect samples during the Center's 2006 interdisciplinary research cruise in an area where toxic phytoplankton blooms have been a problem. Photo by Alison Scherer.

In 2007, the Center was awarded 2 days of research time aboard the R/V Thompson. This sampling was coordinated with Small Grants for Exploratory Research (SGER) funds from NSF. The main objective of the cruise was to collect samples for environmental transcriptomics at a suite of sites in Whidbey Basin, Hood Canal, and the Straits. In November 2009, Center investigators and students participated in a 2-day cruise on the R/V Thompson to collect field samples at 9 stations in Puget Sound, and in October 2010 Center investigators and students participated in a 2-day cruise to collect field samples at 14 stations in Puget Sound. A primary focus of the 2010 cruise was to reoccupy stations sampled on previous fall cruises in Puget Sound to enhance the time-series of *Pseudo-nitzschia* biogeography in Puget Sound.

These Center research cruises have provided an excellent venue for Center REU students to present their work in an interdisciplinary setting.

ARRA Administrative Supplement

The Center applied for and was awarded a \$53,000 Administrative Supplement from NIEHS through American Recovery and Reinvestment Act (ARRA) stimulus funding. This supplement allows the Center to further develop its comparative/cross-species genomics approach to take Center research to the next level by leveraging a series of ongoing Center studies examining gene-environment considerations between *Pseudo-nitzschia* species and human health. While the mechanisms involved in the regulation and functional response of *Pseudo-nitzschia* to DA toxin have received some attention, the relationship between *Pseudo-nitzschia*'s functional response and humans' functional response to DA toxin has received a great deal less. Center researchers have begun exciting work using an *in silico* comparative genomics approach to identify conserved signaling pathways and proteins that may be involved in a shared functional response in diatoms and humans to DA toxin. This effort spans numerous research projects and facility cores and also supports graduate research.

Research Experience for Undergraduates (REU)

Since 2005, 14 Research Experience for Undergraduate (REU) students have been supported through funds leveraged from NSF to participate in projects that have spanned the full range of Center research in Oceans and Human Health. Participating students have come from six different majors and worked in both research and facility cores and with partners at NOAA's Northwest Fisheries Science Center in Seattle, Washington, which houses the NOAA West Coast Center of Excellence for Oceans and Human Health. The REU program has also provided career development opportunities for graduate students and post-docs in the Center, several of whom have served as primary mentors for fellows. REU fellows have presented their research at special REU sessions of the Center's joint UW/NOAA Oceans and Human Health seminar series as well as in other venues such as the 2009 Fifth Symposium on Harmful Algae and the Center's interdisciplinary research cruises. The REU program also hosts activities open to all undergraduates on campus including cruise experiences, a "field day" where students helped with sampling of a large-scale incubation experiment, and a summer lab tour series where Center investigators from both ocean and public health sciences host laboratory visits and give informal research talks.

Oceans and Human Health Training Grant

The Center successfully competed for a NOAA training grant titled "Pre- and Post-doctoral Traineeships in Oceans and Human Health" (Pacific Northwest Consortium). The goal of this training grant is to train the next generation of scientists adept at understanding and shaping a newly emerging field focused on the interaction between oceans and human health and well-being. The traineeship support structure is designed to maximize the number of early-career scientists exposed to the research philosophy and opportunities associated with participation in the Pacific Northwest Consortium. Pacific Northwest Consortium funds have supported stipend and tuition for 4 graduate students for 1-2 years each and the stipends for 3 post-doctoral researchers for 1 year each to conduct research. Four of the Center's graduate students have been funded through the traineeship. The Pacific Northwest Consortium has just completed the process of reviewing student applications for another round of funding and is pleased to offer funding for several new Oceans and Human Health graduate students and postdocs.

Outreach and Translation

Beyond publishing and presenting the finding of its work, the Center pursues additional means to reach out to stakeholders and translate results in meaningful ways. Below are several examples.

Disaster Response

Response to the 2005 Hurricanes Katrina and Rita

The Center created a flyer for residents returning to homes that were damaged by the devastating 2005 hurricanes Katrina and Rita. Refer to the next page to view the two-sided flyer, which included important risk communication messages about anticipated hazards from multiple sources inside and outside the home. The flyer was peer-reviewed by experts at the UW and through the NIEHS Core Centers COEP (Community Outreach and Engagement Program) Hurricane Katrina Working group. Through an arrangement with a local printing company, 5,000 copies were express mailed directly to a rescue center in La Porte, Louisiana. Additionally, copies were distributed through the COEP working group.

Response to the 2010 Deepwater Horizon BP Oil Spill

The 2005 Katrina/Rita re-entry flyer was repurposed by NIEHS grantees in the Gulf to distribute to communities impacted by the 2010 Deepwater Horizon BP Oil Spill. The Sealy Center for Environmental Health and Medicine and the NIEHS Center in Environmental Toxicology COEC at the University of Texas Medical Branch at Galveston repurposed the flyer for inclusion in a publication called *Joshua Tree Journal*, a community-based social services provider, which generally does a run of about 80,000 copies distributed in Galveston, Chambers, Brazoria, and other coastal counties.

The Center also compiled a list of human health information resources and selected references that Deepwater Horizon BP Oil Spill responders and those potentially affected by the spill may find of use. This list was compiled in collaboration with the UW's Institute for Risk Analysis and Risk Communication, also directed by Dr. Faustman. These outreach and reference materials are available on the Center Website (<http://depts.washington.edu/pnwh2o/>) and have been viewed hundreds of times since they were posted after the spill.

Furthermore, the Center hosted a series of journal clubs related to the spill. In the Fall of 2010, journal club was dedicated to the human health implications of the spill. The journal club addressed such questions as: What are the short- and long-term health effects of the spill? What is known about potential health risks associated with dispersants used to mitigate the spill? What potential health impacts do the oil spill response workers, volunteers, and local communities face? How has Unified Command responded to potential human health threats? What health tracking and medical surveillance efforts are underway? What mental health and wellbeing repercussions might result from the spill's impacts on the economy (fisheries, tourism, etc), aesthetics of the region, and ecological health? In the Winter of 2011, journal club was devoted to the risk management, legal, and regulatory context for the spill. Following the Katrina/Rita re-entry flyer on the next 2 pages, view the flyers for the Center's journal clubs focused on the 2010 Deepwater Horizon BP Oil Spill.

View the Center's Katrina/Rita re-entry flyer on the next 2 pages, followed by flyers for the Center's journal clubs focused on the 2010 Deepwater Horizon BP Oil Spill →

Re-Entering your home after a hurricane or flood:

Things to consider when your home is approved for re-entry

PROTECTING YOURSELF AND YOUR FAMILY:

When officials tell you that your home is safe to re-enter, you need to know what to expect and how to protect yourself and your family from harm. During your visit you will need to check for damage and plan clean up activities.

Do not enter your home until you are told it is safe to go inside by local officials. Do not ever go into a house or building that is marked unsafe.

Before cleaning up, you will need to learn how to clean safely depending on what you find in your home. Use the checklist on the back of this sheet to mark the hazards you find. Then learn how to handle them by calling 1-800-CDC-INFO.

When you return to your neighborhood and home, please move cautiously and take steps to protect yourself from injury or harm. Remember that fire fighters and paramedics may not respond to an emergency as quickly as normal.

1 BE PREPARED:

Buddies – do not enter a home or other structure alone. Bring at least one other able adult to help you.

No Children – keep babies and children away from the home or structure. If you are pregnant, or think you might be pregnant, stay out of the home until health officials say it is safe.

Better safe than sorry – senior citizens, people with allergic or respiratory conditions like asthma, dermatitis, or chronic bronchitis, people with cancer or who are having chemotherapy, or other conditions that affect their immune systems should stay away from the home until health officials say it is safe.

Tetanus booster – if it has been more than 10 years since you had a tetanus shot than get one before going home. If you don't know then get a booster shot. Without the booster a small cut or rash can be infected or cause serious health problems.

Sturdy footwear is important when entering a home or other structure. Waterproof boots with a good tread and steel shank are recommended.

Protective Clothing – it may be hot, but protect your skin by wearing long pants, long sleeved shirts and rubber, PVC or latex gloves. Bring extra gloves and a clean change of clothes and shoes in a separate plastic bag to wear after you leave your home.

Food and water – bring plenty of bottled of water with you until the tap water is safe for drinking. Bring snacks that do not need to be refrigerated.

Other basic necessities are waterless disinfectant hand soap, mosquito repellent containing DEET, flashlight, heavy-duty trash bags and first aid items.

2 DO NOT ENTER IF:

The building looks **structurally unsafe**.

Look for damaged exterior walls or beams, collapsed ceilings, floors or staircases.

You smell **gas**.

You see **downed power lines**. Even if power is not restored, downed power lines present a danger. Do not re-enter if power lines are down and near or on your house and yard.

You see or smell a likely **chemical spill**.

You see an **electrical hazard**.

Standing water may be dangerous and hide snakes, electrical and other hazards. Do not touch or walk in standing water.

If the house and yard look safe and it has been cleared for re-entry, enter cautiously.

3 LEAVE IMMEDIATELY IF:

You **feel any of the following symptoms**:

wheezing, chest tightness, shortness of breath, escalating allergy symptoms, nausea, dizziness, headache, fatigue, burning sensation in nose or throat, or if you get a rash. If these feelings are severe or if they do not go away after leaving the house contact a health care provider (or 1-800-CDC-INFO).

You see or smell structural damage, gas, chemical spill, or electrical hazard.

Mold covers more than 10 square feet of the walls or ceiling.

4 INSIDE THE HOME:

Open windows. Beware of cracked and broken glass. Look for items listed under the hazard checklist on the other side of this flier.

Do not touch damaged containers of household cleaners or garden chemicals with your bare hands or skin.

Wear protective gloves before touching dirt and mold.

Wash your hands frequently. If the tap water is not safe, then use waterless disinfectant hand soap.

Electrical Hazards:

Look out for damaged power cords. Do not use an item if the power cord or electrical system was waterlogged, is damp, or looks frayed or damaged. Some damaged items will look okay but be unsafe.

Do not use generators, heaters, charcoal and gas grills inside a home or enclosed space. These items produce carbon monoxide, a deadly gas that you cannot smell or taste.

TELEPHONE HOTLINES:

For information about **health** issues call the CDC hotline at 1-800-CDC-INFO

If you suspect that someone has been **poisoned**, call the National Poison Control Center at 1-800-426-4435.

Report **oil and chemical spills** by calling the National Response Center at 1-800-424-8802.

5 SPECIAL CONSIDERATIONS:

Most **homes built before 1978** have lead paint and asbestos insulation. Lead and asbestos are also in the dirt left by the floodwater. To learn about lead and asbestos clean up call 1-800-CDC-INFO.

Is stored food safe to eat? Damaged and opened containers of food should be discarded. All food in your refrigerator should be thrown away.

Can I drink the water? If bottled water is not available, adults and teens can drink water that has been boiled or treated. Do not use tap water to make infant formula and give children bottled water only until local officials say the tap water is safe to drink.

Mold is dangerous to your health. It spreads through the air and it may be in the air you breathe. Only a N95 respirator that fits snugly will protect your lungs from mold in the air. Some people wear a dust mask or bandana but these do not protect your lungs. Also, a respirator will not fit men with beards and mustaches. If mold covers more than 10 square feet of your walls and you do not have a respirator, you should leave.

During your first visit look at how much of the home has mold and then contact health officials to learn what you should do. You can get help by calling 1-800-CDC-INFO.

Moldy items such as books and papers that you want to keep can be put in ziplock bags and frozen until you can treat them.

6 WHEN YOU LEAVE:

Your hair, skin and clothing will be dirty and may contain hazardous dust and materials. Change into clean clothes as soon as you leave. Shower and put on clean clothes as soon as possible after leaving your home. Wash the dirty clothes separately from your family's laundry.

Do not hold or hug your child until you have bathed and changed clothing.

Hazard Checklist

Do not enter the house if there is:

- ___ Structural damage ___ Downed power lines ___ Leaking gas
- ___ Mold covering more than 10 square feet

Learn how to handle these hazards by calling 1-800-CDC-INFO:

- ___ Mold covering less than 10 square feet
- ___ Dirt left by the floodwater
- ___ Lead and asbestos in homes built before 1978

If you find any of the following items have been damaged or have leaked, throw them away in a double bag and label it "hazardous material." Once utilities are restored you can learn how to dispose of this waste.

KITCHEN:

- ___ Drain opener
- ___ Oven cleaner
- ___ Furniture polish

BATHROOM:

- ___ Toilet bowl cleaner
- ___ Mouthwash
- ___ Prescription Medicines
- ___ Non-Prescription Medicines
- ___ Sharps

GARAGE/BASEMENT:

- ___ Gasoline, kerosene and solvents
- ___ Windshield washer fluid
- ___ Antifreeze
- ___ Paint Thinner
- ___ Pesticides
- ___ Garden Chemicals

For information about **health** issues call the CDC hotline at 1-800-CDC-INFO

If you suspect that someone has been **poisoned**, call the National Poison Control Center at 1-800-426-4435.

Report **oil and chemical spills** by calling the National Response Center at 1-800-424-8802.

This fact sheet provided by:

U.WA Center for Ecogenetics and Environmental Health
U.WA Center for Children's Environmental Health Risks Research
U.WA Center for Human Health and Ocean Studies
K/P Corporation, Seattle, WA

Risk Assessment Issues for Deepwater Horizon BP Oil Spill & Human Health

Journal Club



**ENVH 593, Current Concepts in Risk Assessment
Autumn Quarter 2010, Credits: 1**

This class is required for students completing the Risk Emphasis Program

Instructor: **Elaine M. Faustman, PhD, DABT** – Professor, Department of Environmental and Occupational Health Sciences and Director, Institute for Risk Analysis and Risk Communication (IRARC)
Co-Instructor: Alison Scherer, MS

Time & Dates: **Wednesdays: 3:10-5:00 PM**
Five Sessions: 9/29 (short session: 3:10-4:10pm), 10/6, 10/13, 11/17, & 11/24
Class will be held in 4225 Roosevelt Way NE, Room 2228

Course Description: In this course we will explore the human health dimensions of the Deepwater Horizon BP Oil Spill, the largest offshore event of its kind in U.S. history. The April 20th, 2010 Deepwater Horizon BP drilling rig explosion that triggered the spill not only took the lives of 11 workers but also unleashed myriad implications for both human and ecological health. The journal club will ask questions such as: What are the short- and long-term health effects of the spill? What is known about potential health risks associated with dispersants used to mitigate the spill? What potential health impacts do the oil spill response workers, volunteers, and local communities face? How has Unified Command responded to potential human health threats? What health tracking and medical surveillance efforts are underway? What mental health and wellbeing repercussions might result from the spill's impacts on the economy (fisheries, tourism, etc), aesthetics of the region, and ecological health? It is anticipated that Winter quarter, risk communication and risk messaging will be the focus of journal club.

Learning Objectives: Upon completion of this journal club, students shall be able to:

- Demonstrate familiarity with the potential human health risks associated with the Deepwater Horizon BP Oil Spill
- Apply risk assessment approaches to complex emergency and disaster situations
- Describe implications for wellbeing and mental health that might stem from the spill
- Articulate challenges and opportunities for Unified Command's response to potential human health concerns arising from the spill



For more information, contact Elaine M. Faustman at 206-685-2269 or faustman@u.washington.edu
Institute for Risk Analysis and Risk Communication (IRARC)

Risk Management, Legal & Regulatory Context for Deepwater Horizon BP Oil Spill & Human Health Journal Club



ENVH 593, Current Concepts in Risk Assessment | Winter Quarter 2011, Credits: 1

This class is required for students completing the Risk Emphasis Program

Instructor: **Elaine M. Faustman, PhD, DABT** – Professor, Department of Environmental and Occupational Health Sciences and Director, Institute for Risk Analysis and Risk Communication (IRARC)
Co-Instructor: Alison Scherer, MS

Time & Dates: **Thursdays: 3:10-5:00 PM**
Five Sessions: ~~1/13~~ (canceled), 1/20, 1/27, 2/3 & 2/10
Class will be held in 4225 Roosevelt Way NE, Room 2228

Course Description: In this course we will delve deeper into our exploration that began Fall quarter of the human health dimensions of the Deepwater Horizon BP Oil Spill. Journal club this quarter will focus specifically on the risk management, legal, and regulatory context surrounding the oil spill as it relates to human health. We will ask questions such as: How are health risks – both potential future and immediate ones – addressed and managed? What are the relevant regulatory context considerations? How are oil spill human and ecological health threats communicated? By whom (BP, government, advocacy groups, media, etc)? How do health risks compare to health risk perceptions among workers and members of affected communities? How do we handle uncertainty in regulatory decisions? What are legal implications related to human and ecological health and the oil spill? What can be learned for the future?

Learning Objectives: Upon completion of this journal club, students shall be able to:

- Demonstrate familiarity with the human and ecological health risk management, including risk communication and perception, issues associated with the oil spill.
- Identify risk management contexts of complex emergency and disaster situations on a broader scale and identify lessons learned.
- Articulate regulatory and legal considerations regarding potential human health concerns arising from the oil spill.



For more information, contact Elaine M. Faustman at 206-685-2269 or faustman@u.washington.edu
Institute for Risk Analysis and Risk Communication (IRARC)

Oceans and Human Health Seminar Series

Since 2004, the Center has hosted on a highly successful Seminar Series in Oceans and Human Health in partnership with the NOAA Northwest Fisheries Science Center's NOAA West Coast Center of Excellence for Oceans and Human Health, co-located in Seattle. Speakers represent public health and ocean science fields and the audience draws students and scientists from these disciplines as well. Seminars take place twice per month during each academic quarter. The seminar is alternately held at the UW campus and NOAA Northwest Fisheries Science Center, located near the UW campus. The seminars have been well attended and have attracted approximately equivalent attendance for ocean sciences as well as public health sciences, including attendees representing local, state, regional, and federal government, as well as tribal representatives and researchers from other universities. Of note, one seminar on the topic of ocean acidification drew over 100 attendees.

Throughout the life of the Center, several quarters of the seminar series have been devoted exclusively to highlighting Center students' research. This has provided an excellent opportunity for Center students (undergraduates, graduate student, and post-docs) to share their work.

Each quarter the Center broadly advertises the seminar series to stakeholders throughout the region. Example flyers are shown below:

University of Washington's Pacific Northwest Center for Human Health and Ocean Studies and the National Oceanic and Atmospheric Administration's West Coast Center for Oceans and Human Health

SEMILNAR SERIES

FALL 2010

This series encourages communication among scientists, students and others interested in the complex interactions of oceans and human health. Speakers and articles will bridge disciplines, highlight cross-cutting issues, and expand awareness of the role of our oceans on human health. Everyone interested in these topics is welcome to attend.

Students who would like to receive credit | contact Micaela Parker at micaela@u.washington.edu.
For more information | contact Rita Peterson at ritap@u.washington.edu or Stephanie Moore at stephanie.moore@noaa.gov.

LOCATION | FSH 108
TIME | 2:30pm - 3:30pm

Date	Title	Speaker
10.12 TUES	Assessing Pseudo-nitzschia Diversity in Puget Sound Over Time and Space	Matthew Knight
10.26 TUES	Understanding Pathogens Conducted in Real-Time	
11.09 TUES	Eyes on Puget Sound: A New Perspective	
11.23 TUES	Environmental Impacts of Ocean Acidification	
12.07 TUES	Spicing Up the Menu: How Seafood Can Help Us Get Thicker	

Sponsors:
- Elaine Faustman - Professor, UW Dept. of Environmental & Occupational Health Sciences, UW School of Public Health and Community Medicine, and Director of the Pacific Northwest Center for Human Health and Ocean Studies.
- John Stein - Deputy Director, NOAA Fisheries Service, Northwest Fisheries Science Center, and Director of the West Coast Center for Oceans and Human Health.
- Ginger Ambrose - Professor, UW School of Geography, and Co-Director of the Pacific Northwest Center for Human Health and Ocean Studies.
- Vera L. Trainer - Program Manager, Marine Resources Program, Northwest Fisheries Science Center and Adjunct Affiliate Faculty, UW School of Fisheries.

University of Washington's Pacific Northwest Center for Human Health and Ocean Studies and the National Oceanic and Atmospheric Administration's West Coast Center for Oceans and Human Health

SEMILNAR SERIES

SPR 2010

This series encourages communication among scientists, students and others interested in the complex interactions of oceans and human health. Speakers and articles will bridge disciplines, highlight cross-cutting issues, and expand awareness of the role of our oceans on human health. Everyone interested in these topics is welcome to attend.

Students who would like to receive credit | contact Micaela Parker at micaela@u.washington.edu.
For more information | contact Rita Peterson at ritap@u.washington.edu or Stephanie Moore at stephanie.moore@noaa.gov.

LOCATION | NOAA Auditorium
TIME | 2:30pm - 3:30pm

Date	Title	Speaker
04.06 TUES	The PNW HAB Bulletin: Early Warning for the Razor Clam Fishery in Washington State	Barbara Hickey Professor / UW School of Oceanography
04.20 TUES	Neurobehavioral Effects of Developmental Exposure to Domoic Acid	Kimberly Grant Senior Research Scientist / UW School of Public Health, Dept. of Environmental & Occupational Health Sciences
05.04 TUES	Shellfish Infectious <i>Vibrios</i> in Coastal Waters: Impacts and Overview on the 'Oyster Crisis'	Ralph Elston Chief Scientist/Aquaculture and Affiliate Professor / UW School of Aquatic & Fisheries Science
05.18 TUES	Trajectory Forecasting in the Coastal Ocean for Emergency Response to Oil Spills and Other Hazards	Amy MacFadyen Oceanographer/Emergency Response Division-NOAA/NOS/OR&R

***Special Panel Discussion LOCATION | FSH 203 (2:30 - 4 pm)**

Date	Title	PANEL MEMBERS
06.01 TUES	Linking the Climate and Oceans & Human Health Communities*	Nathan Mantua (UW) Ed Miles (UW) Dan Ayres (DFW) Frank Cox (DOH) Jerry Boicourt (DOH) Cari Franz-West (DOH) Ginger Ambrose (UW)

Followed by HAPPY HOUR 4-5pm

Sponsors:
- Elaine Faustman - Professor, UW Department of Environmental & Occupational Health Sciences, UW School of Public Health and Community Medicine, and Director of the Pacific Northwest Center for Human Health and Ocean Studies.
- John Stein - Deputy Director, NOAA Fisheries Service, Northwest Fisheries Science Center, and Director of the West Coast Center for Oceans and Human Health.
- Ginger Ambrose - Professor, UW School of Geography, and Co-Director of the Pacific Northwest Center for Human Health and Ocean Studies.
- Vera L. Trainer - Program Manager, Marine Resources Program, Northwest Fisheries Science Center and Adjunct Affiliate Faculty, UW School of Fisheries.

University of Washington's Pacific Northwest Center for Human Health and Ocean Studies and the National Oceanic and Atmospheric Administration's West Coast Center for Oceans and Human Health

SEMILNAR SERIES

WIN 2011

This series encourages communication among scientists, students and others interested in the complex interactions of oceans and human health. Speakers and articles will bridge disciplines, highlight cross-cutting issues, and expand awareness of the role of our oceans on human health. Everyone interested in these topics is welcome to attend.

Students who would like to receive credit | contact Micaela Parker at micaela@u.washington.edu.
For more information | contact Rita Peterson at ritap@u.washington.edu or Jeff Turner at jeff.turner@noaa.gov.

LOCATION | NOAA Montlake Auditorium
2725 Montlake Blvd E - Seattle, WA 98115
TIME | 2:30pm - 3:30pm

Date	Title	Speaker
01.11 TUES	Evidence for Widespread Iron Based Bacterial-Algal Interactions in the Marine Environment	Shady Amin Post Doc/University of Washington/School of Oceanography-Center for Environmental Genomics
01.25 TUES	Environmental/Public Health, Tribal Science and Academic Partnership Opportunities	Dave Fuller Hydrogeologist & Water Resources Manager/Port Gamble S'Klallam Tribe
02.08 TUES	Climate Change and Human Health	Howard Frumkin Dean/University of Washington Public Health Professor/University of Washington/Dept. Environmental and Occupational Health Sciences
03.01 TUES	Contributions of Marine Products to Global Nutrition, and Implications of Changing Climate	Tracy Collier Science Advisor/NOAA Oceans and Human Health Initiative

Sponsors:
- Elaine Faustman - Professor, UW Department of Environmental & Occupational Health Sciences, UW School of Public Health and Community Medicine, and Director of the Pacific Northwest Center for Human Health and Ocean Studies.
- John Stein - Deputy Director, NOAA Fisheries Service, Northwest Fisheries Science Center, and Director of the West Coast Center for Oceans and Human Health.
- Ginger Ambrose - Professor, UW School of Geography, and Co-Director of the Pacific Northwest Center for Human Health and Ocean Studies.
- Vera L. Trainer - Program Manager, Marine Resources Program, Northwest Fisheries Science Center and Adjunct Affiliate Faculty, UW School of Fisheries.

Tribal Rights and Fish Consumption Workshop

Center researchers worked together to organize and host a highly successful regional event on the topic of tribal rights and fish consumption. Why was this needed?

Fish consumption rates are frequent drivers for making water quality decisions, however contemporary fish consumption rates do not accurately reflect the traditional heritage rates or desired consumption rates of Pacific Northwest native groups. The current amounts of fish consumed are suppressed due to restrictions from contaminated waterways and limited resources and resource access.

Fish in the Pacific Northwest represent an essential cultural, spiritual, nutritional, and ceremonial resource for tribes, and tribal perspectives and tribal government contexts are needed to inform state and federal government-level decisions. Rarely, however, do tribal government representatives and scientists— including fisheries biologists, toxicologists, ecologists, and nutritionists—sit side-by-side and consider the challenging issues inherent in the relationship between tribal rights and fish consumption.

That changed in August 2009 when dozens of academicians, government agency representatives, environmental advocates, private-sector individuals, and students from Washington, Oregon, Idaho, and Alaska attended the “Tribal Rights and Fish Consumption Workshop: Issues and Opportunities for the Pacific Northwest” at the University of Washington. Twenty-seven of the participants represented 14 tribes. The event served as a follow up to an initial workshop titled “Treaty Rights and Fish Consumption: Honoring Tribes’ Rights in Practice” hosted in 2007 in Seattle, WA by U.S. EPA Region 10.

The workshop included a keynote address, five “modules”, a panel discussion, and a poster session. The workshop “modules” represented distinct themes to provide an overview of the subject matter, facilitate discussion, and offer lessons learned. Each module consists of 3 parts: (1) a 20-minute oral presentation by module chair introducing the theme and setting the stage for the subsequent breakout session: a 90-minute breakout session with approximately 3 speakers; and a 15-minute lessons learned presentation. The five modules included: 1) The Legal Framework: Obligations and Opportunities; 2) Pacific Northwest Exposure Within a Tribal Context; 3) Oregon Department of Environmental Quality Fish Consumption Rate Project; 4) Building the Case of Importance of Fish Consumption and Tribal Health (led by Faustman); and 5) Fish Consumption Rate Standards and Protection of Human Health. The panel session was titled “Fish Consumption Rates and Regulatory Decision Making Within the State of Washington.”

Workshop participants were invited to submit of materials related to tribal rights and fish consumption for inclusion in the workshop Website resources page. The workshop Website (<http://depts.washington.edu/tribalws/index.php?doc=home>) includes not only the resources page where visitors can access select presentations, articles, reports, and links relevant to workshop themes, but also the workshop agenda and other information pertinent to tribal rights and fish consumption. Having these resources in one place allows Website visitors to do their “one-stop shopping” for materials related to tribal rights and fish consumption.

The workshop proved to be a successful event. In their evaluation feedback, a vast majority of workshop participants indicated that the workshop covered material useful to them and that the workshop modules and panel discussion were very valuable. Participants also indicated that the workshop was a very good venue for networking and discussing lessons learned.

Below is a flyer describing the workshop:

Tribal Rights and Fish Consumption Workshop: Issues and Opportunities for the Pacific Northwest



On August 12-13, 2009 the University of Washington hosted the “Tribal Rights and Fish Consumption Workshop: Issues and Opportunities for the Pacific Northwest” that served as a follow up to an initial workshop entitled “Treaty Rights and Fish Consumption: Honoring Tribes’ Rights in Practice” hosted in 2007 in Seattle, WA by U.S. EPA Region 10.

The workshop successfully brought together 64 participants, including 20 speakers, from diverse sectors to discuss relevant studies, share lessons learned for the Pacific Northwest, and determine key issues in Washington State related to tribal fish consumption rates. Participants came from Washington, Oregon, Idaho, and Alaska and included 27 participants representing 14 tribes. Participants also included 14 academicians, 14 government agency representatives, 6 members of the private sector, and 3 environmental advocates.



Participants listen to a presentation. Photo courtesy Sarah Fisher

We are pleased to provide a workshop resources page for you to do your “one-stop shopping” for resources (articles, reports, contacts, select presentations, and links to other conferences) relevant to workshop themes.

Please visit <http://depts.washington.edu/tribalws/index.php> for more information



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The workshop planning committee, led by Dr. Faustman, is preparing workshop proceedings for publication. The committee includes Katie Frevert (UW), Anna K. Harding (Oregon State University), Catherine O’Neill (Seattle University), Barbara Harper (Confederated Tribes of the Umatilla Indian Reservation and Oregon State University), Lon Kissinger (U.S. EPA Region 10), Patricia Cirone (former U.S. EPA Region 10), Jamie Donatuto (Office of Planning, Swinomish Indian Tribal Community), and Center research scientists Alison Scherer and Ami Tsuchiya.

The workshop was sponsored by the Center and the UW’s Institute for Risk Analysis and Risk Communication, also directed by Dr. Faustman. The workshop was co-sponsored by the Research Translation and Outreach Core of the UW’s Superfund Research Program. For more information, visit: <http://depts.washington.edu/tribalws/index.php?doc=home>

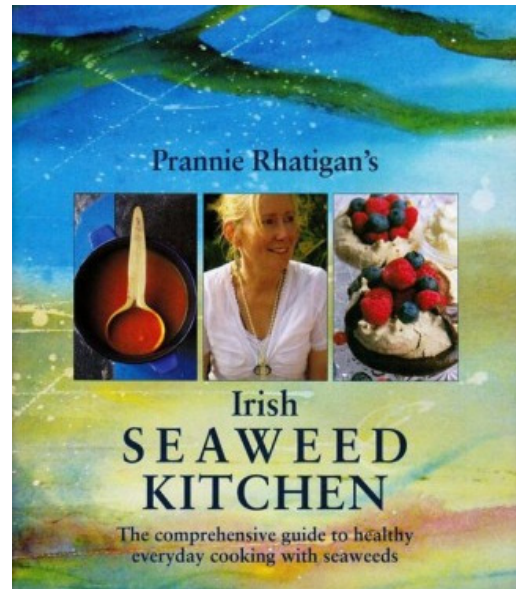
Algae and Human Health Symposium

The Center is proud to be co-organizing a one-day symposium on “Algae and Human Health” on July 15th that will be part of the Psychological Society of America’s Annual Meeting in Seattle, WA, July 13th-16th.

The overarching goal of the symposium is to stimulate better understanding among health professionals of negative and positive consequences of different algae for human health. Negative consequences include harmful algal blooms (HABs) that produce marine biotoxins that accumulate in shellfish tissue. When people consume the contaminated shellfish, they may become ill or die. Health professionals are at this time largely ill-equipped to address such health problems among patients. Positive consequences of algae may include health benefits (nutritional, therapeutic), but to what extent are health professionals knowledgeable in this area? Can they address patients' concerns about whether to eat algae, and how to weigh the risks and benefits? Health professional will gain new knowledge through this symposium that will benefit their practices. The symposium will also feature a panel discussion evaluating purported health benefits of consumption of sea vegetables and /or concentrates (nutritive, therapeutic).

The symposium will offer certificates to nutritionists/dieticians seeking Continuing Professional Education Units (CPEUs) and to naturopathic physicians seeking Continuing Education as well. These continuing education opportunities were coordinated and made possible for the Center. Medical doctors will also be able to seek Continuing Medical Education (CME) Category II credits by attending the symposium.

In addition, the symposium will offer an algae-rich dinner designed by symposium speaker Dr. Prannie Rhatigan, a medical doctor and author of *Irish Seaweed Kitchen* (see the book cover at right), a comprehensive guide to everyday cooking with seaweeds (nori, kelp, dulse, etc). The Center coordinated hosting the dinner at the University of Washington Club, whose chefs are exceptionally enthusiastic about working with Dr. Rhatigan. Dr. Rhatigan will also provide a cooking demo for interested parties. Area chefs, including members of the Seattle Chefs’ Collaborative, will participate, as will chef/naturopath Cynthia Lair, who hosts the online cooking show *Cookus Interruptus* and teaches students how to cook with algae at Bastyr University, an accredited institution located north of Seattle, Washington that is internationally recognized as a pioneer in natural medicine.



Other related activities include a beach walk to identify algae of relevance for human health and also invited paper and poster sessions.

The Center is broadly advertising the symposium throughout the region and is pleased to attract interested parties from diverse disciplines including microbiology, oceanography, toxicology, exposure sciences, occupational health, nutrition, naturopathy, nursing, medicine.

View the Center's flyer advertising the symposium on the next page →



Algae and Human Health Symposium

July 15th, 2011, 8:30am – 12:00pm, in Kane Hall at the University of Washington in Seattle, WA

Part of the Phycological Society of America's Annual Meeting, July 13th-16th, at the University of Washington. For more information: <http://psaalgae.org>

Symposium Synopsis: The symposium (organized by Drs. Pat Tester [pat.tester@noaa.gov] and Wayne Litaker [wayne.litaker@noaa.gov]) will highlight positive and negative effects of algae on human health. Speakers include Dr. Lora Fleming (MD, MPH, PhD, MSc) of the U. of Miami and European Centre for Env. Human Health, who will speak on ciguatoxins and brevetoxins; Dr. Lorraine Backer (PhD, MPH) of the U.S. Centers for Disease Control and Prevention, who will speak on cyanotoxins; Dr. Sherwood Hall (PhD) of the U.S. Food and Drug Administration, who will speak on saxitoxins and domoic acid poisoning; & Dr. Prannie Rhatigan (Irish General Practitioner; author of *The Irish Seaweed Kitchen*), who will speak on "Algae in the Kitchen: Sea Vegetables for Everyday Health".

Related Afternoon Activities: Additional activities in the afternoon include cooking demos by Dr. Rhatigan, nutritional discussions with Drs. Rhatigan and Gaile Moe at Seattle Pacific University, and contributed papers/posters at the UW on all aspects of algae and human health, including a presentation by the PSA Committee on Nutrition and Functional Foods.

Algae-themed Dinner: A Sustainable Seafoods/Sea Vegetable Dinner at the University of Washington Club will be held on the evening of the 15th. The ticket price is \$27.

Registration: A special one-day registration fee of \$100 will be offered to Health Professionals (advance registration required at http://psaalgae.org/website/opportunities/annual_meeting.html). At registration, health professionals may also sign-up for a cooking demo (\$25), a ticket (\$27) for the evening dinner at the UW Club, and a July 12th marine algal field trip (\$25).

Continuing Education: Certificates will be available on the day of the symposium for up to 8 hours of contact time for **Registered Dietitians** and **Dietetic Technicians, Registered**. Certificates for **Naturopathic Physicians** for up to 8 hours of contact time will also be available. Certificates must be submitted to the proper accrediting entities for approval.

Co-Support: The PSA gratefully acknowledges the co-support of these activities by Maine Coast Sea Vegetables, Inc., Acadian SeaPlants, Ltd., and the University of Washington's NSF/NIEHS-funded Pacific Northwest Center for Human Health and Ocean Studies.

Contact for additional information: Dr. Patricia Tester (pat.tester@noaa.gov) at 252-728-8792; Dr. Susan Brawley (brawley@maine.edu) at 207-581-2973; or Dr. Gaile Moe (gmoe@spu.edu) at 206-281-2238.

Photo Credits (left to right): NOAA; S. H. Brawley; USGS, S. H. Brawley; NOAA, Brian Bill; and S. H. Brawley

